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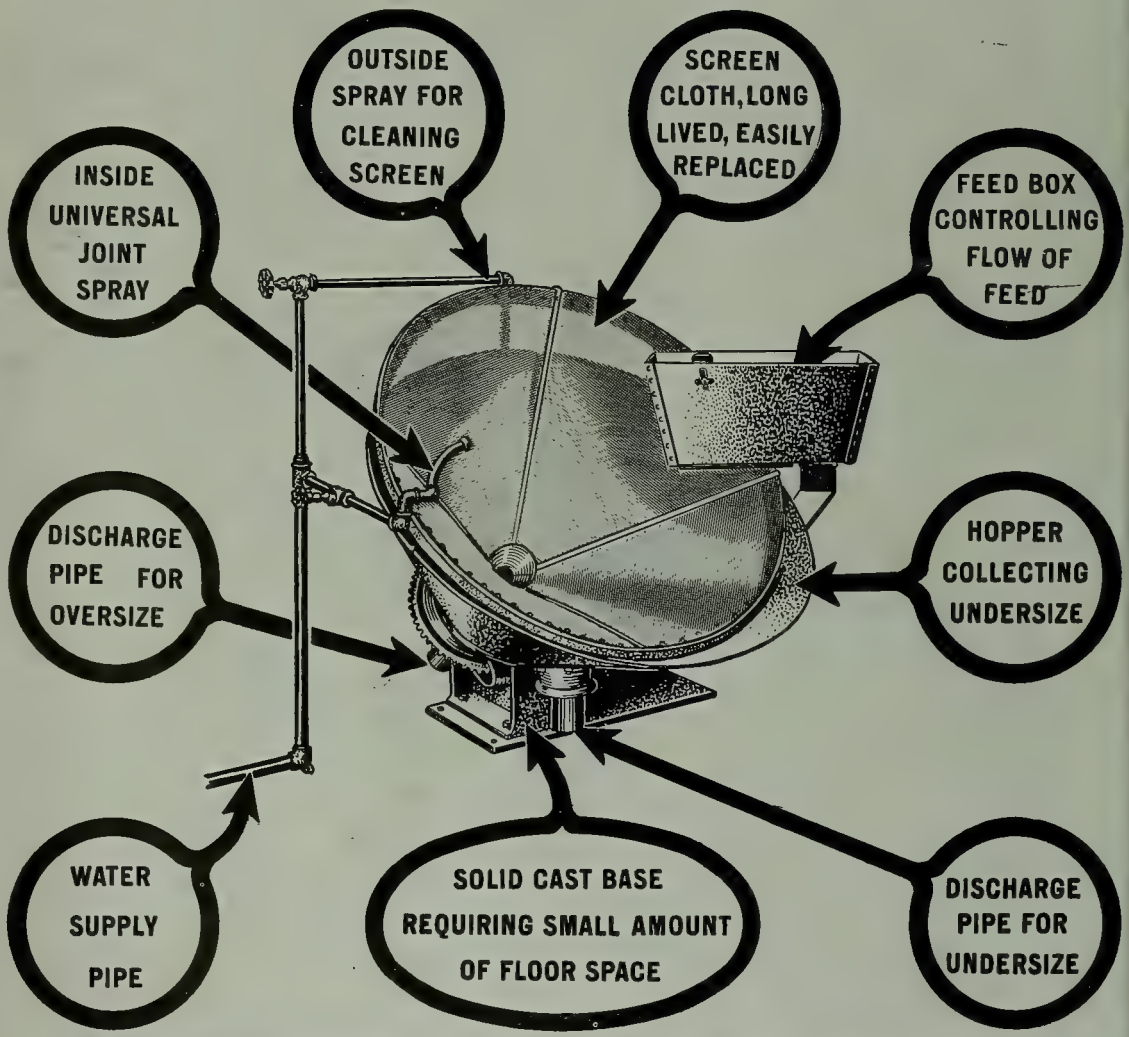
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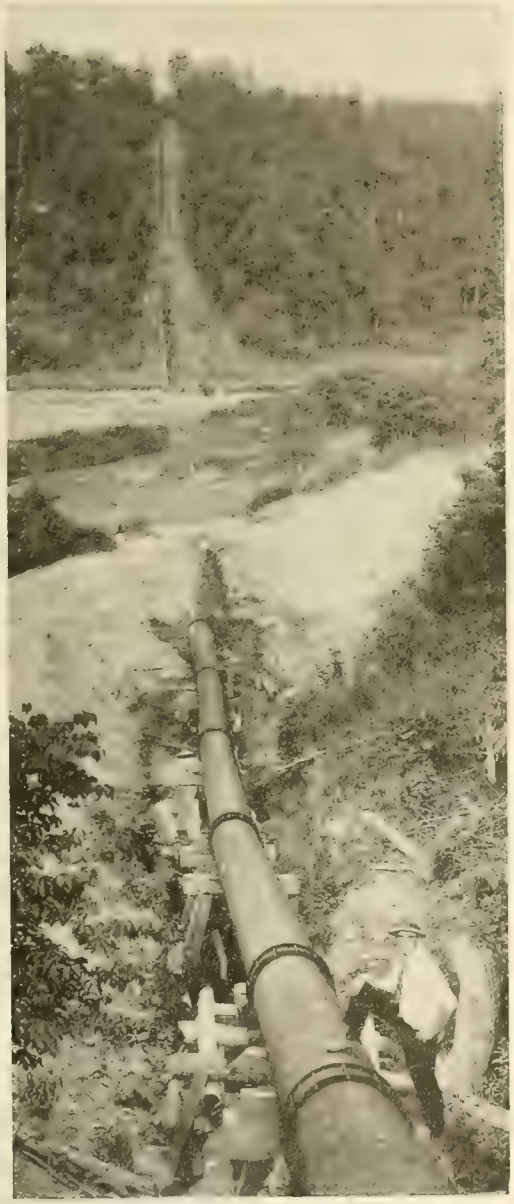

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EDITORIAL.

Greeting.

The Annual Review Number is the medium we use once each year to express appreciation of our readers' indulgence for our sins of commission and omission. The year 1909 to us will be a memorable one, marking as it does the enlarging of our scope through our affiliation with Mr. T. A. Rickard's 'youngest born', *The Mining Magazine*. His interest in the MINING AND SCIENTIFIC PRESS is lessened in no degree by his change of residence to London. To our friends who have supported us by their interest we extend our hearty thanks. Not the editors alone, but the contributors and the advertisers as well, make a paper. All have done their part this year. Nineteen hundred and nine was a successful year from every point of view. Our subscription list is longer, the professional directory has grown until it is now the most complete printed in any mining journal, and today we present the largest paper ever issued in our half century's history. We recount these things less in a boastful than a thanksgiving spirit. We believe in a mining journal as the organ of the profession—a paper written by and for mining engineers, and the flattering increased support which this paper is receiving from the active men of the profession is as gratifying in its evidence of success in approaching

our ideal, as is the tangible reward on the business side. To us mining engineering is at least as noble as is any other profession, and we welcome all evidences of growth of a true professional spirit. We welcome also such evidence that ideals have place and bring profit in business.

MINING in the Lake Superior copper district has been reviewed for us this year by Mr. Robert H. Maurer, who has been a collaborator with Mr. Horace J. Stevens, well known as the author of the invaluable 'Copper Handbook'. The source of our review is a guarantee of its high value.

PRODUCTION at the Goldfield Consolidated continues on the magnificent level maintained throughout the year, which has made this the premier gold mine of the world. The official figures for November reveal a production of 19,284 tons of ore, valued at $724,450, of which 93.96% was recovered as bullion. The average value of the ore was $35.30 per ton, and the cost of operation was $6.92.

COPPER has attracted more attention in the year just closed, than did any other metal. We have peculiar satisfaction, therefore, in presenting in this issue a full review of the copper markets of the year written by Mr. L. Vogelstein of L. Vogelstein & Company in New York. The world-wide activities of this firm make the review authoritative and we are glad to express our hearty appreciation of so able a collaborator.

IT GIVES us pleasure to announce that Mr. M. E. Applebaum, president of the New York Metal Selling Company, will write for us hereafter a monthly review of the metal situation. This will appear in the first issue of each month. In view of the fact that Mr. Applebaum does not represent any specific copper-producing interest he will be able to give an unbiased view of the situation, and we take this opportunity of expressing our appreciation of his co-operation.

THE ANNUAL review of progress in cyanidation and related phases of milling by Mr. Alfred James has become an institution. We have great pleasure in presenting in this issue his letter for 1909. Mr. James always writes trenchantly. Not everybody agrees with him, in his rating of filters for example, but his criticisms are always founded on wide observation and study and are worthy of, as they will receive, wide attention. His letter always provokes discussion stimulating to the profession, and we shall be glad to hear from his fellow cyaniders. For our own part we defer till a later issue a more specific review of progress in American methods.

GOLD MINING in France is the title of an interesting article by Mr. James A. Rickard in the December number of *The Mining Magazine*. Many gold producing districts in southern Europe are becoming prominent with the cheapening of costs of treatment. The same issue of this magazine contains articles on the 'Early Days on the Gold Coast', by Mr. E. T. McCarthy, and 'Measurement of Pulp and Tailing', by Mr. W. J. Sharwood, with many other valuable metallurgical contributions. 'Professional speculator' continues his analysis, classifying the leading mining stocks of the world under the headings of Excellent, Fair, Moderate, Indifferent, and Remote. The editorial pages are notably attractive, covering questions which engage the present attention of all advanced engineers and mine operators.

THE EIGHT-HOUR LAW relating to labor in mines and reduction works has been sustained by the Supreme Court of California in the test case brought in the form of an application of Mr. Fred J. Martin for a writ of *habeas corpus*. The law was purposely violated in all its provisions, so that the decision handed down settles the relative obligations of employers and employees in these particulars. The constitutionality of the law is affirmed, the contention that it is special or class legislation being refuted. The inclusion of mill-men within the meaning of "men working in smelters and reduction works" is sustained, and the meaning of eight hours "actual work" is held to be time actually engaged in labor, exclusive of that taken in traveling to and from the place of work. The decision will be more fully discussed in a later issue. Our anticipations have been confirmed. The findings of the court seem inevitable under strict legal reasoning.

Far Eastern Mining.

Mining in the Orient in 1909 made good progress. Interest in gold mining centered largely in the placers. In East Siberia Mr. C. W. Purington demonstrated the value of the gravels near the mouth of the Amur, by a 90-day run with a Paige scraper-excavator. At a working cost of less than 10 cents per ton, 61,500 cubic yards were handled. The total clean-up amounted to $67,000. The greater part of the material was tailing from old placer workings. The Kolchan mines, at which this work was done, include 6000 acres, of which about one-half is suitable for dredging. The normal working season is 200 days. Wood, at $1.25 per cord, is available for fuel. As all conditions seem favorable, a large modern dredge is to be installed next year.

In Burma elaborate tests carried on for some time by Mr. N. Samwell having proved the value and availability of the ground, preparations are now being made to begin operations on a large scale. A modern dredge has been ordered, and it is expected that others will be erected later. In the Paracale district of the Philippines the most distinct success of the year has been scored by the dredges. The machines in use are of New Zealand type and are small as measured by California standards. However, the placers are shallow, soft-bottomed, and the material handled is mainly of small size. The country is low lying and swampy, and the extent of the payable ground is unknown. The gravel has proved to be rich, yielding approximately a dollar a yard, and there seems to be every probability of the development of a satisfactory dredging field. Considerable new capital is going into the district and its steadily increasing importance may be safely predicted. Quartz mining in the Philippines also shows signs of improvement. The Benguet Consolidated

has been put on a paying basis and the neighboring Headwaters mine is reported to have developed ore reserves sufficient to warrant the building of a 60-ton mill. At Masbate the year's work has been satisfactory and profitable mining seems near. In the Malay Straits the tin output in the first ten months of the year showed a gain of approximately 50,000 peculs of 1 33⅓ pounds each.

Attention at Manila is just now centered more on oil than gold. It has long been known that petroleum was present in the Islands and numbers of seepages have been marked. On the Tayabas peninsula some drilling has been undertaken. A recent reconnoissance of the field by Mr. George I. Adams, of the Philippine Bureau of Mines, resulted in a favorable report, and it now seems likely that American capital will be invested. The oil so far found is of unusually high grade, and resembles that from the Dutch East Indies. There would be considerable local market, and in addition it seems likely that oil could be brought to the United States to advantage, since California petroleum is usually deficient in the lighter volatiles. The fuel problem in the East seems in a fair way to be satisfactorily settled. The East Batan Coal Mining Co. has opened a colliery and built a wharf at Batan and is prepared to fill commercial orders. Preparations are being made to furnish an output of 1000 to 2000 tons per day. The Batan coal has been tested recently on a trans-Pacific voyage of one of the transports and was found satisfactory and economical. In the north both Chinese and Japanese companies are now supplying coal in quantity. One of the incidents of the year was the conclusion of negotiations regarding the Fushun mines in Manchuria, Japanese possession being confirmed.

The major interest in China has been in railway development. Probably the two most significant events of the year were the satisfactory ending of negotiations between China and Japan regarding the Antung-Mukden line, and the opening of the Peking-Kalgan railway. By the former, not only is a much needed railway link secured, but the joint development by the two Powers of the important mineral resources of a large area assured. The Peking-Kalgan railway is of note not only from its commercial aspects, but because it has been built exclusively by the Chinese with money derived from the profits of the Imperial Railways of North China. In marked contrast with many American lines, Chinese railways are immensely profitable, the proportion of expenses to earnings in one case being only 28 per cent. The new line is 122 miles long and joins Peking with an important city in the northwest. It is to be rapidly extended, and is a standing reminder of the fact that under honest and efficient management China is prepared, to an unappreciated extent, to develop her own resources. Much has been heard in the course of the year about American participation in the Hankow-Sze-Chuen railway loan, but negotiations still drag. The importance of the matter is to a large extent sentimental. The real development of Chinese mineral wealth has not yet begun, though apparently a secure foundation is being laid in monetary and administrative reform.

Conservation and Its Progress.

The beginning of a new year is an appropriate time to take account of the state of public opinion as well as to measure the output of our mines and to forecast the markets. Of the great public movements now in progress, none more intimately concerns the mining industry than that initiated by Mr. Roosevelt when in May, 1908, he called into conference the Governors of the States to consider the problem of conserving our natural resources. The time was ripe, and the method chosen was well calculated to fix attention. Following the first conference and a hard summer's work on the part of the 'National Conservation Commission', a second gathering was held at Washington, in December. At this meeting reports of the various sections and committees were submitted, and the first great national inventory was placed before the people. It is impossible here to give a resumé of the report which, with the accompanying discussion, forms nearly 800 printed pages. It is a public document (No. 676 Senate, 60th Cong., 2nd Session) and may be readily obtained. The main conclusions are familiar to all. In general the report showed that the natural resources had limits which should be taken into immediate account in business operations. The need of much more study before recommending a complete program was clearly shown, and arrangements were made for a joint committee to carry on the work. At the close of the year this second conference had but recently adjourned and hope of Congressional aid in at least part of the program, was strong.

In 1908 and 1909 a number of the States established Conservation Commissions. In a few they were duly created by statute and provided with independent funds. In others they were made informal committees to assist in the correlation of the work of the various departments. It early became apparent that in Congress there was little disposition to give definite recognition to the movement. Relations between Congress and Mr. Roosevelt were strained, and it was openly charged that the President had exceeded his authority in appointing a 'Commission' without first securing legislative approval. Not only was no provision made for the permanent support of the 'Conservation Commission', but its disbandment was forced by a clause slipped into the Sundry Civil Bill forbidding the detail of any employee for service with any such commission, or the payment of any money for expenses or salary to anyone working on such a commission or council. This effectually stopped the movement so far as any direct participation of Federal officers was concerned. On the other hand, Congress did slightly increase the funds available for the work of the regular Government bureaus, such as the Geological Survey, engaged in making studies of the sort recommended by the Conservation Commission. There is no question as to the legal authority of Congress to take the action that has been noted, but there is also no question in the minds of most of those familiar with conditions in Washington at that time that this action was taken less through motives of broad public policy than of a personal desire to 'get back at' the President. Of the whole legislative program asked by the Conservationists, the only re-

form achieved was an Act permitting an entryman, under certain specific conditions, to elect to acquire title to surface only in the case of agricultural lands underlaid by coal.

On March 4 a new President was inaugurated, and no portion of his policy has been more closely scrutinized by the public than that relating to conservation. Mr. Taft's program in this matter, as announced in September at Spokane, has been reviewed already. In that and subsequent speeches he made it sufficiently clear that he is in favor of conservation, but disclaims any responsibility in the matter further than to make recommendations to Congress. A special message on the subject is promised soon after the holidays. The public will await it with a certain academic interest. Just what good it will do is far from clear, since Congress has already shown an unfriendly attitude. Mr. Taft is evidently a 'wise and upright judge'. We believe him to be sincere in his interest in the movement, but we also believe him to be obsessed with a fear of any rupture of friendly relations. He has deliberately chosen to adopt the plan of bargaining in legislation. Having given consent to the tariff bill, having sacrificed popularity to endorse publicly Mr. Aldrich and Mr. Tawney, he would seem to have a balance to his credit and to be entitled to draw a certain amount of legislation on account. His draft will presumably be honored, but we fear that the rate of exchange will be found high. The astute keepers of the legislative shop know well the art of marking up the price while a customer lingers at the window.

In one other particular the year has been notable—in the prominence given to the so-called Pinchot-Ballinger controversy. It is a little difficult to see how it came to be regarded as so essentially a personal matter. That Mr. Gifford Pinchot, the Forester, and Mr. R. A. Ballinger, the Secretary of the Interior, are not congenial members of the official family has been abundantly evident from the first. It is not necessary, however, to impute to either any personal motive or any dishonesty. They are merely the unlucky present representatives of the ever-contesting camps of loose and strict constructionists. Both have been severely criticised, Mr. Pinchot for excessive zeal in behalf of the general good, and Mr. Ballinger for similar zeal in behalf of individuals as against the Government. It is well to remember that Mr. J. R. Garfield, who became eventually the almost champion 'trust-buster' of the last administration, was once bitterly 'muck-raked' for a too friendly attitude toward the Chicago packers. We have no desire at this time to judge Mr. Ballinger, but we would point out that between doing the utmost that the law allows and the minimum that it requires, there is as broad a 'twilight zone' as between State and National authorities. Within that zone the President as chief executive has full responsibility both for himself and for the subordinates that he selects.

In 1908 the Conservation movement was organized, and made rapid headway. In 1909 it practically stood still. In 1910, whether it shall dwindle or shall enter the constructive stage, will be determined largely by one man, Mr. William Howard Taft, President of the United States.

Bureau of Mines Again.

The bill providing for a national Bureau of Mines has been reported favorably at Washington, and will doubtless be passed promptly by the House after Congress re-convenes. In the Senate the Committee on Mines and Mining proposes before reporting to hold public sessions, to hear evidence for and against the measure. In the meantime Mr. S. M. Cullom of Illinois has introduced a resolution calling on the Secretary of the Interior for information regarding the mine rescue-work now being carried on by the Government, and the funds needed for its expansion. This resolution called out a spirited debate as to the function of the United States Government in such matters. It may be promptly conceded that to the States belongs the police power of regulation in mining, without absolving the Federal authorities of all responsibility. There is abundant room for both. A national bureau which is scientific and investigative in character, corresponding in fact to the Geological Survey, is necessary, if the States are to proceed wisely and with any degree of uniformity to inspect and regulate the mines. The benefits of such a system have been shown already in the establishment of a system of 'permissible explosives' for use in gaseous mines. The Geological Survey, with the coöperation of the manufacturers, tested the explosives offered, and listed those found safe. The inspectors, thereupon, in the States where they had authority, promptly ruled that only such powders should be used. It was a simple cheap means of ending a condition of almost intolerable uncertainty and danger. Any system of State laboratories and State tests would have involved enormous expense and endless conflict, as exists already in the simpler matter of grading illuminating oils. In the matter of mine rescue-work it must be clear that the United States Government cannot undertake to equip and maintain enough stations to meet all demands. Its duty must continue to be largely that of pointing the way and setting the pace. The States and the District Associations of operators must supplement these efforts.

The growth of the sentiment favorable to a national Bureau of Mines has been steady, and the extent to which public opinion in the matter has clarified is seen by a comparison of the bills regarding the subject presented to Congress this year and last. In 1908 the proposed acts were as varied as they were numerous. Many of them were impracticable and some actually harmful. As indicative of present conditions may be cited the fact that the various bills now before Congress were taken up and considered in detail at a meeting held in San Francisco, December 20, at which were present some twenty of the foremost practising mining engineers of the Pacific Coast. After full consideration they unanimously endorsed the bill presented by the House Committee and urged its prompt passage by both Senate and House. It was recommended that a proviso be added to make clear that neither the Bureau itself nor any of its members should engage in private work—extending in fact to the new Bureau the excellent rule under which the Geological Survey has operated. A provision of this sort is in the Dick bill now before

the Senate Committee, and should by all means be included in the measure passed. We believe that a Bureau of Mines can be established, manned, and run on the same high plane that has given to the Geological Survey the universal confidence of mining men. There is clear need for such a Bureau to study problems relating to safety in mines and efficiency of mining. Too much legislation based on imperfect or inaccurate data already cumbers our statute books, and accurate data are urgently needed. That the National Government should assume its share, not the whole load, of the responsibility and expense of acquiring this material, is but simple justice to the great mining industry. In the Technologic Branch of the Geological Survey there is an adequate nucleus for the proposed organization, and the excellent work already done is an earnest of what a larger organization with adequate funds may be expected to accomplish. Such an organization, to do good and economical work, should develop rather than be suddenly created, and the time is clearly ripe for the next step in the growth of this particular work—the organization of the National Bureau of Mines as a means of promoting safety and efficiency in a great basal industry. Mr. Senator and Mr. Congressman, it is up to you. A small amount of action will save many more lives than a large amount of talk.

Gold Production and Value.

No startling changes have occurred in gold production during the year 1909. An increase is evident, which is variously estimated between two and three per cent. In 1908 the world's output was placed at 21,529,300 fine ounces, worth $444,382,312. The bankers of the country are anticipating an increase to nearly 22 million ounces for 1909. This is probably an underestimate. The Transvaal alone will make a showing of about $155,000,000, which is better by ten million dollars than in 1908. Rhodesia has apparently not done so well, the bullion shipments from that territory and from West Africa being estimated at approximately $15,500,000. The Australasian output has also receded to some extent, the forecast being for a total of not more than $70,200,000 for the year. There will be a slight fall in the Mexican production, somewhat difficult to estimate, but probably amounting to several million dollars. The Mexican contribution to the world's total in 1908 was $24,518,548. Indications are that a material increase in that Republic will occur in 1910.

The gold production of the United States has never reached a hundred million dollars in any year of its history. High-water mark was attained in 1908 when the output was $96,313,256. As there are no indications of important decreases in any quarter, and in view of the fact that Nevada shows an augmented production of nearly six millions, while the increased copper output of the country will add to the amount of by-product gold, it would seem safe to predict that the United States will be credited with more than $100,000,000 worth of the yellow metal for the year 1909. The growth in Nevada is peculiarly gratifying. The heavy shipments of ores, which brought the output above fifteen millions in 1907, proved wasteful, and this led to a sharp curtailment during the succeeding year, while preparation was being made for milling the ores at home. The result is seen in a rise from $12,090,218 in 1908 to nearly eighteen millions in 1909. California has steadily yielded about nineteen millions per annum for a number of years. A slight decline in lode-mining has been offset by the growth of the dredging industry. At the present time an increase in both forms of mining is noted, and the addition of a quarter of a million to the output during 1909 will probably be duplicated in 1910. Alaska will contribute at least as much as in 1908, and may pass the twenty-million mark. From Nome a total of approximately $4,000,000 is promised. Colorado will also hold its own, and with the activity which has been noted during the last six months it will retain its place at the head of the list among the gold-producing States of the Union, and its output will increase in future.

The annual production of gold has been rapidly increasing within the last twenty-nine years, a circumstance which has attracted the serious attention of political economists. In 1880 the world's total was $106,600,000. It had advanced to only $118,848,700 a decade later. Thenceforward the curve rose with extraordinary rapidity. In 1900 the output stood at $258,829,703. In 1905 it had reached $378,411,754; it passed four hundred millions in 1906; and apparently it will exceed $455,000,000 in 1909. Concurrently there has been an increase in the price of all commodities, which is the same as saying that the purchasing power of gold has declined. This phenomenon has been more noticeable within the past eighteen months, when an average increase of 35 per cent in all staple-commodity prices has been observed. The greatest advance has been in cotton and hides, closely followed by wool, while food-stuffs have risen on an average about thirty per cent since July 1908. If it were true, as some assert, that the increased production of gold was responsible for this decrease in its purchasing power, an advance in the price of metals corresponding to the greater cost of agricultural products should be noted. Such, however, is not the case. The higher cost of living has to some extent entailed a higher cost of production for the metals, so that iron and steel are about 25 per cent higher than in 1908, and copper has shown a moderate advance. Zinc has increased for special reasons, while other metals have shown sympathetic changes. But the metal market has not experienced an improvement in prices commensurate with the phenomenal soaring of quotations on agricultural products. This accentuates the point we have made in the past, that the opening of new mines and the growth of manufacturing, with the demand these make for an increasing army of men for the facilitation of commerce, has proceeded at so rapid a pace as to leave agricultural development proportionately far in the rear. Stated otherwise, there is an underproduction from the land as compared with the advance in other forms of industry. The purchasing power of gold for metals and metallic manufactures is relatively greater than for other staple commodities. If the change in price-level were due to an augmented gold supply there should be practical

uniformity in the rate of depreciation. Such uniformity does not exist. Economic conditions are manifestly responsible for the present discrepancies. A disproportion between the number of producers of staples for food and clothing, and the increased numbers engaged in metal mining, manufacturing, in commerce, and in the other arts and employments of a civilization which is growing more complex, has created an extraordinary demand for the necessaries of life, to which has come the inevitable response of higher prices.

M. L. de Launay, in his interesting book, 'The World's Gold', published a couple of years ago, pointed out that "the economic law, which seemed so firmly established, has been somewhat contradicted by the facts of the last ten years; the rate of interest, instead of continuing to fall, has risen perceptibly in the case of transferable securities." This has gone forward with great rapidity. Increased production of gold involves an augmentation of the bank reserve, and this should presumptively increase the volume of banking credit and work a lowering of the market price of money. Such has not been the case.

No cheap money is in sight either for call loans or for capital in its fixed forms. The phenomenon is not confined to America, in spite of an excess of gold exports over imports of $100,000,000 within the year. The bank rate in London has recently been up to 5 per cent, and has only slightly receded. Finally, it may be said that the volume of the world's business has enormously increased. Expansion of business has been witnessed on a vast scale; it has widened over continents, and progress has invaded countries, which were almost undeveloped thirty years ago. The bulk of this growth of industry has occurred within the past twenty years. It has broken the tendency to concentration of financial operations within narrow limits; it has multiplied the centres of demand for money, and has absorbed enormous quantities of gold in the active function of maintaining a balance of exchange. The demand for gold has expanded more rapidly than its production.

In spite of occasional discoveries of highly productive deposits it must be noted that the number of sources for rich ores is decreasing; that the extraordinarily high-grade placers are fewer than in the past; that the world is compelled more and more to devote its efforts to winning the royal metal from deposits of lower grade. The cost per ton for mining and treatment is lessening, but the cost per ounce of gold recovery is rising. This follows partly from the leanness of the ores, from the great increase in capital invested in mines and works, and from the rise in wages as a direct result of the enhancement in the cost of living. In view of all these circumstances it seems fallacious to ascribe the decreased purchasing power of gold to the absolute increase in the amount produced. The enormous development of the agricultural resources of the world which is taking place under the stimulus of excessive prices must presently overtake the development in other directions, and with the larger output the law of supply and demand must restore the exchange-value of gold to a point nearer its former level.

Mexico in 1909.

Conditions in Mexico are actually better than current complaints indicate. Affairs are in a healthy state when business is free from the peril of disarrangement by the imposition of new taxes. To that extent Mexico is in a better position than the United States, where the Payne-Aldrich tariff bill, pretending to lower the wall of protection, and really aimed at increasing revenue, materially upset business through most of the year. The fiscal year in Mexico ends on June 30. For the year 1908-09 the disbursements were roughly ₱18,000,000 in excess of receipts, but the optional expenditures provided for in the appropriations introduce an elasticity into the budget permitting of economies. Thus the estimates were ₱104,040,316, which the finance minister, Mr. José Yves Limantour, cut down to ₱97,871,750. The falling off in revenue, however, has produced no deficit, since there has been for some time an accumulating surplus, the excess of income for the previous three years having aggregated ₱29,358,893. In making up the budget for 1909-10, despite a manifest tendency toward improved financial conditions, Mr. Limantour has not attempted to discount the future, except in so far as to assume that such betterment will preclude recourse to the surplus, the forecast being for an outgo of ₱97,261,000. The railroad returns, taken as a barometer, justify this prediction of fair weather. The first annual report of the consolidated railroad property, which has just been issued, shows gross earnings amounting to ₱97,611,044 from the 5261 miles of road merged in the National Railways. This income was sufficient to meet all fixed charges in full, and also to provide for the guaranteed dividend of 2 per cent on the first preferred stock. This result was attained after allowing ₱1,340,400 as a reserve for accrued depreciation of equipment and after deducting ₱63,357 as 5 per cent of the net profits transferred to the reserve fund, leaving a surplus of ₱50,469 to be carried forward. The gross earnings fell off ₱6,500,000, the saving having been effected almost wholly through reduction in the cost of handling transportation. During the latter part of the year 1909 the gross earnings of the National Railways have increased more than two million pesos over those for the corresponding months of 1908. The decrease in freight carried during the period of financial depression has been chiefly in ores, noted more especially on the International Railway; a result of the low price of metals. A corresponding decrease in general merchandise was the natural corollary to this reduction of prosperity on the part of the leading industry of the Republic. The agricultural tonnage slightly increased, but this was abnormal, and is accounted for by an excess of importations of foodstuffs, necessitated by the failure in native crops. The abundant rains of the past season insure a return of agricultural prosperity, which will redound to the benefit of the mines as well as to the national exchequer.

It is worthy of note that the bulk of the revenue of the Mexican Government is derived from taxes levied on foreign commerce, the import duties alone returning ₱42,000,000. The stamp tax, against

which the mine operators are wont to protest, yields ₱13,500,000 the tax on mining property ₱1,800,000 and the Government royalty on gold and silver ₱2,250,000. Thus it appears that the direct contribution from the mining interests constitutes but a minor portion of the total national revenue. Indirectly, however, the foreigner bears a considerably larger proportion of the total, since the bulk of the native population absorbs a relatively small part of the imports, these representing in large degree the demand by aliens and by enterprises chiefly owned and operated by aliens.

The disparity between agricultural production and the development of the mineral industry, which is so conspicuous in the United States, is even greater in Mexico, and has materially increased the cost of mining. Under the most favorable conditions the output of grains and beans is inadequate, and an unfavorable season precipitates hardship. Such a crisis was experienced during 1909 when the shortage was so serious that the Government was obliged to import large quantities of staples for distribution at cost. But for this act of paternalism a severer burden would have been thrown upon the mining companies. As previously stated, the outlook favors a better harvest in the coming year. The development of the agricultural resources of the country is of paramount importance to the mineral industry, and to this end the Government is encouraging the building of many new lines of railroad. It happens that the mineral deposits of Mexico are so universally distributed that no railway extension can fail to open new districts. The Southern Pacific of Mexico is rapidly closing the gap which will connect the West Coast line with Guadalajara, thus benefiting the mining interests of Jalisco and Tepic, while opening the rich agricultural regions of the West to the central portion of the Republic. The extension of the Mexican Central from Guadalajara to Manzanillo has given the central plateau an outlet to a port on the Pacific, and has developed a district chiefly important for agriculture. A concession has been granted for a line from Oaxaca to the West Coast at Salina Cruz, and thence northward through Guerrero, Michoacan, Colima, and Tepic, connecting with the Southern Pacific. This has been acquired by the Pan-American railroad, under control of Mr. David E. Thompson, former Ambassador from the United States to Mexico. One division of the road, from Oaxaca southward to Ejutla, is already built, and will be continued into Central America. In the north conflicting rumors have been circulated concerning the completion of the projected extension of the Chihuahua Pacific across the mountains into Sonora. A favorable traffic agreement between the Cole-Ryan interests and the Southern Pacific will probably postpone the construction of this line except as needed for the development of lumbering in the Sierra Madre. It is said that for this purpose an additional 190 miles of track will be laid during 1910, which will benefit a number of mining camps in the mountains.

Without making invidious distinctions it may be pointed out that great activity has been a feature of three separate mining districts during 1909. These are Santa Eulalia in Chihuahua, Hostotipaquillo in Jalisco, and Pachuca. The prospects for increase of silver mining in Pachuca are particularly encouraging. A number of plants in the vicinity of Hostotipaquillo are only awaiting the completion of the transmission line from the Chapala Hydro-Electric Company's plant to begin operation on a large scale. This district is characterized by large bodies of relatively low-grade silver ores, with varying quantities of gold. Guanajuato has held its own by reason of capable management, despite the low price of silver, and it is interesting to observe that the predicted closing of silver mines in many parts of the Republic has not taken place. The producers of this metal have been clamoring for a return to the free coinage of silver, but the Government defends its monetary system by pointing to the damage resulting from fluctuation in exchange which seriously affects the cost of supplies. During the fiscal year 1908-09 the Mexican mints coined ₱6,528,000 of silver and ₱1,760,000 of gold.

The metal market has been unfavorable to the development of the smelting industry, although the Chihuahua smelter resumed in the early part of the year, and has been kept busy by the excellent developments at Santa Eulalia and elsewhere. The Velardeña smelter has been in operation, but the works at Torreón have experienced difficulties. This plant will, however, benefit by the general improvement which is now taking place, and a revival of smelting is also promised for Oaxaca. The smelter at Cananea has been a heavy producer, and the outlook for northern Sonora has distinctly brightened. Zinc mining has not been as seriously affected by the new United States tariff as was anticipated, and shipments continue to be important.

The oil industry has been in a feverish and disturbed condition for the larger portion of the year. This has been due in part to irregularity in the output of the wells, which is said to have led the National Railways to return to the use of coal for many of its engines which had been equipped for oil-burning. There has also been a bitter contest between the Pearson interests and other producers for control of the oil business, which culminated in a statute permitting the importation of crude oil free of duty for refining within the Republic. This act has been severely criticised as a concession to the Standard Oil. It certainly is not in accord with the jealous fostering of national industries so prominent in the policy of the Government in other directions. Large areas of unprospected oil territory exist, which it would seem wise to develop with such encouragement as could properly be granted.

The political excitement during 1909 has happily terminated by the withdrawal of General Bernardo Reyes from the arena. The stability of Mexico need not be questioned, and foreign capital continues to flow steadily into enterprises of every kind. The enormous sums invested in mines and railroads within the year is sufficient proof of the confidence of the world in the future of the country, to which may be added the significant fact that in spite of alarmist reports when politics were at fever heat, Mexican national and railway bonds showed no decline in price upon the exchanges of New York and London.

THE LONDON MARKET.

By T. A. Rickard.

The close of 1909 found Great Britain in the throes of a constitutional crisis and on the eve of a general election. Nevertheless, the phlegmatic temperament of the English people is admirably illustrated by the imperturbability of the general public, despite the shrill excursions and alarms of politicians and the grave warnings of statesmen. Business is not seriously affected, but proceeds in the customary detached manner. The mining market is quiet, but not depressed, such liquidation as marked the last quarter of the year being perfectly logical after the abortive boom that made Throgmorton Avenue so lively early in the summer. It is harder to 'stampede' the British public than in the delirious days of an earlier decade. Mining has become a saner business, promoters' profits are less extravagant, Companies Acts are more compelling, and shareholders are more wide-awake to their rights than in flamboyant days of yore. And it is well. The few make less loot, the many have a run for their money.

The year just ended has seen a decided revival of activity in the mining world of London and has given to 1910 the promise of further prosperity. South Africa still dominates the market and yields approximately 34% of the total gold production. Technical progress continues and the costs of extraction are undergoing a decrease highly creditable to those directing the industry.

Nevertheless a threatening cloud has overshadowed the promise of further development, and that is the scarcity of native labor. At the end of 1909 all the Chinese had practically been repatriated, so that the gold mines of the Transvaal are now dependent on Kaffir labor, bossed and supplemented by white men. Owing to the growing necessities of an expanding industry, not on the Rand alone, but in Rhodesia, as well as in the diamond mines, and by reason of an increased demand for labor in construction throughout South Africa, there has been a serious pinch in the labor required for new mining enterprises, and even a restriction in the current supply for established mines.

The 'big houses', meaning thereby the financial corporations controlling large groups of mines, prefer to belittle this danger to the progress of Rand industry, but the warnings of others equally well informed and less biased have checked speculation and have taken the life out of the share market. It is possible that the completion of the South African Union will enable more thorough and better organized recruiting for native labor throughout the southern half of the continent, and in this direction lies the best hope of improvement. Otherwise there will be a renewed demand for Asiatic labor and a revival of political controversy highly injurious to the business of mining.

West Africa has made great strides in 1909. The discoveries of ore and the developments underground have been satisfactory, but hardly less important are the amalgamations and consolidations of companies following upon the investment of capital by the leading South African and Western Australian operators. At one time a real boom in West African mines seemed imminent, but the restricted extent of the goldfields, and the dominance of one or two groups, tended to check expansion.

In Western Australia the continued, but slow, decline of gold mining marks the exhaustion of several productive properties. The total production has only decreased slightly, but the salient fact remains that no new big mines have been developed, although exploratory work in depth at Kalgoorlie has strengthened the position of the Great Boulder, Golden Horseshoe, and Ivanhoe mines. In this region also several useful consolidations have been effected, diminishing the cost of administration and releasing the mills of exhausted mines for the treatment of ore reserves in neighboring properties. But the most interesting feature has been the acquirement by the old Western Australian companies of new opportunities in other countries, by the purchase of oil lands, gold mines, and other ventures of a promising nature. This illustrates not only the dogged spirit of British enterprise but the recognition of the fact that a well organized staff is an asset not lightly to be discarded.

The Mexican and American mines on the British market have done well during 1909 and no noteworthy disappointments have injured the prospects for future business. The group at El Oro and the equally important group at Treadwell have continued to illustrate the profitable character of mining when conducted with skill and sense. New flotations are under way, and 1910 ought to see the addition of several names to the list of North American mines quoted on the London Stock Exchange. There are a number which might well be listed.

Russian mines have gained in prominence; one or two companies are doing excellently and others are full of promise. It is remarkable how many mining engineers have been sent to Siberia during 1909, and most of them have returned with encouraging reports. Unless all signs fail, that part of the world will be prominent in the mining record of the next decade.

The copper market has engaged the interest of many, and American mines producing that metal have afforded counters for some lively gambles, but the average Londoner is still quite skeptical as to the millions of tons of low-grade copper ore claimed to have been exposed with such astonishing rapidity in the new mines of the 'chalcocite disseminated in porphyry' type. The general skepticism has not prevented a few enterprising individuals from making handsome profits from participation in the boom on the New York curb.

There is plenty of money available for mining in London; the former issues have been thoroughly digested, and a new crop of speculators has reached the adult age, the mining business is in good odor, and it only needs a few striking developments to create a widespread financial interest. The various exploration and promotion corporations are keenly on the lookout for fresh opportunities, and any important new mining district would receive a profuse irrigation of British capital.

COPPER IN 1909.

Written for the Mining and Scientific Press
By L. Vogelstein

*Copper mining is one of the most important industries of this country. The amount of money involved in its exploitation is exceeded by that in few other lines of production, and the value of the product is probably exceeded only by the value of the iron and oil produced in this country. The most important event in the copper industry in 1909 was the formation of the statistical bureau called the Copper Producers' Association, which is supplying the world with correct statistics, showing the quantities of refined copper produced, the quantities shipped to domestic consumers and for export, and the quantities of marketable copper held in refineries or in warehouses at the end of every month. The benefits which the industry will derive from the organization of this Association are not yet fully appreciated, and it will take a few years' experience to demonstrate to the world that these statistics in the end will be the best barometer of copper-trade conditions. In view of the publication of statistics by the Copper Producers' Association we are this year, for the first time, in a position to give correct figures of stocks of copper, production, and deliveries, and we have to compare these figures with the publications of previous years by the United States Geological Survey, which are not quite as reliable, and are not compiled on exactly the same basis.

COPPER PRODUCERS' ASSOCIATION FIGURES, 1909.
(December estimated.)

	Pounds.
Stock January 1, 1909	122,537,266
Production	1,410,000,000
Domestic deliveries	700,000,000
Exports	690,000,000
Stock at end of year, estimated	142,000,000

U. S. GEOLOGICAL SURVEY FIGURES, 1908.

	Pounds.
Stock January 1, 1908	125,745,796
Refining output (blister copper exported added)	1,137,962,408
Exports	661,876,127
Domestic consumption	479,955,318
Stock at end of year	121,876,759

It will be seen from these figures that the apparent increase in the production of refined copper for the year 1909 was approximately 272,000,000 lb., or 25%. However, an analysis of this larger production will show that only part of the increase is due to an increased mining production in this country. In the first place, the American production in the year 1908 was seriously curtailed on account of the shut-downs incidental to the panic conditions of the year 1907. Furthermore, of the increased production of the year 1909, a larger part is due to an importation of large quantities of copper from foreign countries for refining in this country. The importations of copper for the year 1909 are going to reach 280,000,000 lb. as against 218,000,000 in 1908, and 252,000,000 in 1907. Consequently, of the increase of 272,000,000 lb., 62,000,000 are attributable to the increased importations of foreign copper. The balance is accounted for by the increased production from Nevada and Utah. According to the United States Geological Survey, the production of copper in Nevada for 1908 was 12,241,372 lb., while at the present time the Steptoe smelter of the Nevada Consolidated is producing copper at the rate of 6,000,000 lb. per month. The production in the State of Utah for the year 1908 was 71,000,000 lb., while for 1909, the Utah Copper Co. alone is turning out approximately this quantity. Besides, the mines belonging to the Amalgamated group, in Montana, will turn out their full complement in 1909 as against a materially reduced production in 1908. The increase in the State of Montana will probably amount to over 70,000,000 pounds.

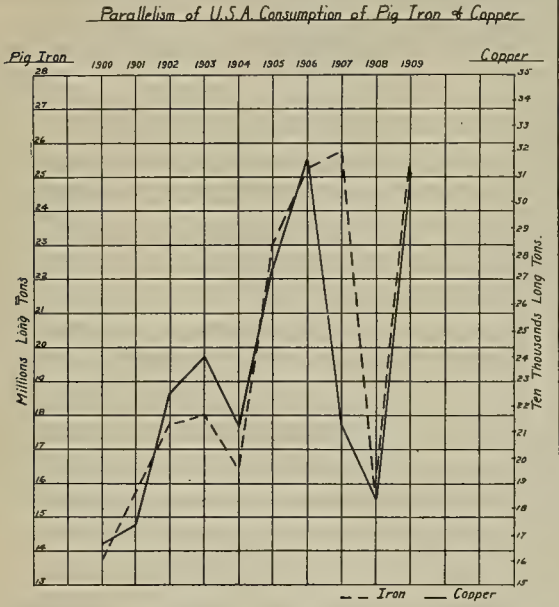
It will be noted from the above statement of consumption that during the year 1909 the copper consumption in the United States reached 700,000,000 lb. This is the largest on record, the highest previous record being the year 1906 with a consumption estimated by the United States Geological Survey of 686,000,000 lb. During the year fears were expressed time and again that production had outrun consumption to such an extent that an equilibrium could not be established. As a matter of fact, it must be admitted that the increase of visible supplies of copper all over the world shows that the world's production during the year 1909 far exceeded the world's absorption of copper into consumption. According to above estimates, the stocks of copper held at refineries in this country have increased between January 1 and December 31, 1909, by about 20,000,000 lb. The European visible stocks of copper as reported by the bi-monthly statistics, including controlled warehouses in Liverpool, Swansea, Birmingham, and France, show an increase to December 1, 1909, of 50,000 tons of 2240 lb. each, or 112,000,000 lb., and it is reasonable to suppose that the month of December will show a further increase in English and French stocks of copper of about 13,000,000 lb. making the total increase on the other side 125,000,000 lb., plus 20,000,000 increase in this country, or 145,000,000 lb. of copper for the whole year.

The world's production of copper for the current year is going to reach a figure of about 1,900,000,000 lb. (it is too early to make a close estimate of the world's production). Consequently, the increase in visible stocks of copper during the year 1909 represents hardly one-twelfth, or one month, of the world's production. In this connection it is worth while to compare the development of the iron and copper industries in this country. The accompanying diagram will show that these two industries are running absolutely parallel to each other, and that the increase in consumption of both metals has been continuous and in the same proportion, although there are some slight variations due to temporary conditions.

The paramount question in the copper industry of this country, and as a matter of fact in the copper industry of the world, is, what may we expect from the year 1910 as to production and consumption?

*Written December 14, all figures for December estimated.

The production of copper has reached in the year 1909 a high-water mark, and it is not likely to show a material increase in the year 1910. Experience has taught us that the world's copper production has to increase from year to year in order to cope with the permanent increasing demand for the red metal. The world's production of copper, measured in tons of 2240 lb. each, was as follows, the figure for 1909 being estimated: 1891, 285,000; 1895, 340,000; 1900, 495,000; 1905, 693,000; 1908, 760,000; 1909, 900,000. It will be seen that the production of copper in 18 years more than trebled. However, the consumption of copper has kept pace with this enormous increase, and with few interruptions during periods of commercial depression, consumption has overtaken production in spite of the enormous increase in supplies. Particularly this country has been making exceptional strides in the consumption



of copper. In 1898 we consumed 264,000,000 lb. of copper; in 1901 we consumed 390,000,000 lb., an increase of 50% in four years. In 1903 we consumed 500,000,000 lb., an increase of 25% in two years; in 1906 we consumed 700,000,000 lb., an increase of 40% in four years, or comparing consumption in 1898 of 264,000,000 lb. with 1906 of 700,000,000 lb., consumption increased in eight years 165%. A careful study of these figures will show that had it not been for the panic of 1907 our consumption of copper would have gradually increased during the year 1909 to at least 800,000,000, and should reach in 1910 900,000,000 to 950,000,000 lb. While this theory was very much questioned and doubted at the beginning of the year, the last few months seem to indicate the correctness of such calculation.

Deliveries of copper into domestic consumption have steadily increased since the beginning of this year and have reached by the month of November a figure of 66,000,000 lb., which would indicate an annual consumption of 800,000,000 if continued for twelve months. In spite of this huge consumption of copper by the end of the year, it is admitted that construction of new large power-plants, electrification of railroads, building of trolley lines, and other work, has not been resumed since the interruption in the year 1907. The reports issued by the big electrical manufacturing companies show clearly that consumption is still running far behind the years 1906 and 1907. It is, therefore, reasonable to assume that with a revival of construction work, which is bound to come, consumption of copper in the United States will soon reach 75,000,000 to 80,000,000 lb. per month.

The price movement during the year 1909 was very erratic. At the beginning of the year the price for electrolytic copper was 14c. to 14.25c., this price having been reached in the latter part of the year 1908, stimulated by the election results and in anticipation of an early improvement in business. Owing to the disappointment felt over the slowness of the improvement, and owing to large new supplies coming on the market, this price could not be maintained, and it declined rapidly during the months of January and February, reaching a low point in the beginning of March when European buyers bought enormous quantities of copper at 12c. per pound. These enormous purchases stimulated the market, and it gradually improved from the low point at which not all of the producers were sellers, reaching about 13½c. by the middle of June, when the improvement in the iron and steel lines commenced to be felt in copper. The heavy production shown in the statistical publications, and the fact that European consumers had covered their wants at the low prices prevailing in the early spring for several months, brought about a cessation of the buying movement, and prices sagged off slowly to about 13c. by the beginning of August. The publication of the Copper Producers' Association figures for the month of July stimulated the market for a short while, but pessimistic sentiment in England and on the Continent, the tightening of the money rates, and the bearish attitude of some of the principal sellers, further depressed the price to about 12⅝c. by the end of October. At that time rumors of the negotiations for the combination of the principal copper mines in this country were spread, and stimulated by these rumors and by some speculative purchases of copper the market took a sudden spurt and slowly advanced to about 13½c. during the second half of November. The decision of the Circuit Court against the Standard Oil Co. put a temporary damper on the combination rumors and thereby depressed the copper market; so that at this writing prices are slightly below the best. It is, however, felt that the improvement in the market conditions due to the increased consumption in this country is going to be sufficient to keep copper prices from falling materially below the present level.

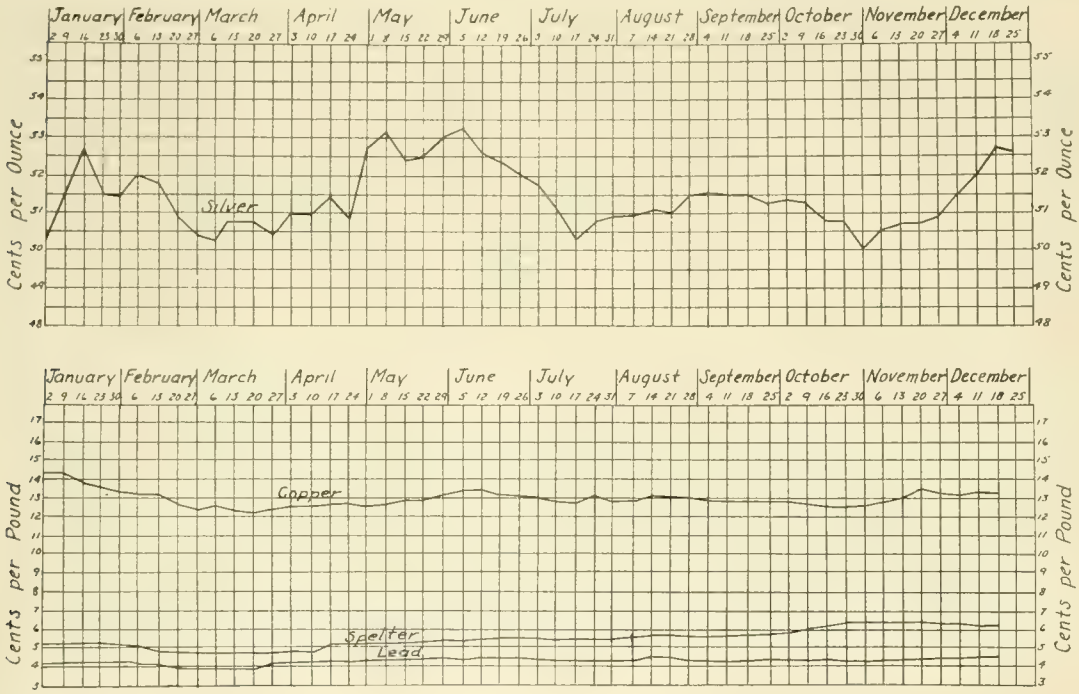
In conclusion a word should be said about the importance of speculation in the maintenance of copper prices. Ever since the panic of 1907 outside speculation has taken hold of the copper market and time and again has surprised the producers and consumers by taking a bold stand whenever large offerings seemed to find a bottomless market. These speculators have not made any material profit during

the past two years, but they have held on to their purchases, firmly convinced that sooner or later the improvement which has been felt in all other markets, and particularly in the iron market, would have its effect on the copper market. Only an open and free market, such as exists on the London Metal Exchange, could have afforded the facilities for speculating in copper to outsiders, and looking backward at the troublesome period of the last two years, it can be stated emphatically that, without the assistance of outside speculation, prices would have reached a much lower level on account of the inability or unwillingness of producers to carry larger stocks of copper. Practically all the copper carried in English and French warehouses is being held for account of outside speculators, who are paying heavy interest, carrying charges, and commission

LEAD IN 1909.

Written for the Mining and Scientific Press
By J. H. Lang.

The lead market closed in 1908 under the depressing influence of anticipated tariff revision and the rather poor business current at that time. These influences continued operative during the first two or three months of 1909 until prices in March had fallen to 4c., New York, for common Western de-silverized metal. The Dingley tariff provided a duty of 1½c. on lead in ore and 2½c. on pig lead. A strong fight was made to have these rates reduced to 1c. and 1½c. respectively, and for a time it looked as though the effort would be successful. In fact advance copies of the new tariff published in March gave the lower



Range of Metal Prices in 1909.

The development of the market during the year 1910 will depend principally on conditions in this country. Business in Europe has been good, although not splendid, but conditions in the Old World are much steadier, and the figures of consumption in foreign countries do not show the heavy fluctuations which are to be seen in this country. If the hypothesis of a continuously increasing consumption in this country as elaborated above be correct, as it seems to be, according to past experience, it will only depend on the producers whether a higher level of prices can be established and maintained during the coming year. If producers will strain every effort to smelt and refine as much copper as they can possibly turn out, it is doubtful whether a permanently higher level of prices can be maintained in view of the present large accumulation. If, however, producers will at least refrain from increasing their present production, a higher level of prices should be within sight.

duties but almost over night a change occurred and the full text of the bill when officially published restored the old rates. In consequence, and stimulated by the better demand which has accompanied the business revival, prices have steadily risen, reaching by the middle of December 4½c., New York, with good prospects of a further advance. The demand from corroders which remained fairly constant even during the panic, has made new high records this year, owing to the building boom. The 'Pure Food and Drugs Act' militates against the use of substitutes and adulterants through mis-branding. The able and intelligent advertising campaign conducted by manufacturers showing the value of lead as a pigment has also had its effect. Depression of the electrical industry, which normally uses large quantities of lead, was chiefly responsible for the reduced consumption in 1908. This industry having recovered from the panic but slowly, has probably not re-

quired in 1909 as much lead as in 1906-07, but the outlook is that during the next 12 months electrical manufacturers will be large buyers of this commodity. In fact, there is every reason to expect a larger use of the metal in all lines than ever before.

Any estimate of production at this time would be largely guess work, but it is reasonable to look for some increase, especially in Missouri, and it is quite safe to predict that the losses of 1908 will be fully made up. In addition to the domestic production, we used in 1909 the usual quantity of lead from duty-paid ore and bullion. Exports of foreign lead from bonded refineries, however, were much heavier and promise to make a new high record in 1909, having nearly doubled in two years. The effect of these large exports, in conjunction with liberal supplies available to foreign markets from other sources, has operated to keep the price abroad at a low figure, though there was a tendency to rise toward the close of the year, due partly, no doubt, to better business, and possibly to some extent to the operations of a syndicate formed to rescue the industry from its unprofitable condition.

Prices of 'Soft Spanish' in London have varied from £12 7s. 6d. to £13 13s. 9d., equivalent, respectively, to about 2.70c. and 2.73c. per lb., United States currency, and is today at about 2⅞c. per lb. With New York prices where they now are, duty considered, whether lead made from duty-paid ore can be more profitably kept in this country or shipped abroad is quite evenly balanced. The two markets are about on a parity, and may react on one another. In considering this possibility, however, it should not be forgotten that 'Soft Spanish' lead sold as high as £21 15s. in 1907, and averaged for the last three years £16 17s. 6d. (3.65c.). Given a fair revival of trade, prices of metal abroad will rise. Granted a restoration of the three years' average, we should have prices equivalent to 5¼c. duty paid, New York. It is interesting to note in this connection that the new tariff does not provide for the liquidation of bonded lead on exportation of 90% as heretofore, but requires that the whole quantity be exported. The domestic market may thus be deprived of the large quantities of foreign lead annually derived from this source during the past several years.

All things considered the trade has every reason to look forward to the future with optimism. It is the history of America that while trade occasionally stands still or experiences temporary reactions, progress is sure to be resumed with increased vigor. It is not quite clear from what source the increased quantities which, if history repeats itself will be required in 1910, are to be obtained except at higher prices.

The iron ore deposits of Minas Geráes, Brazil, have recently been examined by the Geological Survey of that Republic. The known deposits number 52. Development has been carried on to such an extent as to admit of estimates of quantity which are placed at approximately 6,000,000,000 tons of ore containing more than 60% of iron of merchantable grade of purity.

SPELTER IN 1909.

Written for the MINING AND SCIENTIFIC PRESS
By J. H. LANG.

The spelter market during 1909 has been one of unusual interest. The metal was hard hit by the panic. Its principal uses being for galvanizing and brass making, it suffered in common with iron, steel, and copper. It maintained, however, a relatively sound position—production being cut down in line with the reduced demand so that while stocks accumulated they did not become unwieldy and, as pointed out later, they have since disappeared. Because of the financial stringency and the fact that the industry both as to mining and smelting is less consolidated than is the case with any other metal, the price declined from 7c., St. Louis, early in 1907, to 4c. in December of that year. This latter price was altogether too low, and 1908 marked a sharp recovery, the average for that year being about 4¾c., St. Louis.

January 1909 opened with the market at 5c., but the threatened reaction in business shortly after the first of the year carried the price down to 4⅝c. From that time on, however, there was a steady appreciation, tariff agitation having exactly the contrary effect from that experienced by lead, for, whereas lead miners had high protection and were threatened with a reduction, zinc ores were on the free list, and their producers were clamoring for a duty. It early became apparent that they would succeed in their efforts, and the market rose rapidly, reaching 5¼c., St. Louis, by the middle of the year. It was evident, however, that this rise had by no means discounted the situation, and under the influence of heavy buying by consumers and large speculative purchases after the duty was imposed, the price advanced to 6¼c., at which point it has since held with but trifling reactions.

The large stock accumulated in 1908, estimated at one time as high as 40,000 tons, had dwindled to one-half that amount by the beginning of 1909. It is safe to assume that the whole quantity has since been absorbed, and the industry will enter 1910 in better shape than it has been for two years. Production is estimated at 210,000 tons, and consumption at 225,000, the difference representing decreased stocks.

These figures indicate, so far as consumption is concerned, that normal conditions have been restored, but production is not keeping pace with the improvement. Several causes militate against an increased output. The Joplin district, which is the principal source of domestic ore supply, has for a number of years apparently been unable to expend its production proportionately to the increased demand for spelter. From 1898 to 1908 the ore production in the Joplin district increased from 225,123 to 297,126 tons, an increase of only about 27%, while the production of spelter increased from 114,104 to 249,612 tons, or nearly 119%. In 1900 the production of ore in the Joplin district was 242,500 and of spelter in the United States 123,886 tons, or a ratio of 195 to 100. This ratio had been maintained on an average

for a long period preceding but in 1902, the situation changed and the ratio of zinc ore to total spelter production was only 1.67 to 1.00. During the last two years it has been only about 1.20 to 1.00 in spite of high prices during the larger part of this period. These facts were laid before Congress when the tariff was under discussion, and spelter being worth at that time only about 5c., at which price the duty would have precluded bringing in foreign ores, serious consequences were predicted. The subsequent rise, however, has enabled importations to be continued, and considerable prospecting and development has been undertaken in this country with fair success, notably in Wisconsin. The law as finally passed provided a duty of: ¼c. per lb. on zinc content of ores over 10 and under 20%; ½c. per lb. on zinc content of ores over 20 and under 25%; 1c. per lb. on zinc content of ores containing 25% or over. As transportation and other costs preclude bringing in ores under 25%, the maximum rate applies, and under present conditions, the ore being required, it forms a substantial prop under the spelter market. In other words, granted a consumption of spelter at the present rate, unless domestic ore production is enlarged, the price of the metal in this country can hardly fall below a level permitting the importation of foreign ores, principally from Mexico and British Columbia. At the same time that the above duties were imposed the rate on metallic zinc was reduced from 1½c. to 1⅜c. per lb. These circumstances bring the American into much closer touch than formerly with the foreign market. At the close of the year European brands could be laid down, c. i. f., New York, at 5.30c., or plus duty, 6.67½c. Domestic spelter, laid down in New York, would cost at this writing* from 6¼c. to 6⅜c., New York, showing that the margin below import cost is quite narrow.

An important development has been the formation of a syndicate abroad, or convention as it is called, whereby close control is maintained over the foreign market. Any large drafts from America would quite surely produce a sharp advance in prices, and we do not look to see the domestic market held in check by fear of imports. Also the foreign market is very strong, and prospects for higher prices in England and on the Continent are said to be excellent. In London spelter opened the year at £21 2s. 6d., and with occasional reactions worked its way up to £23 2s. 6d., equivalent in United States currency to about 5.05c. On the whole, therefore, assuming that the present favorable outlook for 1910 is measurably realized, it is reasonable to expect a demand for spelter fully commensurate with the supply, and the consequent maintenance of prosperous conditions throughout the industry. One factor having a possible important effect on production and prices in 1910 is the increased difficulty experienced by Kansas smelters in providing themselves with gas. Operations to some extent have already been interfered with from this cause, and predictions are not lacking that the smelting capacity will be seriously curtailed at no distant date owing to a shortage of gas, and a possible reversion to smelting with coal or oil.

*December 18, 1909.

METAL PRODUCTION IN 1909.

It is impracticable to give at this time exact estimates of the metal production of the year. In the articles on various pages of this issue, approximations are stated wherever data are available. The figures for gold and copper have been brought together in the form of tables. The world's gold production shows an increase as detailed elsewhere. Figures for Africa, India, and Australasia for the first nine months of the year are available and the estimates given are based upon them, it being assumed that the ratios of increase and decrease shown by Transvaal and Rhodesia respectively in the first three quarters held for the remainder of the year. The Australasian output will show a decline, as will also that of Mexico, though the exact amount cannot now be closely determined.

WORLD'S GOLD PRODUCTION.

	1908.*	1909.†
Transvaal	$145,819,016	$155,000,000
United States	96,313,256	105,000,000
Australasia	72,509,200	70,200,000
Russia	30,944,561	31,000,000
Mexico	24,518,548	22,000,000
Rhodesia	12,276,394	15,500,000
West Africa	5,773,544	
India	10,424,067	10,500,000
Canada	9,559,274	9,800,000
Other countries	36,244,452	37,000,000
Totals	$444,382,312	$456,000,000

*According to *The Mineral Industry.*
†Estimated.

In the United States there was a considerable increase due in part to the development of bonanza ore in Nevada, but mainly to the general increase in copper production. No figures for silver are available, though an increase undoubtedly occurred in the United States as another incident to the larger copper production.

GOLD AND SILVER IN THE UNITED STATES.

State or	Silver, 1908.		Gold.	
Territory.	Fine oz.	Com'l val.	1908.	1909.
Alabama	400	$ 200	$ 41,200	.....
Alaska	204,600	109,400	19,858,800	$ 19,460,000
Arizona	2,900,000	1,551,200	2,500,000	3,700,000
California	1,703,700	911,300	19,329,700	19,580,000
Colorado	10,150,200	5,429,400	22,871,000	22,500,000
Georgia	200	100	56,200	.....
Idaho	7,558,300	4,042,900	1,443,500	.....
Illinois	2,000	1,100	.....	.....
Michigan	294,100	157,300	.....	.....
Missouri	49,400	26,400	.....	.....
Montana	10,356,200	5,539,500	3,160,000	3,500,000
Nevada	9,508,500	5,086,100	11,689,400	17,500,000
N. Hampshire	6,300	3,400	3,700	.....
New Mexico	400,900	214,500	306,300	.....
No. Carolina	1,300	700	97,500	.....
Oregon	56,100	30,000	905,900	.....
Philippine Is.	1,300	700	284,500	.....
Porto Rico	.....	.....	600	.....
S. Carolina	200	100	53,700	.....
S. Dakota	197,300	105,500	7,742,200	7,000,000
Tennessee	60,900	32,600	3,700	.....
Texas	447,000	239,100	500	.....
Utah	8,451,300	4,520,600	3,946,700	7,200,000
Virginia	300	200	3,600	.....
Wyoming	3,500	1,900	7,600	.....
Washington	68,800	46,400	253,700	.....
Totals	52,440,800	$28,050,600	$94,560,000	$105,000,000

Market Reports.

ANGLO-AMERICAN SHARES.

Cabled from London.

	Dec. 22. £ s. d.	Dec. 29. £ s. d.
Camp Bird	1 7 6	1 8 9
El Oro	1 6 3	1 6 9
Esperanza	2 15 0	2 18 0
Dolores	1 8 9	1 8 9
Oroville Dredging	0 10 9	0 10 6
Mexico Mines	6 7 6	6 6 3
Tomboy	0 19 4½	1 0 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing Prices. December 29.		Closing Prices. December 29.
Adventure	6½	Mayflower	75
Allouez	57	Mexican Con	4½
Arcadian	7	Michigan	7
Arizona Commercial	51	Mohawk	69
Atlantic	11½	North Butte	49½
Black Mountain	47	Old Dominion	54¼
Boston Con	21⅞	Osceola	169½
Butte & London	25	Parrot	19½
Cactus	6⅛	Quincy	89
Calumet & Arizona	102½	Raven	70
Calumet & Hecla	675	San Antonio	8½
Centennial	37⅝	Santa Fe	2½
Chemung	15	Shannon	16¾
Con. Mercur	10	Superior Copper	63⅜
Copper Range	83¾	Superior & Boston	16⅛
Corbin	23¾	Superior & Pittsburg	16⅛
Daly West	8¾	Tamarack	69
East Butte	13¾	Trinity	10
Elm River	1½	U. S. Smelting	54
Franklin	18⅛	U. S. Pref'd	53
Granby	109	Utah Con	45½
Greene-Cananea, ctf	11¾	Victoria	5
Hancock	33½	Winona	11⅞
Helvetia	5¾	Wolverine	146½
Mass Copper	6½	Wyandot	2⅝

(By courtesy of J. C. Wilson, Mills Building.)

SOUTHERN NEVADA STOCKS.

San Francisco, December 29.

Atlanta	$ 11	Mayflower	$ 2
Belmont	64	Midway	18
Booth	10	Montana Tonopah	81
Columbia Mtn	5	Nevada Hills	75
Combination Fraction	40	Pittsburg Silver Peak	85
Daisy	10	Rawhide Coalition	22
Fairview Eagle	12	Rawhide Queen	22
Florence	2.65	Round Mountain	57
Goldfield Con	8.15	Sandstorm	5
Gold Kewenas	7	Silver Pick	10
Great Bend	3	St. Ives	8
Jim Butler	10	Tonopah Extension	69
Jumbo Extension	13	Tonopah of Nevada	7.40
MacNamara	27	West End	23

(By courtesy of the San Francisco Stock & Exchange Board.)

COMSTOCKS.

San Francisco, December 29.

Alpha	$ 11	Justice	$ 16
Alta	15	Kentuck	14
Andes	25	Lady Washington	15
Belcher	1.25	Mexican	1.75
Best & Belcher	82	New York Con	6
Bullion	21	Occident	34
Caledonia	60	Ophir	2.20
Challenge Con	37	Overman	75
Chollar	30	Potosi	60
Confidence	1.30	Savage	53
Con. Imperial	7	Scorpion	15
Con. Virginia	1.50	Seg. Belcher	12
Crown Point	1.20	Sierra Nevada	66
Exchequer	35	Silver Hill	14
Gould & Curry	43	Union	96
Hale & Norcross	57	Utah	13
Julia	20	Yellow Jacket	1.58

OIL SHARES.

San Francisco, December 29.

Associated Oil	$48.50	Palmer	$ 93
Bay City	1.55	Paraffine	1.10
Blue Moon	30	Pinal	6.00
Brookshire	85	Producers	2.00
Claremont	1.95	Record	5.00
Four	36	S. F. & McK	28.25
Fulton	1.15	Sauer Dough	2.25
Illinois Crude	45	Sesnon	8.00
McKittrick	17	S. W. & B	40.00
Monte Cristo	1.55	Turner	70
Nevada County	26	W. K. Oil	2.15

(Courtesy California Stock & Oil Exchange.)

LOCAL METAL PRICES.

San Francisco, December 29.

Antimony	12—12¾c	Quicksilver (flask)	50½—51
Electrolytic Copper	15¼—16½c	Spelter	7½—8¼c
Pig Lead	4.95—5.90c	Tin	36—37½c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver per oz.
Dec. 23	13.37	4.70	6.20	52¾
" 24	13.37	4.70	6.20	52⅝
" 25	Holiday.	No market.		
" 26	Sunday.	No market.		
" 27	13.50	4.70	6.21	52½
" 28	13.50	4.70	6.21	52⅝
" 29	13.57	4.70	6.21	52⅝

Copper Production in 1909.

According to figures compiled by the *Boston News Bureau*, the production of copper in America for 1909, compared with 1908, was as follows:

	1909.	1908.
Arizona	325,622,000	262,200,000
Montana	312,000,000	293,800,000
Michigan	237,000,000	224,500,000
Utah	117,000,000	87,750,000
California	65,000,000	27,750,000
Nevada	53,700,000	7,500,000
Other States	45,000,000	37,000,000
Mexico-Canada	162,000,000	125,000,000
Total	1,317,322,000	1,065,500,000

Production of copper on the American continent is now at the rate of about 1,400,000,000 lb. per year. Notable in the above figures is the increase in production in Utah and California and the appearance of Nevada above the 50,000,000 lb. mark. An increase in production of copper for the year is noted from the Arizona mines. The following table gives a comparison of the estimated output in pounds.

	1909.	1908.
Copper Queen	109,248,000	89,200,000
C. & A. and S. & P.	52,704,000	50,300,000
Arizona Copper	32,072,000	33,600,000
Shannon	17,725,000	18,000,000
Detroit	24,375,000	19,400,000
Old Dominion	34,950,000	38,000,000
United Verde	36,710,000	33,000,000
Imperial	11,200,000	.....
Miscellaneous	6,638,000	12,300,000
Total	325,622,000	293,800,000

Dividends.

The Osceola Consolidated Mining Co. has declared a semi-annual dividend of $6 per share to be distributed January 26. Of the total, $196,686 will go to the Calumet & Hecla company, which holds 32,781 shares.

The Tonopah Mining Co. of Nevada has declared a dividend of 35c. per share payable January 21. After this has been paid the company will have a cash balance of about $1,000,000, and it is probable that the next dividend will be at the rate of 45 or 50 per cent.

The Guggenheim Merger as now proposed is to increase the capital stock of the Utah Copper Co. from 750,000 shares to 2,500,000 shares and absorb the Nevada Consolidated and Boston Consolidated, issuing one share in the new company for 2¼ of Nevada Consolidated and 2½ of Boston Consolidated, respectively. It is proposed to issue 2,100,000 shares at once using the revenue derived from the sale of the additional stock to enlarge the Utah Copper Co.'s plants and increase the capacity of the Boston company's Garfield smelter, the additional 400,000 shares being issued later to acquire the control of the American Smelting & Refining Co.'s Garfield plant and Baltimore refinery. The total estimated output for this merger for 1910 is 200,000,000 lb. of copper with a profit of $8,175,000 for the year with the metal at 13c. per lb. The estimated production for 1910 without the proposed improvement is, Nevada Con. 75,000,000 lb., Utah Copper 65,000,000 lb., and Boston Con. 25,000,000 pounds.

QUICKSILVER IN CALIFORNIA.

Written for the Mining and Scientific Press
By An Occasional Correspondent.

It can hardly be asserted that the present condition of the quicksilver mining industry in California is at all encouraging to the producers, notwithstanding the fact that within the past few months the prices for the metal have materially advanced in London, and, as a consequence, in New York and San Francisco. The difficulty being met is that the average percentage of mercury in the ores being taken from the principal mines of the State seems to be gradually showing a reduction. This average for the past year has not been over three-quarters of one per cent (0.75%), in the case of the larger producers. A few minor properties have handled in retorts small lots of ore assaying as high as 2, 3, or 5% of mercury, or the mines could not have been worked to a profit, but the more important properties, reducing the ore as it is mined, without sorting, are not able to find it in quantity where it will yield an average of 1%. Some of them are working ore of considerably lower grade. This is vastly different from the early days of quicksilver mining in California when the New Almaden mine was producing nearly 2000 flasks per month from ore which averaged 36.74%. In the year of the highest production of this mine, 1865, when the yield was 47,194 flasks, the average percentage of the ore was 11.30.

Map of California.

From the experience of most of the mines of the State it would seem that the grade of the ore is materially less as depth is attained, and that the richer deposits are found near the surface. This may be noted from the record of the New Almaden mine, in Santa Clara county, which was long the principal producer of the State. That record is given later on in this article. The experience does not, unfortunately, accord with that of the Almaden mine of Spain which was worked 415 years before the Christian era, and is still producing, from deposits that grew richer in depth. The deposits at Idria, in Austria, have been worked since 1490, but no such life appears to be possible for the mines of California where the principal deposits of mercury in the United States are situated. It may be confessed that the quicksilver industry of California is in a somewhat decadent stage, no new deposits of importance having been opened in the past ten years, and the older mines not being nearly so productive as formerly. Some of the older mines, at one time famous for their yield, are at this time making their final clean-ups before discontinuing operations entirely. It is a matter of some surprise, however, that with the advanced price for the product some of the many known mines, long idle, have not been re-opened, as they were closed only owing to the low prices and lack of demand.

The contemplated closing of some of the older mines is the more to be regretted, since there is an increased demand for mercury, with larger sales, while there is a diminished annual output and a smaller stock on hand in San Francisco than has been the case for a number of years. There was, for a long period, a surplus stock on hand, which could not be disposed of except by shipment to Japan and China, where it had to meet the competition of the Spanish and Austrian mines of the Rothschilds, and had to be sold at lower prices than it would have brought in the United States had there been a sufficient domestic market. There was no other way to get rid of the excess of domestic production and the miners of quicksilver suffered accordingly, since it would not do to throw the entire stocks on the market at any price offered. Numerous small properties were compelled to cease operations.

The present California production is being used for home consumption and there is nothing to offer for export in large quantities. The California mines have no longer a surplus to sell to China and Japan. European countries have, of late, been buying heavily, and the same is true of the Eastern States. The former large stocks on hand have been altogether taken up by these demands.

As to prices for quicksilver, it may be said that about October, 1908, the London quotation was £8 10s. per flask; from this level it continued to decline until the figure in June 1909 was £8 5s. In September, 1909, the market suddenly took an upward turn to £8 12s. 6d., and in October it was £8 17s. 6d. In November the value quoted was £9 5s., and in December it was £9 15s. Meanwhile the local stocks had been absorbed by European and Eastern purchasers who have profited by the advance which they seem to have anticipated.

While a year ago the California producers were only getting $42 and $43 per flask of 75 lb., from now on they will derive the benefit from the higher range of prices; the only trouble is that they are not able to produce as much as formerly. There were only about 17,000 flasks of mercury produced

in California in 1908, though so-called official figures give a larger quantity. For the year 1909 those in the best position to know credit the State with but 16,500 flasks. In 1907 the State production was 17,431 flasks. It will be noted that the output of the State is declining, as heretofore stated. No new mines have been opened, and the old ones show a decrease in yield.

The principal producing mine in the State has been for some years the New Idria, in San Benito county, and this continues to make an output of some 700 flasks monthly. The mine is being worked up to its limit and is the only one in the State which is paying dividends of any moment. None of the former large producing mines in Napa, Sonoma, Lake, or Solano counties are making any especially favorable showing in the matter of increase in yield. It is an open secret that the once famous Napa Consolidated will shortly cease operation, and possibly the Great Western may not continue for a long period. Only the Oceanic, of the San Luis Obispo county mines, is doing much. In Santa Clara county the New Almaden is under new management and is yielding about 2000 flasks per year. This is from surface ores of low grade. The new managers, in 1910, are expected to conduct further development in the old mine in order to try to find new bodies of profitable ore. The Guadalupe mine, in Santa Clara county, is taking out better ore and more of it than for some time, this coming from new development, but not from the old mine proper. There are several unimportant mines producing a few hundred flasks per annum which are worked intermittently. The only new one of promise is the Chicago mine, near the Helen, in Lake county, which made small shipments in 1909.

There is little prospecting for cinnabar ores being carried on in California, and there has been small encouragement to open new claims if found. Possibly the recent advance in price may change this condition, but thus far there are no signs of it. After a declining demand for the past ten years or more the California producers were apparently caught napping when the recent increase in price and consumption came to be known. The local stocks were quietly absorbed at low prices though not long before the advance in value became apparent. Alaska, notwithstanding all its placer mines, has been a disappointment as a consumer of quicksilver, and indeed a few hundred flasks have been brought back from there lately. The demand from Mexico has materially decreased with the expansion of the cyanide process for treating silver ores. In the United States the consumption for metallurgical purposes has been steadily declining for some years, the cessation of silver mining and the adoption of the cyanide process in gold mining, together with the restriction of hydraulic mining, having gradually and materially reduced the demand in this direction.

The increase of extensive and deep copper mining on this Coast and elsewhere, has, however, caused an increase in the use of fulminates for exploding powder, and in such use of mercury, it is absolutely destroyed, and not recovered for re-use as in the amalgamation of gold. The same is the case in the use of mercury for drugs and pigments. The recent augmented demand appears to be due to increased use for fulminates, drugs, and pigments.

In the United States there are few districts outside of the Pacific slope in which the ores of mercury are found in such abundance as to be of great commercial importance. Becker, in his famous Geological Survey monograph on the 'Quicksilver Deposits of the Pacific Slope' shows that nearly every mineral association and mode of occurrence known to exist elsewhere, is repeated in California and Nevada, so that the mercury deposits of the Pacific Coast represent those of the world as far as they are known. This opinion was expressed over 20 years ago when, although the annual output had declined from the 'palmy days' there was no such reduction in average assay values of ores in depth as has since been apparent. It is true that this lower average was being shown in the New Almaden mine, then the main producer, but other mines were still yielding high-grade ores. This gradual decline in average value of ore may be best illustrated by the records of the New Almaden mine from the beginning to the time when the ore began to run below 2%, which would plat a descending curve, beginning with a content of 36.74% in 1850 to 1.93% in 1884. In recent years the average grade of the ore has been below 1% in this mine.

The following table shows the quicksilver production and prices at the end of each decade, beginning with initial operations in 1850:

Year.	Total production in flasks.	Average price per flask.
1850	7,723	$99.45
1860	10,000	53.55
1870	30,070	57.38
1880	59,926	31.00
1890	22,926	52.50
1900	26,317	44.94
1909	16,500	41.25

The highest price ever reached was $105.18 in 1874, when the output was 27,756 flasks.

QUICKSILVER PRODUCTION IN FOREIGN COUNTRIES.

Written for the MINING AND SCIENTIFIC PRESS
By H. W. TURNER.

The largest producer of quicksilver ore in the world is the Almadén mine of Spain, the product of which is controlled by the Rothschilds, who make the world-price. There is also a notable production in Austria and in Italy, and a smaller production in Russia, Asia Minor, Mexico, China, and Peru.

Mexico.—While quicksilver ores are common in Mexico, no large deposits like Almadén in Spain, Idria in Austria, Huancavelica in Peru, or New Almadén and New Idria in California, have as yet been reported. Probably the two most important districts are the Huitzuco in Guerrero and the Guadalcazar in San Luis Potosí. The Dulces Nombres quicksilver mine in San Luis Potosí was described by P. A. Babb.[1] This property lies 15 km. west of the railroad station of Enramada. About 14,000 flasks have been produced in the last 20 years from about 10,000 metric tons of ore, showing an average recovery of 4.7%

[1] *Eng. & Min. Jour.*, Oct. 2, 1909.

mercury. The mine was found in 1890. The ore occurs in widely scattered pockets and stringers in Cretaceous limestone, chiefly at points where the limestone has been crushed and slips have formed. The mercury is found mostly as cinnabar, but native mercury is also present, and in addition calomel, and the yellow ores, terlinguaite and eggiestonite, oxychlorides of quicksilver, first recognized in the Terlingua district in Texas. The workings are dry. On account of the occurrence of the ore in scattered stringers and pockets the cost of mining is high, amounting to P4.40 per ton, while roasting costs P3.50 per ton. The ore is reduced in a furnace, and a 90% recovery is claimed. The ground thus far explored is about 400 metres long by 100 metres wide, and to the north and south of this area are about 1000 metres of promising unexplored ground. Mr. Babb regards the deposits as due to sublimation, inasmuch as there are practically no gangue minerals, such as pyrite, calcite, and the like, the mercury salts being the only foreign material. Moreover the limestone adjoining the deposits shows no alteration or impregnation by the mercury salts as should be the case if the ores were deposited from solution. There are no igneous rocks near the workings.

Italy.—The only important district yielding mercury ores in Italy is that of Monte Amiata. Nicou[2] reports that the chief producer was the Abbadia San Salvatore, which furnished 25,000 tons of 1% ore. There were 28 furnaces running, and an average recovery of 95.2% of the mercury in the ore was claimed. The average yearly production of Italy is given as 400 metric tons, and the average cost per flask of 75 lb. as about $33.

Peru.—The famous quicksilver mines of Huancavelica were recently described by L. W. Strauss.[3] The deposits are said to have been first made known by an archbishop in 1532, when the Indians were already mining and producing mercury. Under the Spanish Crown, operations began in 1571, since which time 1,498,434 flasks of 75 lb. have been produced, and Mr. Strauss believes that the recovery was very small, because of careless operation of the furnaces and their crude construction. Up to the present time, it appears that no modern furnace has been erected. The railroad from Callao now reaches to Huancayo, which is the nearest railroad point, and is 120 km. from Huancavelica. However, grading is now in progress to Ieuchaca, which is only 50 km. from Huancavelica, and a spur to the latter place is projected. On account of the scarcity of wood-fuel, llama-dung and straw were used in the quicksilver furnaces. Umlauff[4] reports coal deposits in Yanacelle mountain 15 km. south of Huancavelica, and at other points not far from the cinnabar mines. This fuel can presumably be used in the production of producer-gas. Moreover, oil has been found in quantity in Peru, and this can also be used as a fuel when the railroad facilities are improved. There is also said to be abundant water-power, and it is possible that the water could also be used for concentration of the cinnabar in the low-grade ores.

[2]Abstract in *Eng. & Min. Jour.*, June 19, 1909, p. 1242.

[3]Min. and Sci. Press, Oct. 23, 1909.

[4]A. F. Umlauff, Boletín del Cuerpo de Ingenieros de Minas del Peru, No. 7, 1904.

CALIFORNIA GOLD MINING.

Written for the Mining and Scientific Press
By An Occasional Correspondent

No specially notable events are to be recorded in connection with gold mining in California during 1909, outside, possibly, of the discoveries of unusually rich ore in several re-opened mines in Sierra county. The discovery, two years ago, of 'candle-box' ore in one old mine, called attention to the district around Alleghany and Forest, and this led to re-exploration of other partly developed but long idle properties, all with successful results. The district is one in which both quartz and gravel mines are found, but the most important developments have been in quartz. The mines so far opened are of the class where some capital is needed, as they are all opened by adits. Aside from these no special developments of moment have occurred during the past calendar year. There have been numerous 'strikes' at different places and a number of new mines have been opened of more or less promise, but in general in the older districts of the State the work continues to be carried on in the usual manner, with perhaps a greater tendency to deep development.

The State of California has for some years produced between $18,000,000 and $20,000,000 in gold annually. The official records of the United States Geological Survey placed the gold output in 1908 at $19,329,700. These figures are the result of conferences between the officials of the Survey and those of the Bureau of the Mint. Preliminary inquiries this month show that to this amount may be added about $250,000 for the year 1909. It is highly probable that a gradual increase may be looked for of about a quarter of a million a year for some years. In taking an average of $20,000,000 per year, it may be said that the quartz mines of this State produced about $12,000,000, as compared with $8,000,000 from the placers. The tonnage of ore now being mined annually in California exceeds 2,500,000 tons, of which approximately 2,000,000 is silicious ore. The balance comes from the copper mines. The larger proportion of the silicious ore is derived from the five 'Mother Lode' counties of the State—Amador, Calaveras, El Dorado, Mariposa, and Tuolumne. In these counties the Mother Lode is wide and the grade of the ore is comparatively low. In other quartz-mine counties of the State the grade is materially higher, but the veins are narrower. The principal quartz-mine county of the State is Nevada, which leads all others in the point of production and has done so for some years. In this county the ores average in large quantity a little over $10 per ton, including the concentrate, and there is an apparent increase in the average value. Taking the whole State of California and considering the milling ore only, the average value per ton is only a little over $5.

There are about 1100 productive mines in the State; a few more placers than quartz mines. The hydraulic mining industry shows a gradual falling off in output each year; mainly owing to restrictions placed upon this industry by the Federal mining laws in the drainage basin of the Sacramento and San Joaquin rivers. In the northwestern counties of

the State—Siskiyou and Trinity—hydraulicking still flourishes, as the restrictive laws do not apply. Drift mining does not appear to be prosperous of late, and the gold from that source seems to be falling off in quantity each year. It is possible, however, that there may be a change in this respect, since in the counties of Sierra, Plumas, and Butte a number of new drift mines are being opened and old ones reopened. Surface placer work, somewhat strange to say, is increasing. This may be attributed to the fact that from the long cessation of hydraulic mining on a large scale the mountain and foothill streams have been more or less cleared of débris so that more places are now available for river and gulch mining.

The increase of gold production in California in recent years is due almost entirely to gold dredging operations. The dredges are now producing something like $5,000,000 each year more than the hydraulic, drift, and surface placers combined. Since dredging commenced on a small scale in 1898 these machines have dug out about $32,000,000 in gold, and in 1909 it is supposed they took out by dredging considerably more than $7,000,000. There are now about 70 machines at work in this State. These are operating in the counties of Butte, Calaveras, Merced, Stanislaus, Sacramento, Shasta, Siskiyou, Trinity, and Yuba.

The principal dredging fields now worked are at Oroville, Butte county, Folsom, Sacramento county, and Marysville, Yuba county. The machines constructed within the past few years are of large capacity and great strength, so that material is now being handled at a much less cost per cubic yard than was formerly the case. Those interested in this class of gold mining are constantly on the lookout for new ground which is suitable for the purpose. Certain combinations of large companies in the principal fields have materially cheapened cost in the matter of management, and the whole industry is in a prosperous condition. Dredging requires large investment in both land and plant and cannot therefore be considered a poor man's system of mining. There are now 31 counties in the State producing gold, of which seven are yielding over a million dollars per year. One of them is yielding over $3,000,000, and two others are yielding over $2,000,000. The largest output of gold is now derived from Butte county, where the greatest number of dredges is employed. The next county in rank is Nevada, which derives most of its gold from quartz mining operations. It is notable that three of these seven counties, yielding over a million dollars per year, are dredge mining counties—Butte, Sacramento, and Yuba. Not much more than ten years ago this class of mining was unknown in California. In hydraulic mining, Trinity county shows the largest returns, and the principal drift mines are in Placer county. In ordinary surface or sluicing mines Siskiyou county has the lead. The largest output of silicious ore continues to come from Calaveras, one of the Mother Lode counties.

The increase of electric-power plants throughout the State has had a marked effect in the mining regions. The numerous mountain streams furnish the original source of power, and this is distributed by electricity throughout the various mining districts. This has had the result of materially cheapening mining operations and rendered possible the operation of mines which were formerly idle. It may be said generally that it is now much easier to obtain capital for investment in the gold mines of this State than has been the case for some years. The success of deep development in the Mother Lode region, the Kennedy having reached nearly 3500 ft. of vertical depth, has induced others to continue sinking.

Dredging Grounds on Yuba River.

It may be said, speaking generally, that gold mining is in an excellent condition, and that it is probable there will be a gradual increase in annual output for some years to come. It is to be noted that the speculative feature, in the sale of stocks, is almost entirely absent in connection with the California gold mines. Most of them are worked by private corporations and no transactions are to be noted in the stock exchanges of the country. In the case even of the larger mines it is somewhat difficult to obtain any detailed information as to operations, for the owners considered these matters to be private, and publicity is carefully avoided. Lack of space prevents any extended review which would cover operations during the past year in the many gold-mining counties. Developments in progress have been duly recorded weekly and notation has been made of any marked incidents. The gold miners of California are to be congratulated on the progress that they are making and on the good record shown in a State where gold mining has been carried on constantly for the past 60 years.

IDAHO, OREGON, AND WASHINGTON IN 1909.

Written for the Mining and Scientific Press
By L. K. Armstrong.

In Idaho, in the Coeur d'Alene district, the report of the Mines Employment Bureau shows that 3000 men are on the pay-roll of mines. In addition to this there are, perhaps, as many more employed in the State at large. The lowest wage paid is $3 for muckers, but the mine wage, generally, is $3.50 per day. The Federal company has 1300 men on the pay-roll continuously, followed by the Bunker Hill & Sullivan with about half that number. The destruction of the Hercules mill by fire early in the fall reduced the working force to about half the regular number, 125 men being on the pay-roll at that time. Of the other large mines of the district the number of men employed is shown below: Hecla, 167; Snowstorm, 135; Gold Hunter, 70; Caledonia, 45; Alice, 28; Monarch, 20; Monitor, 20; Interstate and Lucky Calumet, each 15; Bear Top, Jack Waite, Star, and Frisco lease, 12 each; Great Western, Tamarack & Chesapeake, Ivanhoe, Imperial, Idaho, 10 each; with smaller properties making up the balance.

The dividends and estimated distribution of profits of these mines for the year are shown below:

Federal group	$ 720,000
Bunker Hill & Sullivan	570,000
Hercules, estimated	317,500
Snowstorm	202,500
Hecla	190,000
Total	$2,000,000

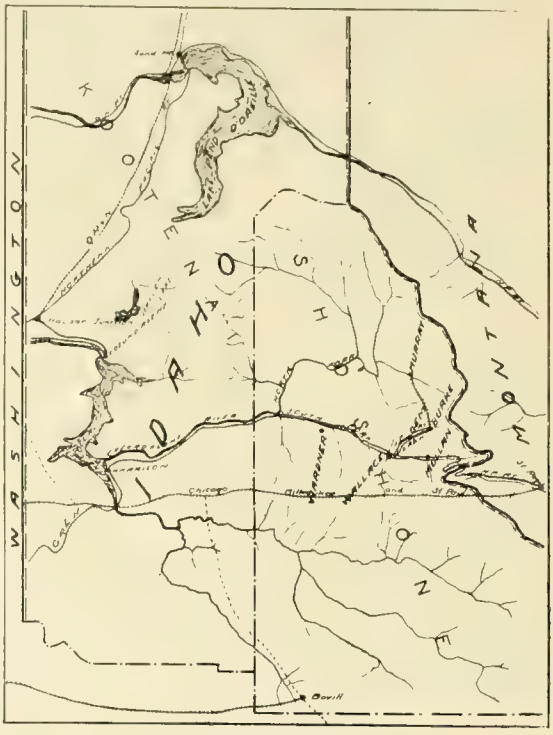
This same group, making a report to the County Assessor for the year ended May 1, 1909, claimed a net profit of $2,487,988.76, as shown below:

Federal group	$ 931,588.00
Bunker Hill & Sullivan	901,701.50
Hercules	383,751.89
Snowstorm	162,148.56
Hecla	108,798.81
Total	$2,487,988.76

According to the annual report of the general manager of the Snowstorm the total net cost of copper production after deducting the silver was 10.115c. per lb., showing a net profit of 3.159c. per lb. The ore averaged 6.394 oz. silver and 4.508% copper. The metal was marketed without any apparent cost for treatment, the silica of the ore causing it to be used for lining the converters. The burning of the Hercules mill in the fall of 1909 reduced the production of that mine for the remainder of the year, and affected the production of the district, the total value of which was not far from $15,000,000 in all metals. Monarch, Bear Top, and other North Fork properties, have profited by the building of the Idaho Northern railroad, and some shipments have been made. Assessment levies have kept several of the smaller non-productive properties of the district in steady operation. The year as a whole has been progressive. Plans are outlined for extensions of the Idaho Northern railway, and the Chicago, Milwaukee & St. Paul contemplates building into the district next year.

On the Montana side the Monitor copper mine and other smaller properties will begin shipments next year, ore being blocked and ready to move. At the beginning of December the old Continental mine, in Bonner county, which has an enormous exposure of low-grade lead-silver ore at the surface and in the shallow workings, passed into the hands of Spokane people who are preparing for early shipments. Around Priest lake and Lake Pend Oreille, there has been considerable development of the copper-bearing and siliceous gold-ore mines, encouraged, no doubt, by the promise of local treatment in the smelter near Sandpoint. There are also a few silver-lead mines undergoing development around the latter named lake, in the Clarks Fork region.

Central Idaho gold districts have not enjoyed that measure of prosperity which might have been expected. Operations at the Buster mine and mill, near Elk City, created an impression of distrust, and but little outside capital found its way into the gold districts. However, there were a few notable exceptions to the generally dull conditions. The Mines Co., Ltd., a Spokane corporation, took over the Crackerjack and other Buffalo Hump mines and installed a large amount of additional milling and other machinery looking to permanent operations. At Dixie the Penn-Dixie company purchased, installed, and started operations with a mill. Previous development warranted this and information is received indicating a successful run. Dredging in the Elk City district was started with two dredges, one of which was entirely new and the other had undergone some extensive remodeling and repair. They are ready for an early start in the spring. At Newsome the Iron Crown mill was run for a few months, netting several thousand dollars. This having been the first season, the new owners planned no



The Coeur d'Alene, Idaho.

work ahead, but next year they expect to operate on a larger scale. Both dredging and hydraulicking in the Pierce district were profitable. The most important quartz development in that district was by the Ozark Mining & Milling Co. which consisted in completing the cross-cut adit which had a length of about 1200 ft. and cut the vein at a vertical depth of over 500 ft., finding ore similar to that near the surface.

Oregon.—The first half of 1909 was exceedingly quiet in the northeastern part of the State, but several old properties resumed operations later, a few were brought into production, and new capital was interested in other cases. This all related to gold mines. The large copper properties, such as the Indiana, did almost nothing. The old Cougar property was opened and new machinery added to the cyanide plant, but deficient capital left unpaid bills and the mine was closed. The Sumpter Valley railway from Austin to Dixie was extended late in the fall, but no regular trains will be run until spring.

Washington.—Stevens and Ferry counties enjoyed the best year in their history in some respects. Shipments were not so large from several of the mines, but development was more extensive. The approach of the I. & W. N. railroad to within about eight miles of Metaline, with assurance of entry into the camp early next year, has given impetus to the development of the mines there. With a few exceptions these mines carry ore high in lead and low in silver, with a lime gangue. There are exceptions to this, however, a few carrying ore high in silver, and others with copper, gold, and silver, all silicious. If, as reported, this road is to be extended to Trail, B. C., the ores can go there, or they can go to American smelters.

At Chewelah development only has been in progress, the United Copper people preferring to hold their ore until better prices prevail, and the other properties not being advanced far enough to make continuous shipments, if any. Development on the United Copper has been satisfactory. The oreshoots have been systematically opened, and a new one cut in the upper works on a parallel vein. The lower adit, which is being projected to cut the vein-system several hundred feet below the old workings, has cut one vein of some importance, but is still several hundred feet from the objective point. The Jupiter company, operating the Last Chance mine, near Northport, has made the usual shipments to Joplin, Mo., estimates of which are not obtainable. Diamond-drill work on the Sunset was continued for the greater part of the season. About midway between Marcus and Orient, the B. C. Copper Co. has had the Napoleon under operation almost continuously, shipments being made to the company's smelter at Greenwood, B. C. This company has also the Lone Star and Washington mines, both in Ferry county, neither of which has produced much ore. The property which has made Orient has been the First Thought, a gold mine owned by P. Burns & Co., a Canadian corporation with some stock held outside. This mine has been in almost steady production for four or more years, but has never had a large ore reserve. The production has been not far from 40 tons per day during the productive period, and the ore has been reported to average between $10 and $20 per ton in gold. These figures have been considered low, but with the exception of some high-grade ore found at intervals it probably represents about the correct value. Recently the company has procured a diamond-drill and has explored a large new territory, with excellent results. This is the first attempt to create reserves, but it is believed that hereafter the company will keep prospecting well ahead of development, and that ahead of mining. It is stated on good authority that this mine, the Northport smelter, and other interests, are to be consolidated under a single management with a view to large operation.

The old camp of Republic, in Ferry county, whose two railroads netted a heavy loss to their owners each year, has been revived and some of the mines are in steady operation. Among these are the Republic, Blacktail, Quilp, and Lone Pine-Surprise. The Belcher, a few miles north of Republic, is a steady producer, having shipped a large tonnage the past season. With the exception of the last named, however, the final solution has not been reached, as only enough ore is accepted by the smelters to fill the demand for converter-lining. It is to be regretted that some concerted action is not taken to solve the local treatment problem. It is believed that finer grinding, that is, re-grinding by tube-mills or Chilean mills, would permit better cyanide extraction, but no attempt has evidently been made to work this out. West of Republic, at Chesaw, and to the south and southwest at Keller, Nespelem, Park City, and other points, greater activity has been evidenced than during the previous year, in some instances with favorable results and in others with less encouragement. These camps are without railway connections, and in consequence do not attract operators as would otherwise be the case.

In Okanogan county, west of the Okanogan river, the Nighthawk mine, not far from Nighthawk, has been in operation nearly all the year, milling ore and shipping concentrate. A number of other mines are under development. The Palmer Mountain enterprise, in the hands of new men, is attempting to discover some orebodies beyond the face of the 4000-ft. tunnel which was such a colossal failure. It is hoped that the new manager may be able to reach the known orebodies found in the upper levels of the mines on the other side of the mountain, nearly 1000 ft. ahead of the breast of the Palmer Mountain tunnel.

Without mentioning enterprises where work has been undertaken or continued without notable results during the year, the Arlington mine, near the site of the old town of Ruby, has been explored by a cross-cut adit at the 450-ft. level, and a large body of high-grade silver-copper-lead ore has been cut and driven upon. Judgment having been rendered in favor of J. H. Holden, by the Washington Supreme Court, the company having the Holden mine under bond, and which has expended a large sum of money in its development, will now be able to secure good title. Diamond-drill operations have disclosed a large body of low-grade copper-gold ore.

COKE AND IRON IN THE MIDDLE WEST.

Written for the MINING AND SCIENTIFIC PRESS
By GEORGE H. CUSHING.

The year has been especially productive of developments regarding coking Western coal, and this promises to become important. The United States Steel Corporation has about completed its new mills at Gary, Indiana, and has constructed in connection therewith four batteries of 70 ovens each, and purposes ultimately to have eight such batteries, with an average productive capacity of 13 tons each in 24 hours. Previous to the establishment of these plants, the Steel Corporation erected an experimental oven at the works of the Illinois Steel Co., at Joliet, using in it a mixture of two Eastern coals. The principle feature of that oven is the regenerative furnace, which permits a quick high temperature for the treatment of all coals. It had previously been discovered, by R. S. Moss, that the quick high temperature in a beehive oven would crack the lighter volatiles of the Illinois coals, and by the production of heavy hydro-carbons permit the coking of almost all and the manufacture of a metallurgical coke from certain coals from the southern part of the State. Inasmuch as the Koppers ovens at Joliet use the same principle, it is now considered entirely possible for the Steel Corporation to make coke from Illinois and Indiana coal. Experiments with that end in view have been made within the year by the Illinois Central railway, the United States Steel Corporation, W. P. Rend, and others, and it is understood that all have reached the same conclusion, that is, that coking of Middle West coal is possible. Since the Steel Corporation has already bought the Kelly properties, which are conceded to be capable of producing a coking coal, and since the J. R. Walsh properties are now being taken out of the hands of a receiver and are known also to produce a coal that will coke, and since the Dering Coal Co.'s mines are now in the hands of a receiver and soon to be reorganized, and since they also produce a coal capable of coking, some important developments are expected within the next year or two. W. P. Rend expects to build a battery of ovens in connection with his Franklin county mines within the coming year, and the Illinois Central railway, to avoid conflict with the city of Chicago on the smoke question, is now undertaking to use coke in its terminal engines. It may produce the coke from its own mines in the southern part of the State.

As to another phase of the mining industry, namely, the iron ore and pig iron situation, quite a satisfactory state of affairs obtains. The statement of the production of the iron ore in the Lake Superior region is of interest, not only because of the volume but also because of a change in the source of supply. The total shipments of iron ore from the Lake Superior territory will exceed by a few thousand tons the shipments for 1907, which were, in round numbers, 42,000,000 tons. To December 1, Lake ore shipments amounted to 41,164,359 tons, to which will probably be added in December at least 350,000 tons. This is highly important in view of the fact that in 1907, the Lake Superior ores were just about meeting the demands of the existing furnaces, and did not take into consideration the enormous absorptive capacity of the new mills of the United States Steel Corporation, at Gary, Indiana. The production of 1907, furthermore, took into account only part of the demands of the new mills of the National Tool Co., at Lorain, Ohio. Since 1907 the Bethlehem Steel Co. has arranged to go extensively into commercial lines and is no longer specializing upon armor plate. Jones & Laughlin have added to their billet and bloom capacity to provide the raw steel required by extended chains of rolls. The Lackawanna Iron & Steel Co. has increased its furnace capacity somewhat, in addition to which the merchant furnaces in the valley and especialy along the south shore of Lake Erie have increased materially, to say nothing of the tremendous absorptive capacity of the new steel mill of the Steel Corporation at Gary, Indiana. Taking all these things into consideration, it must be apparent that the maximum movement of iron ore from the Lake Superior region of even 42,000,000 tons is going to be somewhat short of requirements provided we have a demand for all the pig iron that could be produced. It is understood that stocks of ore on the docks on the south shore of Lake Erie and at the furnaces themselves are not plentiful. This fact assumes a new importance when it is known that a number of the steel mills are now sold up to their capacity for the next three or four months. In the Chicago territory a number of the plants which have withheld their capacity from contracts to obtain the advantage of the open market are now so congested with business that they have been compelled to refuse new orders even at premium figures. The situation becomes more interesting, and possibly significant, when it is known that the railroads of late have been placing record orders both for track supplies and for rolling stock. This action has been due to railroad facilities having fallen short of commercial requirements in the central western territory, and liberal extensions are necessary. This situation harks back to the ore movement because the railroads cannot improve their facilities until they get cars or rails; the car manufacturers and the rail mills cannot supply those demands until they get raw steel; the billet and blooming mills cannot meet the demands upon them until they get the pig iron, and the blast-furnaces, of course, can operate only as they obtain the iron ore. In the meantime the supply of ore is 7,000,000 tons below that of 1907.

There were two reasons for the partial paralysis of the Lake trade early in the season, one of them being the absence of any marked recovery of general business for this year, and the other being the difficulties of the members of the Lake Carriers' Association with all forms of labor on shipboard, starting in with the Marine Engineers' Beneficial Association. At the beginning of the season the vessel owners were willing to accept the challenge of organized labor, since they knew no urgent demand for boats existed and any immediate opening of navigation would cause a rapid decline in freight rates. The vessel owners had been waiting a long time for an opportunity to deliver a body blow to what they considered autocratic labor unions. A running fight developed, and

extended over most of the season of navigation. Its principal result was the almost complete paralysis of Lake business up to the first of June. That, of course, took out of the market the vessel-carrying capacity for a good part of April and all of May, and resulted in crippling the fleet to a certain extent through the year. Furthermore, there was no active demand for iron ore until the opening of the fall trade, the first appearance of returning business coming about August 15 or September 1. As a consequence the movement of iron ore was jammed into the last six months of the year.

A further matter of no mean importance is the increasing percentage of the iron ore from Duluth, Superior, and Two Harbors, with a similar decrease in the movement from Marquette and Escanaba. This means a change in the character of the ore shipped from the Lake Superior territory. In other words, it means that the Mesabi range is rapidly becoming the main reliance of the iron and steel industries, and the old-range ores are less important. This is in some regards the most important development of the entire Lake trade, because, with the possible exception of the content of phosphorus the predominant ores shipped from the Lake Superior territory now grade closely to those coming from Port Arthur and Michipicoten on the Canadian side. As far as metallic content is concerned, they grade evenly with some of the Southern and Western ores. The change in ore movement corresponds to the increase in open-hearth or basic-steel production. In this connection the report of the American Railway Association favoring the use of basic steel rails may be noted. In view of the fact that the centre of the steel production is now broader, and in view of the further fact that the Pittsburg territory is far from controlling the whole of the steel trade now, this means a broader base of supply for iron ore, and marks a centrifugal tendency in steel production.

As to pig-iron production in the central western territory, it can easily be seen that this is not dependent now so much upon the wish of the producers themselves, or upon the demand of the market, as upon the supply of iron ore available.

LAKE SUPERIOR COPPER MINING, 1909.

Written for the MINING AND SCIENTIFIC PRESS
By ROBERT H. MAURER.

There have been years in the history of copper mining in the Lake Superior district that, viewed from a dividend standpoint, have been more successful than the year just closed, but in the production of copper the year leads all by a wide margin. In other respects 1909 was a normal year. During the year there was produced, as nearly as can be calculated, 236,335,700 lb. of fine copper, compared with 222,674,918 in 1908, 216,116,747 in 1907, 229,632,608 in 1906, and 230,437,992 in the banner year 1905.

The year opened with 19 producing companies, and closed with 17 maintaining regular production, the Keweenaw Copper Co. dropping from the ranks of the producers in March, and the Michigan Copper Mining Co. following in the month of October. In the mat-

Each rectangle is a township, six miles square.

Key to Mines.

1. Ætna	19. Tamarack
2. Empire	20. Osceola
3. Delaware	21. Tecumseh
4. Amygdaloid	22. Rhode Island
5. Copper Falls	23. Franklin, Jr.
6. Central	24. Franklin
7. Phœnix	25. Arcadian
8. Cliff	26. Quincy
9. Mohawk	27. Isle Royale
10. Ahmeek	28. Atlantic
11. Allouez	29. Baltic
12. N. Kearsarge	30. Trimountain
13. Wolverine	31. Champion
14. Mayflower	32. Belt
15. Centennial	33. Adventure
16. Tamarack Jr.	34. Mass
17. S. Kearsarge	35. Michigan
18. Calumet & Hecla.	36. Victoria

The Copper Region of Lake Superior.

ter of dividends disbursed there is small cause for complaint, considering the prevailing low prices for the finished product. The average price per pound realized during the year was 13.31c., compared with 13.33 during the previous year, 20 during 1907, and 19.61 during the banner dividend-year of 1906, and is with two exceptions the lowest price recorded in ten years. Dividends were earned and disbursed by seven of the companies, and totaled $6,309,200 for the year. In 1908 there were eight dividend payers and a total of $4,837,300 was disbursed. Total dividend disbursements in 1907 reached $13,469,950, and in 1906 the amount disbursed was $13,911,500.

Labor conditions were ideal. Work was plentiful, and the wage scale satisfactory to employer and employee. With the exception of the Quincy Mining Co., which faced a labor strike of short duration early in the year, capital and labor worked in harmony. The number of men employed in the various branches of the industry was about normal. The growth of the industry has been remarkable, and it is doubtful if there be another mining field on the globe that can show greater advancement over a period of time so great as that in which the Lake Superior copper mines have been worked. Although

an English company made an attempt at mining along the Ontonagon river in the southern end of this district as early as 1770, the history of copper mining in historic times really begins with the organization, in 1844, of the Pittsburg & Boston Mining Co., the first producer and also the first dividend payer of the district. The company operated the famous Cliff mine of early days. Progress since 1844 has been steady. Production at no time fell off more than 10% from the high mark of any previous year, and in 60 years has grown from 1,505,280 lb. to around 235,000,000 annually. A table showing the yearly output in pounds avoirdupois and the dividends paid every fifth year since 1849 is appended herewith.

Year.	Copper, Pounds.	Dividends.
1849	1,505,280	$ 60,000
1854	4,074,560	198,000
1859	8,937,995	360,000
1864	12,491,965	1,150,000
1869	26,625,301	210,000
1874	34,334,389	1,940,000
1879	42,671,529	1,818,620
1884	69,353,202	1,327,500
1889	88,175,675	2,670,000
1894	114,308,870	2,380,000
1899	146,950,338	12,318,450
1904	208,329,248	5,432,300
1909	236,385,700	6,309,200

The total production of copper reaches approximately 4,950,000,000 lb., and the total dividend disbursement stands at $174,655,370. The following table shows the total dividend payments of the several companies:

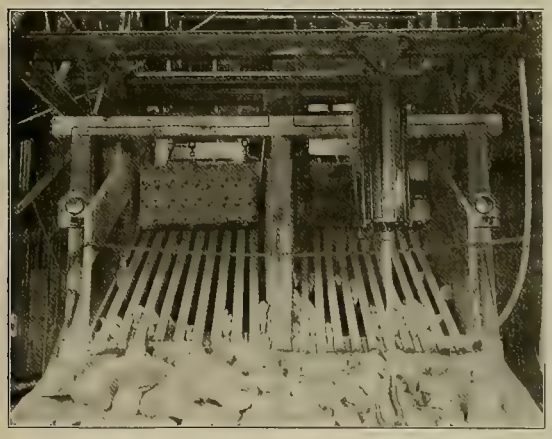
Mine.	Total dividends.
Atlantic	$ 990,000
Baltic	5,550,000
Calumet & Hecla	108,550,000
Central	2,130,000
Champion	5,700,000
Cliff	2,518,620
Copper Falls	100,000
Franklin	1,240,000
Kearsarge	160,000
Minesota	1,820,000
Mohawk	2,050,000
National	320,000
Osceola	8,381,750
Pewabic	1,000,000
Phoenix	20,000
Quincy	18,105,000
Ridge	100,000
Tamarack	9,420,000
Trimountain	800,000
Wolverine	5,700,000

The increase in production was greater last year than it was in 1908, due principally to the greatly increased outputs of the Ahmeek, Isle Royale, Osceola, Champion, and Baltic mines, a further contributing factor being the Superior mine, which alone added nearly 2,000,000 lb. to the total production of the older companies. The Calumet & Hecla output was the smallest recorded in five years, the decrease amounting to about 5,000,000 lb. from the average annual production of that period. The Franklin output also decreased by about 1,500,000 lb. from the preceding year, the smaller production being due to two causes, the sale of the old Franklin mine to the Quincy company, and the curtailment in and final abandonment of the conglomerate mine, leaving the company with but a partly developed mine on the Pewabic lode to draw upon. The Michigan mine yielded a regular production during the first ten months of the year, after which operations were suspended, owing to the not altogether favorable conditions existing underground, coupled with the prevailing low prices for the finished metal. Better conditions in the metal market will again see the Michigan among the regular producers of the district. The Mandan mine of the Keweenaw Copper Co. proved a dismal failure, and probably will not figure as a producer for many years to come. The Superior rounded out her first year as a producer and has more than met expectations. This mine promises a greatly increased production for the new year and will be numbered among the best of the district in the near future. Among other possible new producers are Lake, La Salle, and Gratiot. The first named has opened a wonderfully rich copper deposit, and will probably become one of the largest producers of the district. The La Salle and Gratiot also are in shape to maintain a steady production, but for the immediate future the outputs of these properties will be rather limited. In the following table is given an estimate of the production in pounds of fine copper of the several Lake Superior mines for the year 1909, as also the actual figures of production for the two preceding years. The estimates are based upon the most reliable data obtainable. Official figures will not be available for quite six months to come.

	1909, Pounds (Estimated).	1908, Pounds (Actual).	1907, Pounds (Actual).
Adventure	.....	90,870	1,244,874
Ahmeek	9,875,000	6,280,241	5,510,985
Allouez	3,450,000	3,047,051	2,934,116
Baltic	19,339,200	17,724,854	16,704,868
Calumet & Hecla	80,815,500	81,660,723	83,863,116
Centennial	1,560,000	2,196,377	2,373,572
Champion	19,026,700	17,786,763	16,489,436
Franklin	2,175,000	3,703,421	4,401,248
Isle Royale	5,942,500	3,011,664	2,667,608
Keweenaw	56,400	122,474	.....
Mass	1,956,000	1,766,930	2,078,677
Michigan	1,865,700	3,000,206	2,665,404
Mohawk	11,428,500	10,295,881	10,107,266
Osceola	25,450,000	21,250,794	14,134,753
Quincy	21,500,000	20,600,361	19,796,058
Superior	1,800,000	.....	.....
Tamarack	12,607,500	12,806,127	11,078,604
Trimountain	6,053,700	6,034,908	8,190,711
Victoria	1,553,500	1,290,040	1,207,237
Winona	.....	.....	1,285,863
Wolverine	9,880,500	9,955,233	9,272,351
Miscellaneous	50,000	50,000	110,000
Totals	236,385,700	222,674,918	216,116,747

First and foremost among the mining companies of the Lake Superior copper district is the Calumet & Hecla, with a dividend record of $109,600,000 paid since its organization in 1871. Dividend disbursements made prior to that time by the original Calumet and Hecla companies, of which the present company is a consolidation, amounted to $950,000 additional, and brings the total dividends earned in these operations to well over $110,000,000. During the past year the company disbursed $2,700,000. The largest amount paid in any one year was $10,000,000, which amount was paid in 1899. The com-

pany is primarily a producer of copper, but in more recent years has acquired a considerable interest in other copper producers of this district, and has now become practically a securities holding company, virtually owning and controlling 15 Lake Superior mining companies, giving the Calumet & Hecla the control of upward of 140,000,000 lb. of copper annually out of a total production of about 235,000,000 for the district. Of this amount approximately



Grizzly at Trimountain Shaft.

80,000,000 lb. is secured from operations in its own mines on the famous conglomerate bed and the Osceola lode. Developments in the conglomerate mine show a steady decrease in copper content with depth, and the average recovery of fine copper per ton is now about 35 lb., compared with 80 secured not over ten years ago. Operations in the so-called

Ingots ofCopper.

Black Hills mine of the South Hecla branch resulted in the disclosure of commercial copper ore in ground that was generally looked upon as unpromising, and this should add materially to the life of the company on that end of the conglomerate bed. Development in the Osceola amygdaloid continued without interruption, and the tonnage now opened there is estimated at 15,000,000 tons. This lode is now yielding about 15% of the Calumet & Hecla production. Developments in the Kearsarge lode show no material betterment over past years, and were in the main satisfactory.

The exploratory operations of the company were centered in the exploitation of the Nonesuch lode in the Ontonagon district, and the results there obtained have induced the organization of a mining company to develop the lands carrying this lode. The Calumet & Hecla will own about half of the shares of this company, and will finance and direct the new company. Litigation growing out of the attempt of the company to vote the stock held by it in the several so-called Bigelow companies has been satisfactorily settled in favor of the company, and the control of those properties is now with the Calumet & Hecla.

The Copper Range Consolidated Co., strictly a securities holding corporation, owning and controlling the Baltic, Champion, and Trimountain copper mines, and the Copper Range railroad, stands next to Calumet & Hecla in point of production. The mines operated by this company yielded approximately 44,000,000 lb. of copper during 1909. In 1908 the production was 41,546,525, and in 1907 the output was 41,385,015. Dividends paid during the year amounted to $1,536,740, the Baltic contributing $1,000,000, the Champion $250,000, an equal amount going to the St. Mary's Mineral Land Co., part owner

Mass Copper at Champion Mine.

of that mine, and the railroad $260,000. Trimountain contributed nothing. This mine has long been the 'weak brother' of the trio, and where the production of the Baltic and Champion mines has steadily increased from year to year, the output of the Trimountain has been severely decreased. In the five-year period just closed the annual production of the Trimountain has fallen from 10,211,230 lb. in 1904 to around 6,000,000 for the year 1909. The decreased production is directly traceable to leaner copper ground opened at depth, though developments in the past year show a decided improvement with further depth, and better results in the future are indicated. The Baltic and Champion are in excellent physical condition and continue to yield increased productions with each succeeding year. Both are producing at about the same rate and each is at present yielding slightly better than 19,000,000 lb. annually, compared with productions of 12,177,729 and 12,212,954, respectively, in 1904. The exploratory operations of the company on the so-called Globe tract proved unsuccessful, and all work there was stopped early in the year. Explorations were thereafter centered in

the Canal lands lying to the westward of the three properties, and considerable diamond-drilling was done without disclosing mineralized ground of a character that would warrant shaft-sinking. This work has also been stopped, and the option under which the lands were held relinquished.

The activity of the Osceola Consolidated Co. is reflected in the greatly increased production, which for the year 1909 approximates 25,000,000 lb. of fine copper, and is the greatest annual production recorded in the history of the company. Early in the year the control of this property passed to the Calumet & Hecla, and under the new management many economies in operation are being effected. Dividend disbursements amounted to $769,200, an increase of $576,900 over the preceding year. Developments underground, in both the Osceola and Kearsarge branches, reveal a continuity of ore with depth, and in some of the upper reaches of the North Kearsarge mine further good copper-ground has been found in territory that had long been abandoned. In the South Kearsarge all development has been practically completed, and that mine is now in shape to produce at an extremely low cost. The new shaft-sinking on the north end of the Kearsarge branch was equipped with permanent machinery and is now yielding a regular production.

The Quincy Mining Co., finished the year in fourth place among the producers of the district, with a production greater by about 1,000,000 lb. than was had in the preceding year, despite the temporary loss of one of the four producing shafts operated by the company. The shaft was put out of commission by falling rock, accompanied and caused by air-blasts in the older workings of the mine, and was practically unavailable for hoisting copper ore during the last two months of the year. The air-blasts are unexplainable, and have been of rather frequent occurrence in recent years, but never so severe and lasting in effect as those experienced recently. The development work of the company was confined to the so-called Pontiac tract, in the extreme northern limits of the property, and good progress was made. One shaft is sinking there to open and develop the Quincy-Pewabic lode upon which the old mine is opened, and will be a material aid in keeping the Quincy among the leading producers of the district. The Tamarack, Mohawk, Wolverine, and Allouez companies operated with much the same results as in past years, all keeping reserves well ahead of immediate requirements and maintaining normal productions. The most important development in the Tamarack affairs was the proposal made to the stockholders to set aside the old Cliff lands under a separate corporation, and use the proceeds from the sale of stock to liquidate the company's large indebtedness. Mohawk began the development of the southern end of its property by sinking a shaft thereon, and a rich producer will probably result, judging from the uniformly rich ground opened in the Ahmeek mine adjoining. The situation in the Wolverine is unchanged from past years, and that mine continues to be the second richest producer among the mines of the district, though closely followed by Ahmeek and Superior, in the order named. Allouez succeeded in getting the second shaft down to the lode and is now a two-shaft mine, and in shape to easily double the present rate of production, though there is little likelihood that this will be done this year. Ahmeek and Isle Royale continued with the development begun in the preceding year, and both secured greatly increased productions. Two new shafts on the Ahmeek property are being sunk to open the underlay of the Kearsarge lode under the Mohawk mine, and are expected to be in that ground before the end of the year. This company is developing some of the richest ground opened in the district. The new stamp-mill is nearing completion, and should be ready for service about the middle of the year. Isle Royale obtained a fair average showing of copper ground in the Isle Royale lode, but because of the irregular distribution of the ore, and the condition of the metal-market, later curtailed operations in this bed. Operations there are again being increased and a renewed activity is promised for the new year. Developments in the Baltic lode disclosed a small amount of copper at various depths in the single shaft opened there, but results in general are rather negative in nature, though a marked improvement is taking place as driving in the direction of the Superior mine, now under way, progresses.

The situations at the Centennial, Franklin, Mass, and Victoria mines are unchanged. All are yielding small productions, and with the exception of the first named are still in the prospect stage. There is every indication that both Centennial and Franklin will yield a steadily increasing production and the dividend period cannot be far removed. Mass and Victoria are barely getting a new dollar for each old one expended, and unless there is a decided improvement in the metal-market the prospect for dividends will remain far removed. Both companies are working in extremely low-grade ground, yielding less than 12 lb. of fine copper per ton of rock, and with no permanent improvement in the copper-content of the newer ground under development.

Superior rounded out its first year as a producer, and is coming along at a good rate. Production for the year approximated 1,800,000 lb. of fine copper. Developments in the mine continued to show steady improvement at all points, and a second shaft has been started on the south end of the property. A production of at least 3,000,000 lb. of copper is predicted for the new year, and will increase annually, but it will be several years more before dividends can reasonably be expected.

Michigan and Keweenaw, owing to adverse conditions in the mines, stopped production during the year, and are both engaged in exploratory work. The Michigan has a mine fully developed and equipped, which in the upper levels was exceptionally rich, and gave great promise for profitable operation, but at depth the lode has shown a tendency to narrow and grow lean, and for that reason mining operations were curtailed and an attempt made to find more profitable ground. Keweenaw ceased production early in the year, the Mandan mine, in which mining operations were confined, proving too low in grade to warrant the expenditure of further time and money in an effort to make it a

profitable producer. The company is now conducting exploratory work in the Kearsarge horizon, which has yet to record its first failure, and may add a new mine to the long list already opened on that copper-bearing bed.

Among the non-producers that give promise of early production, and may even now be considered more than prospects, are the Lake, the Hancock, the King Philip, and the Winona mines. The La Salle, and possibly the Gratiot, may also enter the ranks of regular producers within the next year or two. Of these the Winona and King Philip will probably be the first, a stamp-mill for the joint use of these mines already being under construction. Both are opened in the same lode, and continue to open average good ground. The Hancock has developed a considerable tonnage of exceptionally rich copper rock and should prove one of the best amygdaloid mines in the district. Lake continued with the development of the now famous Lake lode, and has already developed about 3,000,000 tons of copper rock of extraordinary richness. Developments during the year were of a sensational character, and indicate that this mine will rank next to the Calumet & Hecla conglomerate mine in point of richness. The La Salle abandoned one shaft and started another, and in the Tecumseh tract it will have a mine of average grade. Its prospects in the Caldwell tract are not so bright. Gratiot continued development with rather indifferent results, and probably will be numbered with the low-grade mines of the North Range. The prospects of the district are many, and include some promising properties, among which the Ojibway, operating on the Kearsarge lode, the Atlantic on the Baltic lode, and the Adventure on the so-called Adventure lodes, seem the most satisfactory. All are conducting development by means of shafts and lateral underground openings, and with the exception of the last-named are securing quite encouraging results. The Adventure's shaft has yet to reach the lodes to be opened in this work, and probably will not get into the copper ground until well along in the new year.

The operations of the North Lake, the South Lake, and Indiana companies are centered in diamond-drilling in an attempt to pick up the extension of the famous Lake lode. The New Baltic has succeeded in finding what may prove to be an extension of the Superior lode, well charged with copper, and the Oneco is diamond-drilling in an attempt to find the same or other copper-bearing lodes of commercial value. The old Oneco lode was cut in this work, and a fair showing of copper was obtained. Laurium is engaged in shaft sinking in the Kearsarge lode, but the work has not progressed sufficiently to indicate its possibilities, though the same should prove equal to those held out for the adjoining La Salle. Seneca has opened the Kearsarge lode by a shaft and by cross-cuts and drifts, but results are discouraging. Mayflower is making what may be the last attempt to find commercial ground upon its property, and the Old Colony, next on the south side, and likewise engaged earlier in the year, has suspended operation and is now idle. The Rhode Island operated the greater part of the year with poor success. Control of the property passed to the Franklin company, and the property is idle. Elm River and Wyandot are opening their respective properties at depth by means of cross-cuts in an effort to find a copper-bearing bed among the dozen or more lodes traversing these properties, and the efforts have in a measure been rewarded, but though some copper-ground was exposed in this work, results on the whole have been rather discouraging. The old Arcadian company was reorganized, and the work was begun on the property late in the old year. The efforts of the New Arcadian company are centered in the exploitation of the eastern portion of the property, all practically virgin territory, and presumably carrying the strike of the Kearsarge and Baltic lodes.

All in all the past year was not very different from the preceding. There have been other years of greater activity in which the productive capacities of the mines were forced to their limits, and years in which the total dividends disbursed exceeded the amount paid in the past year, and though the total output of copper exceeds that of any preceding year, the increase is but the natural result of work done in the past. The productive limit of the Lake Superior district has in no wise been reached, and the known mineral resources have materially increased through the exploratory operations of the several companies during the year just closed.

Pig iron is now being manufactured in California. The final blowing in and operation on a commercial scale by the Noble Electric Steel Co., of its plant on Pit river, above its junction with the McCloud, was one of the important events of the year. The Noble company has been experimenting with the Heroult process for the past three years. A small furnace with several charcoal kilns were first constructed by a French metallurgist, but the heat was too intense and the current too irregular for successful work. Later the plant was remodeled by A. D. Lyon, professor of metallurgy at Stanford University, and pig iron produced. The furnace was then enlarged and the current turned on, but the carbon electrodes disintegrated. They have now been replaced by graphite pieces 9 in. diam., built in segments so any desired length may be obtained. The iron has been used in the local foundries and pronounced of excellent grade. The possible influence of this work on the future utilization of local ores, and the development of manufacturing on the Pacific Coast, is immeasurable.

Coal.—For 1909 the coal production of Utah shows an increase of 15 to 20% over that of 1908. Quite a number of new companies have been operating for the first time during the year. The Utah Fuel Co. leads in output, with nearly 2,000,000 tons. The Union Pacific, Pleasant Valley mine at Schofield, the Consolidated Fuel Co.'s mines at Hiawatha, the Independent Fuel Co.'s at Kenilworth, the Wasatch mine at Coalville, and a number of others have produced around 600,000 tons of coal during the year. Owing to the closing of a number of copper smelters, and to other difficulties, the coke production shows a decrease of from 30 to 40% over 1908.

MINING IN ALASKA IN 1909.

The annual report on the mineral resources and production of Alaska for 1909 is now in preparation under the direction of Alfred H. Brooks, of the United States Geological Survey, and will be published about the middle of May. The more important features of this report are abstracted in the following statement. Accurate statistics are not yet available, but the estimated value of the output of gold here given is probably less than 4% in error; that of the copper output less than 15.

Mineral Production.—The value of the mineral output of Alaska in 1909 is estimated at $20,200,000, practically the same as that of 1908, which was $20,139,272. The estimated value of the gold output of 1909 was $19,460,000; that of 1908 was $19,292,818. The copper production of 1909 was approximately 4,000,000 lb., valued at about $520,000; that of 1908 was 4,585,362 lb., valued at $602,267. Probably the output of none of the other mineral products, including silver, coal, marble, and gypsum, differed greatly from that of 1908, when the total value was $244,189. From 1880, when mining was first begun in Alaska, to the close of 1909, the total value of the mineral production has been, in round numbers, $168,000,000. Of this amount the gold mines have contributed about $161,000,000; the commercial value of the silver output has been about $1,200,000, and the copper production has been about $4,700,000. The remainder is represented by the value of the output of coal, gypsum, tin, and marble. The placer camps of the Yukon basin were the scene of much mining activity in 1909. Two new dredges were put in operation near Nome, material progress was made in constructing a railway up the Copper River valley, and some work was done on the railway to the Matanuska district. The most significant feature of the year's mining operations was the amount of prospecting and development work done on auriferous lodes in some of the placer districts.

Coalfields.—The coalfields form an important factor in the present situation. If opportunity is given to mine the coal, railway construction over a part of the territory, at least, will be pushed with the utmost vigor. The exploitation of the high-grade coal is of great importance to Alaska, but is probably of still greater importance to the commercial interests of the Pacific States. It will give a new impetus to manufacturing and transportation interests. By furnishing coke for smelting it will probably make available for local use the iron deposits of the west coast of the United States, and thus lead to the conservation of those of the East, more valuable because nearer the centres of population.

Lode Mining.—Preliminary estimates indicate that the value of the gold produced from lode mines in 1909 was about $3,400,000, or approximately the same as 1908, which was $3,357,335. Of the auriferous lode mines operated in 1909 all but five are in the Juneau district. The Treadwell group continues to be the dominating factor in lode production, but some other large enterprises have either, like the Perseverance, become productive or, like the Ebner and Kensington, will soon be producers. A large pro-

ducer-gas plant is being established near Juneau by the Perseverance company, and the Ebner mine has been taken over by a new company and is to be opened on a large scale. There is promise that the protracted litigation over the Kensington mine and other properties at Berners bay will soon be settled, and extensive developments are expected in this field at an early date.

In this field of essentially low-grade orebodies the possibility of utilizing water-power is receiving increasing attention. The topography of the country is not favorable to natural water storage, though some lakes in the region will furnish power. Water-powers are by no means so abundant as might be inferred from the heavy precipitation, most of which runs off quickly. Moreover, every water-power enterprise must provide for the low water of the winter months. The high relief, heavy timber, and the fiords make the establishment of transmission lines difficult.

One of the most encouraging events of the year was the discovery of promising lode prospects in many of the gold placer districts. Notable among these are the auriferous quartz veins found near Seward on Kenai peninsula, on Willow creek, in the Susitna basin, near Fairbanks, in the Koyukuk and Chandlar valleys, and in the Bonnifield district. Auriferous veins have been found at several places on Kenai peninsula, and the prospecting on some of them during the year has yielded encouraging results. Noteworthy discoveries were made at False creek and near Moose pass, not far from the Alaska Central railway. Some rich auriferous quartz has been found on Willow creek, an eastern tributary of the lower Susitna. Little information is at hand concerning the character of the deposits last mentioned, but there can be no doubt of their high content in free gold. Two small stamp-mills were operated in this district during 1909.

The discovery of auriferous quartz in 1908 in the valley of Chatham creek and in Skoogy gulch was followed in 1909 by similar discoveries at several other localities that apparently lie in the same belt. The country rock of this belt is chiefly quartz-mica and quartzite schist with granitic intrusives. The schists are closely folded and strike, in general, northeast and southwest. The abundant quartz veins are in some places parallel with the schistose structure; in others they cut across the lines of structure. The schist, as well as some of the quartz veins, has been subjected to extensive shattering and local brecciation. The spaces thus formed have been filled with crystalline quartz, ferruginous matter, and other materials, including gold. A study of the schists and igneous intrusives made to determine the origin of the metallic deposits indicates that the metallization was probably caused by the igneous intrusions.

During the summer of 1909 more or less systematic prospecting of quartz veins was carried on at ten or more localities, most of them in a zone about ten miles long, stretching northeastward from Pedro Dome and drained by creeks carrying auriferous gravels. Some of these quartz veins are close to the igneous intrusives, and all are within an area of possible igneous influence. The veins that have been opened range from small stringers less than an inch wide to veins 12 ft. or more thick. The schists of this belt are much jointed and locally faulted, and the veins occur along joint-planes and local fault-planes, and have themselves been in places much broken and faulted. The rich ore that has thus far been found is chiefly in small stringers, or in veins, the largest nearly 3 ft. thick. Valuable deposits are reported to occur at places in the wall-rock as well as in the veins. Though many of the individual stringers pinch out and some of the veins are broken by faulting, others persist for several hundred feet along the strike.

The auriferous quartz is dull white, shows in places comb structure, and much of it contains visible gold in the hand specimens. Some of the associated minerals are iron pyrite, stibnite, sphalerite, and galena. Complex sulphides containing antimony are probably also present. The material has not yet been studied in sufficient detail to establish the character of some of the metalliferous minerals. The specimens collected by the Geological Survey party show no trace of tellurium, though this mineral has been reported by prospectors.

Development has been confined to surface prospecting, sinking on the veins to depths of less than 100 ft., and driving along them to distances not much exceeding 100 ft. The material has been milled in small lots by means of a small stamp-mill established at the town of Fairbanks during the winter of 1909. Although insufficient development work has been done on these veins to determine definitely their importance, some of them are nevertheless of a character to warrant the effort that is being made to develop them and to encourage the search for other lode deposits in this district.

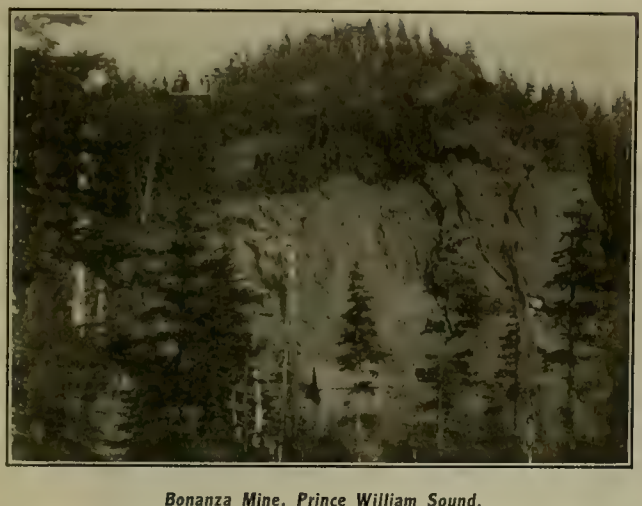
Much lode prospecting has been done during the year in the Bonnifield district, which lies about 40 miles south of Fairbanks. Some promising prospects are said to occur in a belt that follows closely the base of the Alaska range. One very large orebody has been reported on Jerome creek, a tributary of Wood river. This ore, judging from specimens and not from field examination, is made up of an altered rhyolite porphyry, which has been fractured and permeated by secondary quartz with some pyrite. The ore is said to carry gold and some silver. Systematic prospecting of this property is going on with the use of a small stamp-mill.

Considerable quartz prospecting has also been done in the Koyukuk and Chandlar regions. Here the country rock consists of carbonaceous schists and phyllites. Through much of the schist there is a rather uniform dissemination of secondary quartz, but at certain localities the quartz occurs in stringer leads that lie parallel to the schistosity. In still another locality the quartz veins seem to follow fissures which cut the foliation of the schists. In some places the schists are highly mineralized with gold-bearing pyrite. Free gold occurs in quantity in some of the quartz veins.

Copper Mining.—Only seven copper mines were operated in Alaska during 1909, but these produced nearly as much metal as the nine mines operated in 1908. The low price of copper, though the principal cause for the small production, did not greatly deter

activity in prospecting, both in the Ketchikan and Prince William Sound districts.* The Mount Andrew, Jumbo, and It mines shipped ore throughout the year, and work at the Goodro made sufficient progress during the summer to put the mine on a productive basis. In the Prince William Sound region the Bonanza still remains the largest producer. At the Gladhaugh the sinking of a cofferdam to take a large body of ore lying above the first level was begun. Considerable development work was done also on other properties.

The inland copper districts await railway transportation. Only at the Bonanza, in the Chitina district, was there any actual mining. Here an aerial tram was completed in August and brought down some ore, which is ready for shipment as soon as the railway is completed. The probability of early railway connection stimulated prospecting throughout the Chitina valley, and much of this was more systematic than that of the past. As a rule, however, property owners in this field have been inclined to do only the required assessment work and to defer the installation of mining and prospecting plants until transportation charges have been reduced. In the Nabesna region one property has been systematically developed, but elsewhere in the Nabesna-White copper belt little has been done but assessment work.



Bonanza Mine, Prince William Sound.

Placer Mining.—The value of the placer gold produced in 1909 is estimated at $16,000,000; that mined in 1908 was worth $15,888,000. This is a remarkably good showing, for, owing to various causes, there was a falling off of nearly a million dollers in the gold output of Seward Peninsula. This loss, however, was more than made up by the increased production of the Yukon camps, notably Fairbanks, Koyukuk, Innoko, Hot Springs, and Birch Creek.

The installation of two additional dredges near Nome and the successful operation of three others in Seward Peninsula and of three in the Forty Mile district are, perhaps, the most significant facts of the placer mining operations. These dredges and the hydraulic plants operated in the Birch Creek, Hot Springs, Nizina, Porcupine, and other districts in Alaska indicate that, as bonanza mining decreases, progress is steadily being made in equipping plants to exploit the gravels containing less gold. It does not follow that, because there have been many successful ventures with large plants, all the low-grade gravels of Alaska can be profitably exploited. Investors can not be too careful in scrutinizing projects of this kind and in insisting on exhaustive prospecting of the gravel beds and on the study of local conditions before they undertake to install large mining plants.

At Nome, unfortunately, the installation of large plants has not gone on rapidly enough to insure the holding up of production when dry seasons curtail the output of the smaller operators. No one who has studied the mineral resources of Seward Peninsula can doubt that it includes extensive reserves of gold-bearing gravels. With the exception of the dredges and some small hydraulic plants there are but few large mining ventures in this field. Mining has also been retarded in Seward Peninsula by lack of recognition of the comparatively small quantity of water available under head for mining purposes. This condition will have to be met before material advancement can be made in large mining enterprises. The past summer was one of the driest yet recorded in Seward Peninsula and serves to emphasize the need for revolutionizing mining methods that depend for success on the use of water supplied by ditches.

Although there were no new developments in the Fairbanks district other than those in lode prospecting, already referred to, the gold production was larger than in 1908. The increase was due mainly to the output of a few rich claims on Engineer creek. Though the district is prosperous and many claims still contain valuable pay-streaks, it must not be forgotten that on many of the creeks the days of bonanza mining are numbered. Unless means are at once devised for mining the large bodies of auriferous gravels whose content is too low for exploitation by present methods, the output from the placers will soon decrease. Much of this ground is probably too deep for dredging, and its excavation therefore presents a serious problem, worthy of the attention of experienced engineers. If cheap power could be obtained—either direct water power or power generated for pumping by utilizing the extensive lignitic coal deposits of the Bonnifield district—it is possible the heavy overburden of muck might be cheaply removed by water under head, so that the auriferous gravels might be dredged; or they might be elevated by mechanical means, as in the Klondike. The gravels of the upper drainage basins of many of the creeks are not too deep for dredging, and it seems probable that some dredging enterprise may soon be launched.

If the cost of mining could be reduced by establishing railway connection with the coast, many deposits, both in the Fairbanks and adjacent districts, could be profitably exploited by methods now in use. The present system of water transportation is expensive and—what is perhaps more important to the mining interests—particularly uncertain. Unless some change is made, however, placer mining will,

*The district is reviewed in detail in another column by U. S. Grant.

within a few years, be confined to a small number of large enterprises, as it now is at Dawson.

During 1909 mining was continued on all the creeks that were productive in 1908. There was special activity along the lower courses of Cleary, Vault, and Dome creeks, and as a result a large amount of gold was taken out of the Chatanika flats. So far as known, Goldstream and its tributaries made the largest production, Dome creek standing second.

Of the districts adjacent to Fairbanks, Hot Springs and Birch Creek were most prosperous, but mining was also done in the Rampart, Tenderfoot, and Salchaket regions. In the Hot Springs and Birch Creek districts several large plants were operated during most of the season. In addition to the smaller mining enterprises three dredges were in operation in the Forty Mile basin in 1909. One of these is on the south fork of Forty Mile and two are on Walkers Fork. It is significant that dredges are successfully operated in this district—one of the most isolated placer districts in Alaska. The initial cost of these plants is probably double what it would be in some of the other districts, and, moreover, for two of these dredges the ground has to be thawed.

The Koyukuk district, which has been growing in importance as a gold producer, has been developed practically without the aid of outside capital. The productive placers of this district fall into three groups, which appear to mark three auriferous belts and include (1) those of Myrtle, Marion, Missouri, and Gold creeks; (2) those of Vermont, Nolan, and Emma creeks; and (3) those of Mascot creek. Up to 1907, when the deep placers of Nolan creek were discovered, mining was confined to shallow deposits. In 1909 probably 90% of the gold was taken from the deep gravels of Nolan creek. The Koyukuk district is difficult of access and mining costs are high, but in spite of the adverse conditions the value of its gold output in 1909 was more than half a million.

In 1909 the Innoko district produced gold to the value of probably $300,000. This indicates that systematic mining has begun. In mid-summer placer gold was found on Otter creek, which flows into the Haiditarod, a northeastern tributary of the Innoko. Sufficient prospecting appears to have been done to indicate the presence of a pay-streak 50 to 70 ft. wide, in which the gold is rather uniformly distributed. It is reported that this pay-streak carried gold worth 7 to 10c. per pan. The alluvium is said to be frozen and to be about 12 ft. deep. The information at hand indicates that these placers lie in what would be an extension of the Innoko auriferous zone. So far as prospected the gold seems to be more uniformly distributed than in the Innoko gravels. The above information appears to form the basis for the stampede to the Haiditarod which took place from Fairbanks and other points in Alaska late in the summer.

Although the placer-gold output of the Yukon and Seward Peninsula placers overshadows that of all the smaller districts, yet in 1909 these made an aggregate production of half a million dollars. Their wide distribution—from southeastern Alaska to the Kobuk river, north of the Arctic Circle—is a measure of the extent of the auriferous mineralization in the Territory.

REVISED ATOMIC WEIGHTS.

Written for the MINING AND SCIENTIFIC PRESS
By F. H. MASON.

On November 17, at London, the International Committee on Atomic Weights issued its report for 1909. The committee has taken under consideration researches on the atomic weights of chlorine, nitrogen, carbon, iodine, silver, phosphorus, arsenic, chromium, tellurium, mercury, palladium, krypton, and xenon, and they recommend that changes be made only in the atomic weights of arsenic, chromium, krypton, and xenon. The following are the researches upon which the advised changes are made:

Arsenic.—The ratios between arsenate of silver, Ag_3AsO_4, and bromide and chloride of silver, were determined by Baxter and Coffin (*Jour.* Amer. Chem. Soc., 1909, 31, 297) by two methods; first, in the usual way, by solution and precipitation; and second, by heating the arsenate in a stream of HCl or HBr. From these researches, the figure 74.957, when silver equals 107.88, was obtained as the atomic weight of arsenic.

Chromium.—From analyses of silver chromate by two methods Baxter, Mueller, and Hines (*Jour.* Amer. Chem. Soc., 1909, 31, 529) obtained the figure 52.008, while Baxter and Jesse, from similar analyses of silver dichromate got the figure 52.013 as the atomic weight of chromium. (*Jour.* Chem. Soc., 1909, 31, 541.)

Krypton and Xenon.—Moore isolated large quantities of krypton and xenon from the residue of 120 tons of liquid air (*Trans.* Chem. Soc., 1908, 93, 2181), and, by determining the density of gases, arrived at the figures 83.012 for krypton and 130.70 for xenon.

The new figures, then, adopted by the committee are: Arsenic 74.96, chromium 52.00, krypton 83.00, xenon 130.70. In the case of chromium and krypton it will be noticed that the committee has rounded off one hundredth for the sake of obtaining whole numbers.

Researches by Easley, that have not yet been published but were communicated privately to the committee, place the atomic weight of mercury at 200.62. As Easley, however, is still continuing the research, it was decided to let this element remain at the old figure, 200.00, for the present. The wisdom of retaining the old figure, 35.46, for chlorine, instead of 35.468, as suggested by the research of Guye and Fluss (*Jour.* Chem. Phys., 1908, 6, 732), is confirmed by the recent researches of Gray and Burt (*Jour.* Chem. Soc., Oct. 1909), which were concluded too late to come under the investigation of the committee.

From the viewpoint of the metallurgist and the mine analyst, the most important change is that of the metal chromium from 52.10 to 52.00. This changes the factor for reducing Cr_2O_3 to Cr from 0.68421 to 0.684625, and other factors proportionately. Should the further researches of Easley confirm the higher figure for the atomic weight of mercury, and the committee intimates that it is likely such will be the case, it will make a considerable difference in the determination in cases where the element is not weighed as metal.

THE BOICZA GOLD MINES IN HUNGARY.

Written for the Mining and Scientific Press
By Newton B. Knox.

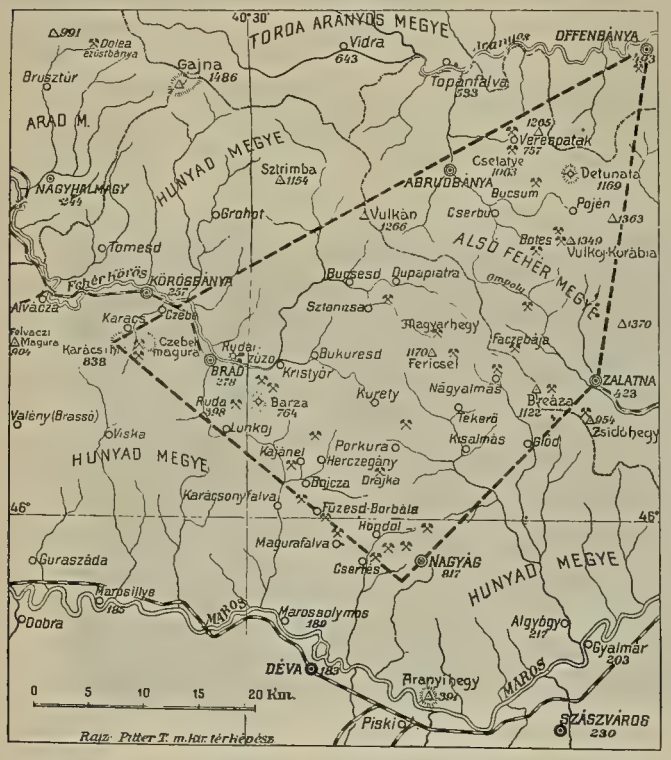
English engineers have a saying that some time there comes to every engineer a call to inspect a Hungarian gold mine. Recently my opportunity came and these notes and impressions are based on a flying visit to that delightful and interesting country. Gold is found in Hungary in three districts: Schemnitz, Kremnitz, and Transylvania. The first two are of little importance, while Transylvania in east Hungary, and adjoining the Galician border, is the chief gold producing region of all Europe.

The gold deposits of Transylvania lie within the boundaries of a well defined quadrangle as will be seen by the accompanying map. It will be noted that Boicza lies midway between the districts of Brad on its north and Nagyag on the south. In the Brad district is situated the well known Twelve Apostles group, consisting of the mines of Ruda, Barza, Muszari, Valea Mori, and Valea Arzulin—the whole famous as the largest gold producer on the Continent. It is German owned and German managed, equipped with a 200-stamp mill and employs 3000 men per day. The records of the past two years claim a profit of $350,000 to $500,000 annually. Up to 1904, according to Malcolm Maclaren, this property has produced 450,243 oz. crude gold derived from 1,410,209 metric tons of ore (6.3 dwt. per ton), and the total value of its output to date is about 6¼ million dollars. In 1904, 163,000 metric tons were treated at a total cost of $5 per ton. The management boasts to be able today to treat, at a profit, ore carrying 2 dwt. per ton. In 1902 out of a total yield of all Hungary of 2¼ million dollars 30% was produced by the Twelve Apostles mine. South of Boicza lie the old mines of Nagyag, now owned and operated by the State, and at present awaiting the completion of a 60-stamp mill. The gold here occurs chiefly in the telluride form known as nagyagite. At Boicza the following eight separate mines lying near to and adjoining the village of that name, have been formed into a group under one ownership: Boicza, Troicza, Kajanel, Tresztia, Herczeyany, Barbura, Csertes, and Magura. Of these the first four are the most important. The Boicza district is locally known as Siebenburger (seven municipalities).

The Transylvania mines are very old. They have been worked for generations, indeed I know of no other gold district whose mines have suffered less from inactivity during a long life. It is true, other ancient mines exist, in the Far and Near East, in parts of Africa, mines whose birth occurred even earlier than Siebenburger; yet all these died comparatively young, whereas Boicza and her neighbors have continued mining almost unbrokenly throughout the centuries. Hungary has been the dark and bloody ground of Europe and with each succeeding conquest her mines have changed hands to be worked by their new owners. Thus the history of the mines is intermingled with that of the country and every conqueror has left his mark on each. The history of Siebenburger antedates the Roman occupation, for in Homer we read "on Maris the Ayathyas sat and dug for gold." The Dakers, a sturdy people, next settled here and they too, "sat" and dug for gold. Their king, the warlike Dekebalus, successfully opposed the Roman legions till finally overthrown by Emperor Trajan who, invading the country from two sides, seized the capital, Sarmizegthusa. Legend has it that the mighty treasures of the Dakin king were hastily buried in these mountains and only last century a stock company was formed for their exploitation. In 106 A. D. Dakin became a Roman province and was named by them

Village of Boicza, Hungary.

'Auraria' (gold country). After 170 years of peaceful Roman occupation and ownership came the wild Germanic tribes, followed later by other barbaric herdes. Then came the Hungarian kings; and after them the Turks, who in turn were conquered by the Crusaders. Coming down to later times we read in old documents, that in 1444, King Albert granted to one George Brankovits the mines of Boicza, then named Kisbanya (little mine). The various mines have been at times State-owned or subsidized by the State. Trestia was once owned by the family of Count Gyulayana, Barbura, by Count Kalnoki. All have been worked by companies of either local or German holding, and the management has usually been German. These companies ran their long adits, put up their mills and wire-rope ways, stoped their ore, and—failed. Various reasons have been assigned for their failures, extravagant and incompetent management and ill-advised metallurgical treatment, being the usual ones. Finally, the mines have been acquired by an enterprising Rumanian, who is working them at a profit of about $60,000 annually.



Map of Gold Districts of Transylvania, Hungary.

Topographically the district is not unlike the Mother Lode region of California, only here in Hungary the red adobe soil and grave-yard slates are lacking. Boicza is situated 23 kilometres north of the railroad town of Deva, and 15 km. north of the river Maros. It lies on the slopes of Soredill, a mountain 687 metres above sea-level. The climate is good; warm in summer and bracing in autumn and winter. About two to three feet of snow falls. The region is given over to plum growing. From the plums is made a brandy or schnaps famous throughout Hungary. This is called Sligovitz, and 2000 litres were produced last year. The workmen of the district are mostly Rumanians with some Germans and Hungarians, and a few Gypsies. Thus Boicza town contained in 1899, 1100 Rumanians, 500 Germans, and 200 Hungarians. As a cheap laborer the peasant here is excellent. He is a good workman, industrious, willing, and his politeness is carried to a degree that strikes an American as positively cringing. He has his neat little thatched cottage, his patch of cultivated ground, and seems on the whole prosperous and contented. In this land of surprises the dress of the peasant is not the least surprising. Here the women wear on all occasions heavy cowhide knee boots, and here too their husbands are clad, on fete days, in white trousers (pants would be the proper word) edged with beautiful flowing ruffles which causes them to appear to the eyes of an embarrassed stranger to be wearing part of their wives' wardrobe. In the attached photograph the ladylike appearance of these gentlemen will be noted. While on the subject of dress it would be an oversight not to refer to the glorious opera-bouffé uniform of the Saxon mine foreman worn throughout the continent. This uniform is of black cloth trimmed with gilt buttons, is embroidered all over with gold stars and golden cross hammers. Add to this the epaulet of gold fringe, and you have the German mine foreman in his 'habit as he lived'. Solomon in all his glory * * * *. The only reason he does not wear a sword like the Berlin postman is because the idea has not occurred to him. Fancy falling down a winze while dressed like this! The miner is superstitious to a fault, is given too many holiday fetés, and gets gloriously and shamelessly drunk to celebrate the slightest event. Usually the foreman and superintendent are German. They have no labor unions.

The Soredill peak and range are composed of a complex of melaphyre and quartz-porphyry (dacite) superposed by dark blue Jurassic limestone. This limestone, outcropping boldly as it does on the peaks above town, forms a distinct feature of the landscape. Economically, however, it is of little importance as no orebodies lie within it. The melaphyre with its bodies of intruded dacite show evidences of great shattering and fissuring. Both rocks have undergone extensive weathering and kaolinization, especially in the neighborhood of orebodies. The latter usually occur in the dacite. The ore in the district occurs as (1) 'gauch' veins; (2) stockwerk; (3) normal fissure veins; (4) a combined fissure and stockwerk.

1. The gauch vein is the most characteristic of the region, and is best seen in the Troicza mine. Its vein filling is composed of angular quartz-porphyry fragments either cemented together by secondary jaspery quartz, or more often lying embedded in clay. These angular fragments have every appearance of fault-breccia, though the walls from which

they were derived, have subsequently undergone such alteration and prophylitization that the veins now blend gradually into the unaltered dacite. The gold-bearing solutions came in with the cementing materials. At times the breccia forms a sheathing, sometimes 60 ft. wide, on each side of the vein; being itself either low grade or barren, and the ore a narrow streak sandwiched in the centre. The gauch veins (that is, the ore) vary in width from a stringer to several metres. The walls are irregular and poorly defined. Consequently the orebody is apt to suddenly pinch or swell. In depth, these veins tend to give up their gauch characteristics and become ordinary fissure veins with cleaner cut walls and a clay gouge.

Villagers at Open-Air Ball.

2. Stockwerk occurs occasionally but does not here play as important a rôle as at the Twelve Apostles and Czebe where most of the gold is won from this type of deposit. In the south end of the Boicza mine several roughly parallel fissures approach, and near their union is a shattered mass of quartz-porphyry crossed in every direction by stringers and veinlets of quartz—the whole forming a typical stockwerk and known locally as 'the stock.' This mass has been stoped to a depth of about 300 metres and forms a neck 20 to 30 metres in diameter, the whole running about $5 per ton. Occasionally one of the main veins cuts through the stock without losing its identity as a vein or its ore content. Often masses of free gold are found within the stock.

Mouth of Boicza Adit.

3. Normal fissure veins are best seen in the Boicza. There they occur in unaltered or slightly altered dacite, possess regular well defined walls, and average about 2 ft. in width. Much free gold is found in this type of vein, and its occurrence forms incentive to prospecting by tributors. In some veins stringers and veinlets of heavy sulphide ore have enriched the country adjacent to both walls. In the old stopes such stringers have been left behind either purposely or overlooked. Blasting down would enhance materially the value of the stope-filling when the time comes for its extraction.

The gold occurs in masses of free gold, not unlike the rich pockets of Tuolumne, Mariposa, and Trinity counties, California. More usually it occurs associated with telluride gold, pyrite, marcasite, zinc blende, galena, and sometimes small amounts of chalcopyrite. The fineness of the gold is 600 to 700. The ore as a rule carries no minerals which would interfere with successful cyanidation. Ore-shoots appear from old stoping maps to be persistent in both strike and depth, the shoots showing a remarkable continuity. However, as the old miners often mined unpayable ore, not too much reliance can be placed upon evidence of the kind. From sampling results, the shoots appear to be 100 to 400 ft. long, measured along the drift, and the veins from 4 in. to 3 ft. wide. The value averages from $4 to $12 per long ton. How these shoots behave above or below the drifts I am not prepared to say, but they have every appearance of strength.

Tunnel Buildings.

What stands out the sharpest in the memory of a visiting engineer is the appalling amount of development done on the eight mines. Boicza itself has no

less than 22 miles of adits, drifts, and cross-cuts. With this as a measure one would not be far wrong to estimate the total amount of workings in the group at 100 miles. Of course, all workings are not at present open, yet as a whole, they are in a surprisingly good state of preservation, especially the main drifts. Each mine has its long lower main adit. These in many cases connect. The Boicza cross-cut is over 1700 metres long. The Kajanel and Herczegany is 2200 metres (1½ miles), the Grinn tunnel, at Troicza which connects with the Barbura mine workings is 4500 metres (13 miles). Almost without exception the adits have been driven at the expense of the State and one cannot help feeling that in some cases at least the object of driving has been, not so much as a means of development or transportation, as to give employment to the people. This idea is strengthened by the unduly large cross-section of most of the tunnels. The lowest practical level of exploration by means of adits has been reached. Shafts must be used in the future, and indeed Boicza has at present a shaft extending 810 ft. below its adit. Transportation is carried out in the Boicza adit by means of an electric haulage system; 350 volts, 40 amperes, 6 hp. (overhead type) locomotion and ton trucks on a 580-mm. gauge. The other adits employ horses. Dry rubble stone work laid in elliptical cross-section is used in the main adits instead of timber. It stands well and is found to be cheaper. In a level 2.2 metres high by 1.4 metres wide, it cost $4 per running metre—contractor finding everything. The raises and ore-chutes are also all dry stonework and cost, under same conditions, 75c. per metre in height. The mining practice has no unusual feature. The stopes are filled from the wall directly the ore is removed. This also is done by contract and cost 60c. per running metre. This price includes both the stoping and filling. The Rumanian timberman as yet does not understand the use of wooden wedges in mining. He cuts with infinite patience a neat and finished hitch in each wall, wherein he inserts, usually horizontally, his timber. As a result a visit through old open stopes is not without its dangers.

A curious feature of Boicza is the tunnel-house commonly built over the mouth of each working adit. This is usually a large wooden building, two stories high with the continuation of the tunnel passing through the lower floor. The tunnel mouth is closed by an iron grating or grill, locked, and in charge of the gate keeper. No miner passes through this gate. He must on entering ascend to the second story where his number is taken by the time keeper. He changes his clothes in the change-room here, and then kneels before an altar with its crucified Christ and prays for a safe deliverance from the mine. He then passes down the back stairs directly into the tunnel. On returning, this procedure is reversed; the miner is searched for free gold and he now gives thanks before the mine altar for his safe return.

The remains of the Roman workings are most interesting. So well did the Roman miner labor when he "sat and dug for gold" that his workings have been utilized today wherever they have been found. The Roman miner working, as he did, without powder, left a beautifully smooth and finished drift behind him. It is of the most unusual size, being roughly 7 ft. high and 2 ft. wide at top and about 5 ft. wide at the bottom. The Roman workings in Kent, England, were all driven by tools of tempered copper or bronze as proved by the particles of this metal still remaining in the tool cuts. Here in Hungary, on the other hand, the Roman miner used iron or steel. The small niches cut in the wall wherein he placed his little bronze or clay lamp are still visible. In 1880 there was found in the neighborhood of the Rudolfi tunnel a collection of Roman coins dating from an epoch between Julius Augustus and Marcus Aurelius. Bowls of limestone for grinding ore have been found, and also a Roman miner's bronze lamp bearing the inscription 'Murri'. These relics are all to be seen in the museum at Deva.

The only mill now remaining is one of 50 stamps built by Frazer & Chalmers, and this is in a poor condition. The metallurgical process is bad. No attempts are made to save the concentrate, and it is doubtful if 50% is recovered by the present method. In the mill stand unused about a half dozen queer looking German vanners of a happily obsolete pattern, each about 15 ft. long and 3 wide, combining a traveling belt movement with a bump-table effect. Here also are the spitzsch and spitzlutten, so dear to the heart of the German mill-man. Power is steam-generated by wood fuel; the latter costing only 50 to 60c. per cubic metre.

The total cost per ton excluding taxes, insurance, and office expense, is given at $3.20. Most work is carried on by contract, the contractor finding everything except power and the mine sharpening and repairing tools. The following are a few of the costs:

Driving in soft ground, 2.20 by 1.40 m., per metre forward	$3.80 to $5.00
Driving in wet ground, 2.20 by 1.40 m., per metre forward	5.00 to 10.00
Sinking in dry ground, any size, per metre deep	18.00 to 20.00
Sinking in wet ground, any size, per metre deep	20.00 to 40.00
Shaft timbering, per metre deep, company finding timber only	4.00
Stoping 2 m. high by 1 m. wide, per metre forward	1.20 to 3.20
Timbering in drifts, with lagging, per metre forward	1.20
Dry stone work for raises, chutes, etc., hole 0.8 m. diam., 1 m. high	0.75
Track laying (new) per metre	0.05
Track laying (old) per metre	0.02½
Tramming by contract, any distance per truck	0.02½
Stope filling, per metre forward	0.65
Day laborers, smiths, carpenters, engine men, per shift 10 to 12 hours	0.28 to 0.80

The contractor does the tramming to the nearest delivery spot and finds all blasting material, lights, tools, and incidentals. Each miner on day's wages stopes, blasts, and delivers in chutes one ton of ore per shift.

Notwithstanding its former failures and its present poor mill-recovery, the Boicza mines are not without hope. In spite of its 100 miles of development, there still exist large areas of unexplored ground which hold out every encouragment for prospecting.

METALLURGICAL PROGRESS IN COLORADO.

Written for the Mining and Scientific Press
By Philip Henry Argall

In reviewing the metallurgical processes in operation in Colorado at the close of the year 1909, the changes prominently brought to notice are: (1) the decline of the smelting industry, due to the scarcity of high-grade ore; (2) the decadence of the chlorination process as a factor in the treatment of Cripple Creek ore; (3) the rejuvenation of the cyanide process. The important metallurgical success of the year has been Stratton's Independence mill, which has fairly solved the problem of treating the lowest grade Cripple Creek ores at a profit. In the other direction changed conditions are shown by the closing down and dismantling of the Argo plant of the Boston & Colorado Smelting Co., a plant which has been in successful operation since 1873.

Victor, Colorado, Cripple Creek District.

Cripple Creek.—This has been a quiet year in the metallurgy of Cripple Creek ores. The great mills of the valley plants treat 80% of the ores produced in the district, about one-half by chlorination in the plants of the United States Reduction & Refining Co., and the Portland Gold Mining Co., and the other half by cyanidation at the Golden Cycle plant. All of these plants are situated in or near Colorado City. The small cyanide mills of the district, excepting that on the Isabella property, remained closed during the greater part of the year. These mills, being designed for the treatment of oxidized ores by direct cyanidation, are unable to handle the sulpho-telluride ores which now form the bulk of the production. Thoroughly oxidized ores are practically no longer mined, therefore, good extraction from the mixed oxidized ores and sulphide ores now being produced cannot be expected and a dismal future for the dry-crushing non-roasting mills in the district is foreshadowed. The Wishbone mill has been overhauled, and an Australian roaster installed. This is said to be now in successful operation on ores from the Midget mine which contains less than $10 per ton. Since this mill began operation the rate on ores, including freight and treatment charges, has been reduced to $4 per ton where the gold content is under $10. With coal at $5 to $6 per ton, labor at $3, and all supplies carrying an enormous freight charge, it is evident that roasting plants in the district cannot begin to compete with the valley mills on ores below ½ oz. per ton, particularly plants handling less than 300 tons per day. The following are the open rates on which ores are purchased by the valley mills, including railroad freight from mine to mill, based on paying $20 per ounce for gold content.

Oz. gold.	Per ton.
Up to ½	$4.00
½ to ¾	5.25
¾ to 1	6.00
1 to 1¼	6.50
1¼ to 1½	7.00
1½ to 2	7.50
2 to 3	8.50
3 to 5	8.75

With a freight rate of $1 per ton on ½-oz. ore, the mills receive but $3 per ton for treatment. This is, no doubt, close to the actual cost. The railroad rate is based upon the Vanderbilt maxim 'all the traffic will bear', and amounts to one-fourth the value of $4 ore for less than a 35-mile down-hill haul from mine to mill. The mills continue the scaled rate, at best not more than covering expenses on the lowest grade, but thereby stand to take good profit on the

higher grades. Cripple Creek, like all great camps, continues to produce a large tonnage of increasingly lower-grade ore, consequently the great need is for some method that will give a profit from the treatment of sulpho-telluride ore worth $3 to $5 per ton. The high-grade ore has always gone to the smelter, perhaps 90% of the ore exceeding 4 oz. per ton having been smelted.

In the neighborhood of 40,000 tons per month has been shipped out of the district in 1909. The treatment of this ore is distributed as follows: 50% by cyanidation, 40% by combined chlorination and cyanidation, 10% by smelting. All the ore treated in the district is cyanided, and, if included, would bring the average monthly tonnage up to 50,000, with the treatment distribution about as follows: 60% by cyanidation, 32% by combined chlorination and cyanidation, 8% by smelting. This shows clearly the marked advance in cyanidation.

There is a strong rumor that the mill of the Portland Gold Mining Co., which now handles over half of the ore treated by chlorination, will in the near future be changed to the cyanide process, leaving—providing no other changes are made—but one chlorination mill in operation as against five a few years ago. Taking those mills only which passed the adolescent stage in treating Cripple Creek ores, their history may be summed up as follows:

Mill	Capacity in tons per day	Process	Remarks
Lawrence	100	Chlorination	Destroyed by fire.
Gillett	100	Chlorination	Destroyed by fire.
Economic	300	Chlorination	Destroyed by fire.
El Paso	150	Chlorination	Destroyed by fire.
National	100	Chlorination	Dismantled.
Philadelphia	250	Chlorination	Obsolete and inoperative.
Union	300	Chlorination	In suspended animation.
Standard	400	Chlorination	At about 75% capacity.
Portland	300	Chlorination	At about 80% capacity.
Golden Cycle	700	Roast-cyanide	About capacity.
Metallic	350	Roast-cyanide	Dismantled.
Dorcas	100	Roast-cyanide	Burned.
Brodie	120	Roast-cyanide	Burned.
Isabella	100	Straight cyanide	Running at capacity.
Wild Horse	100	Straight cyanide	Inoperative.
Anaconda	100	Straight cyanide	Inoperative.
Independence	170	Cyanide-concentration	About capacity and being enlarged.

The Golden Cycle mill began operation as a leaching plant using bromine solution—Cassel patent—and was later changed to a barrel plant, still using bromine. Still later it was again changed, this time to a barrel chlorination plant, and about a couple of years ago, after being sold to the Golden Cycle Mining Co., was enlarged and re-built as a roasting and cyaniding plant. The National began as a barrel bromination plant, under Engelhardt's patents, and was later changed to a barrel chlorination plant. It operated for a time, but after its sale to the United States Reduction & Refining Co., was dismantled.

The battle between the chlorination and cyanidation processes in the treatment of Cripple Creek ores in the larger mills is interesting. In the early days, treating oxidized ores, the cyanide process was but slowly introduced and was not particularly successful. With the introduction of the roasting-cyanidation process over half the mill ores were at one time treated by that process. When the largest of the cyanide mills, the Metallic, passed into the hands of the United States Reduction & Refining Co., it was dismantled and later was destroyed by fire, leaving the Dorcas the only mill of this class in operation. The Dorcas mill burned some four years ago, and left a clear field for chlorination. Two years ago the Golden Cycle mill revived the roast-cyanide process on a large scale. The chlorination mills having previously begun the cyaniding of all the tailing from the barrels, cyanidation once more came to the front. In the opinion of some metallurgists this process will ultimately drive from the field the chlorination process in the treatment of Cripple Creek sulpho-telluride ores.

The Portland Gold Mining Co. is now erecting a new mill at the mine, which is to use some modification of the cyanide process not yet made public. Judging from an article in the technical press, it involves some modification by the use of halogen cyanides. This is evidently an attempt to develop a non-roasting cyanide process which will enable Cripple Creek operators to erect mills at the mines and treat profitably low-grade ores incapable of standing the minimum railroad rate of 3c. per ton-mile. The so-called non-roasting process on Cripple Creek sulpho-telluride ores would not succeed, inasmuch as the ores are particularly rebellious, but for the fact that the sulpho-tellurides can be in the greater part removed by careful concentration, after which cyanide—especially when aided by the halogen cyanides—becomes effective.

Probably the most important event of the year in Cripple Creek metallurgy, though little noticed, was the starting and successful operation of the Stratton's Independence mill. This plant is hauling sulpho-telluride ores running from $3 to $4 per ton in gold, and is pointing the way toward the successful treatment of hitherto worthless material, of which immense quantities exist in the mines and on the dumps throughout the district. While not fully meeting the conditions of the long-sought non-roasting process, it does reduce the amount of roasting necessary, 95% as compared with the other processes in use. The mill, with a capacity of 5000 tons per month, has been running steadily since April on the ore-house dump that showed an average sample value of $3.60 per ton. The whole process may be said to depend on a most careful concentration to remove as completely as possible the sulpho-tellurides, followed by cyanidation of the tailing. The following is a brief description. The dump rock is loaded by means of a power shovel, is coarse-crushed in gyratory crushers and rolls, followed by fine crushing in Chilean mills, using cyanide solution instead of water for both crushing and concentrating. The sand is separated from the slime and both are cyanided. The total cost of this process was estimated by the consulting engineer at $1.50 per ton and so published by the company. The mill is now be-

ing enlarged 50% by the addition of a third Chilean mill and the necessary tables. This will lower the treatment charge to something near $1 per ton, as against the present lowest treatment charge of $4 on similar ores at the custom mills. A method of ore treatment that reduces costs from 300 to 400%, is slightly revolutionary! This process, however, differs from all of the 'epoch-making processes' in one essential—there are absolutely no secret or patented methods in use. The whole process, or combination of processes, consists simply in adaptation of well known apparatus and methods to obtain the desired end.

Leadville.—No metallurgical improvements of note have been introduced into the ore treatment practice of this camp during the current year. As is well known, the bulk of the ores are of smelting grade, the majority of them being treated at the local plant of the American Smelting & Refining Co., the Arkansas Valley. This has one of the newest and best of the Huntington-Heberlein roasting plants and eight modern blast-furnaces, with a capacity of 1000 tons per day. For various causes, some of which will be noted, the plant has not been operated at full capacity, and has at present, but four of its eight furnaces in blast. The Arkansas Valley, is, perhaps, the best equipped smelter in Colorado, having been almost entirely re-built within the last few years, and being equipped throughout with electrical appliances. The low price of silver and of lead during the greater part of the year has resulted in almost entire suspension of mining in what is known as the 'down town' mines, while the incomplete exhaustion of the silver-lead sulphides in the other properties has caused more attention to be turned to mining and milling of the zinc sulphides. There has been consequently a falling off in the development and milling of the smelting grades formerly the sole product of Leadville. The mixed sulphides mined in this camp contain a large quantity of iron pyrite, usually of a very low silver content. The elimination of this, in order to raise the percentage of the zinc, has received the attention of several metallurgists, and has resulted in quite a collection of mills for the treatment of zinc ores.

One of the earlier and most elaborate of the zinc mills is known as the Rowe, and is situated in California gulch, near the mouth of the Yak tunnel. At first this mill was designed for crushing the raw sulphides 'dry' in ball-mills, and then separating the zinc by means of the International magnetic separator. After a short experience with the ball-mills, rolls were substituted and later a new addition was made to the mill for the purpose of roasting the ores to render the pyrite magnetic. During the past year the separation of zinc from the unroasted ores in the International machines has been abandoned; all the ores treated by the plant being roasted in White-Howell furnaces and the cooled product passed through Cleveland-Knowles magnetic separators. The latest change in the process was in the treatment of the zinc product from the separators by wet concentration, the process now being: (1) roasting the sulphides to render the pyrite magnetic; (2) separating the magnetic product by Cleveland-Knowles machines; (3) wet concentrating the non-magnetic product to obtain, first, a galena smelting product, second, zinc sulphide, third, the elimination of silica. This is the largest zinc mill in the district and has a nominal capacity of 300 tons per day. It has been

A. Y. and Minnie Mines, Leadville.

in steady operation throughout the year, but since the company is a close corporation, little can be learned regarding the commercial results attained.

The Cloud City Milling Co.'s mill, erected on the site of the old Harrison smelter about three years ago, but not operated on a commercial basis, was started up again in August. This mill, consisting of a Wilfley roaster, Wetherill separators, and a wet-concentrating plant, is now treating the complex sulphides of the International Mining Co., of Robinson. The process is as follows: (1) crushing by breakers and rolls, followed by drying; (2) roasting in Wilfley roaster; (3) separation by Wetherill magnetic machines, and iron removed; (4) wet concentration, giving two products—galena and zinc sulphide. The plant is now treating 25 tons per day.

The Leadville District mill, situated near the Arkansas Valley smelter, has worked intermittently during the year on the Ibex dumps, concentrating the sulphides which carry gold. It is a wet-concentration mill of 75 tons capacity, using jigs and tables.

The earlier wet-concentration mills erected in Leadville for the separation of the mixed sulphides, were not notable successes, though some of them worked profitably for a time on ores containing considerable galena, producing a marketable lead ore and a mixed iron-zinc sulphide containing some galena and gangue that went into the dumps of the A. Y. and Minnie, Col. Sellers, and other mines. This product accumulated and remained unused for some 15 years. Within the last year or so it has been shipped to the Empire Zinc Co. at Canon City, and to the United States Zinc Co. at Pueblo, chiefly for the zinc content. The concentrators at these mines have not been operated for some time. The Iron Silver Mining Co., one of the largest in the district, several years ago erected a large wet concentrating plant, which, proving unsatisfactory, was dismantled and sold. The production from the numerous mines of this company is now entirely hand-sorted, the best grades of zinc being shipped direct to the spelter manufacturers, the lowest grades sold to the zinc mills, and the mixed zinc and lead sulphides to the manufacturers of zinc oxide paint. The large mill erected on the Resurrection property, consisting of a wet concentrator followed by Wetherill magnetic separators, has not been operated for some years, and the Wolftone wet concentrator has been closed during the past year, the mine output being hand sorted following the practice of the Iron Silver company. The present treatment of the Leadville mixed sulphides follows the lines of (1) hand sorting to separate the shipping from the milling grades; (2) crushing and roasting the mill ores for a magnetic iron product; (3) separation of the magnetic iron, followed in some cases by wet concentrations to produce a lead product for the smelters, and a silica-free zinc for the spelter manufacturers. This general treatment will undoubtedly be followed in the future for all ores excepting those containing much waste rock. For the latter wet concentration should be a first step.

Salida.—Improvements in the plant of the Ohio & Colorado Smelting & Refining Co. include the installation of the Dwight & Lloyd continuous feed and discharge sintering machines, with a capacity of 30 tons per day. These have proved highly satisfactory. It is claimed that this is the only Dwight & Lloyd plant in successful operation on lead ores. The air blast in these machines is created by a suction fan which pulls the air down through the charge, and considerable difficulty was encountered at first because of the clogging of the fan and the breaking of grates. This has been overcome and the plant is working steadily. It contains four blast-furnaces of the usual water-jacketed type, two of which are now in operation handling about 9000 tons per month. In 1909 a new coarse-crushing plant with belt-conveyors and a Vezin automatic sampler has been installed, as well as new ore-bins and bedding floors. The ore-supply is from Leadville and the San Juan region, with some from the Coeur d'Alene district.

Pueblo.—Of the three lead-smelting plants taken over by the American Smelting & Refining Co. at Pueblo, but one, the Pueblo, remains in blast. The Philadelphia, formerly the property of the Guggenheims, has long since been dismantled, while the Eilers plant is now being torn down. The steel plant of the Colorado Fuel & Iron Co. and the zinc smelter of the United States Zinc Co. are the only other metallurgical establishments here.

At the Pueblo plant five blast-furnaces are in operation at the present time, the base bullion being sent to the Omaha plant for refining. The ore supply is distributed about as follows:

Lead ore, 50% from Idaho, 25% from Leadville.
Quartz ore.....from Creede.
Porphyritic ore.....from Cripple Creek.
Oxidized iron ores.....from Leadville.
Pyritic ores.....from Ouray in small amount.

The most noteworthy feature of this smelter plant is the Huntington-Heberlein installation, which comprises 34 pots each of 8½ tons capacity per charge. The preliminary roasting for these pots is done partly in Godfrey mechanical roasters and partly in hand roasters. The incompletely roasted product is used to fill the pots about one-quarter full and serves as a means of starting the fire in the pot charge. The pot is then filled with the regular charge consisting of one-third fairly coarse quartz ore, one-third lead slime, and one-third pyritic ore. A blast of about 15 ounces is turned on and the roasting completed in about 4 hours. The pots are set in circular brick-work, so that the air in passing up through the charge is drawn over the rim of the pot and passes down through the space between the pot and the brick-work and out to a flue at the side. In this plant no fume is noticeable in the converter building. An electric crane is used to handle the hood and to lift the pot out and dump the sintered charge. In charging, the pot is lowered into a pit in the floor, the roasted ore is dumped in from wheelbarrows, and the balance of the charge is dumped on top of the roasted ore from a stock-bin at the side of the pit. The crane then raises the pot and places it in position in its brick-lined holder, the hood is lifted into place, and the blast turned on. The entire operation requires but 15 minutes. A heavy iron weight, hoisted by the crane and allowed to drop on the fused mass, is used in the preliminary

breaking after which all the material is passed through a crusher and sent to the stock-bins. Fifty per cent of the entire tonnage treated at this plant passes through the pots.

The zinc plant of the United States Zinc Co. was started in 1903 with the co-operation of the company operating a zinc works at Overpelt in Belgium, and was designed to treat the zinc-lead concentrates of Leadville and Creede. These contain 20 to 40% zinc, 15 to 20 iron, and from 7 to 8 lead. Recently some very good concentrate having a uniform zinc content of 27% has been coming from New Mexico. The first operation, after sampling, is the magnetic roast. This is performed in a tubular mechanical roaster, after which the roasted material is water-cooled and sent to the concentrator. The iron is now removed from the ore by magnetic separators, and the zinc-lead residue passes over Wilfley tables where the lead is taken out by concentration. The residue from the Wilfleys, containing about 40% zinc, is sent to the roasters, part being treated in four hand Rhenania roasters, and part in a Matthiessen-Hegeler mechanical roaster of 40 tons capacity. The hand-roasters will handle about 8 tons each per day. After roasting the ore is sent to the bedding floor where it is mixed with coal in the proportion of 60% ore to 40 coal. The bed so formed is the regular retort charge. There are six distilling furnaces, each containing 240 retorts arranged in vertical rows of three and which are heated by Siemens regenerative firing. The gas for these is obtained from Duff generators, which require from 1 to 1½ tons of coal per ton of ore charged. Each retort furnace receives a charge of about 18 tons of bed mixture, and the yield of spelter is said to be from 90 to 92%, the daily output being close to 25 tons. The crude spelter contains 2% lead and 0.02 iron, and the residue from the retorts 3 to 4% zinc, 10 lead, and a small amount of gold and silver. The lead bars obtained from the condensers, containing about 2% zinc and the bulk of the gold and silver, are sent to the Omaha refinery. The fritted scrapings from the retorts, containing a little zinc, gold, and silver and a great deal of available fuel, are sent to the Pueblo plant, as are the lead and iron concentrates from the mill. The plant makes its own retorts and condensers, using a mixture of New Jersey and local clays. The retorts are made in a hydraulic press, while the condensers are spun round by machine and afterward formed to the required shape by hand, three men turning out about 400 condensers per day.

Black Hawk, Where Smelting Began in Colorado; Iron City Mill in the Foreground.

At the steel works of the Colorado Fuel & Iron Co. there are in operation at the present time 3 blast-furnaces, the open-hearth plant, the wire and rail mills, and a single turn at the bessemer plant. The only important change in the last two years has been that rails are now made entirely of open-hearth steel and none from bessemer steel as formerly. The open-hearth rail lasts longer and is not so liable to break as were the old bessemer rails. The open-hearth mill is producing about 600 tons of rails per day and is using from 30 to 50 tons of iron ore and 75 tons of limestone in addition to the daily output of pig-iron from the blast-furnaces. Over 1000 tons of coal is used per day in this department, coming from Las Animas and Fremont counties. The principal iron ore supply is from Sunrise, Wyoming, but

considerable ore comes from the Union Hill and Jim Fair mines in New Mexico. The Sunrise ore carries from 45 to 60% Fe. Chrome iron ore—for furnace lining—is received from both Wyoming and California, while all the ferro-manganese comes from England by way of Galveston. Limestone is obtained locally from the towns of San Carlos and Tobasco. There has been no construction during the past year, but at the present time there is a rumor that great improvements are to be made this year. The plant has large orders ahead, but is suffering from a shortage of iron ore just now.

Denver.—The Globe plant, in common with the other American Smelting & Refining Co.'s plants, is operating at about one-half capacity. The Argo plant of the Boston & Colorado Smelting Co. is about to close. Established in Black Hawk by the late N. P. Hill some 38 years ago, and moved to Denver in 1873, this plant has been one of the landmarks of the State. The process used embraced the collection of the precious metals in copper matte and the shipping of this matte to Swansea for refining. When Richard Pearce became metallurgist he introduced the Ziervogel process, in which the silver sulphate in the matte is leached out with water followed by the precipitation of the silver on copper, and of the copper on iron. The treatment of the residues after the leaching of the silver from the roasted ores was kept a close secret until recently, when Harold Pearce explained that the gold was concentrated in copper bottoms, which were granulated and smelted with iron pyrite in a reverberatory furnace. A further concentration was thus obtained, the solubility of gold in metallic copper being greater than in copper matte. These meltings and granulations were continued until an alloy containing from 10 to 20% gold was obtained. This was sent to the refinery, where the same process of concentration was advanced a further stage by repeated melting in crucibles, yielding finally a gold bullion 920 fine and ready for the mint. In a period of 30 years the gold output from this process amounted to 1,532,905 ounces. The Argo was probably the most successful smelter in the West, but with changing conditions and passing of the master mind when Richard Pearce retired, it has gradually declined. The refinery burned in 1906, after which the rich matte was sold to the American Smelting & Refining Co. It is interesting to note in passing one other achievement of Richard Pearce, namely, the development of the reverberatory furnace in copper smelting, which he worked out at this plant, starting with the old Swansea 5-ton furnace and working up to the present 100-ton furnace.

The Modern Smelting Co. has recently erected a pyritic smelter at Utah Junction near Denver, and is now operating one 400-ton furnace. This plant will treat Gilpin county ores and will dispose of its matte to the A. S. & R. Co. There has been an attempt to make this an ideal plant—round sheet-iron tanks form the ore-bins and the plant was so designed that the ore is not to be touched by hand from the time it is unloaded. The ores are not bedded, crushed, or mixed, but ore is drawn from the tanks as needed, mechanically elevated to the feeding floor, and fed from a hopper on one side of the furnace. Apparently the metallurgist can have but a hazy idea of what is on his charge, and this may account for the numerous 'freeze-ups' that have already occurred. The blast is heated in an immense stove, probably the largest in the West. This is another attempt at pyritic smelting, which in almost every case so far has ended disastrously—at least to the stockholders—in the many attempts in this State to establish pyritic smelting with, or without, hot blast. It is true that at Leadville a plant was successfully run up to the time of its absorption by the A. S. & R. Co. It then closed, the company doubtless finding the iron flux more valuable in lead-smelting. It is difficult to obtain copper in Colorado, and it has been fully demonstrated that without in the neighborhood of 1% Cu on the charge the precious metals cannot be saved. One of the earliest attempts at pyritic smelting in Colorado was made at Kokomo, and was followed later on by the Bi-Metallic works at Leadville, and still later by a small plant at Silverton backed by the Guston mine. The most elaborate plant was erected at Florence and ended in disaster—where it was contemplated to treat large quantities of aluminous Cripple Creek ores, but where it was found that these ores worked no better than in the lead furnace. The large works at Golden has been twice resuscitated, and though now dormant are expected shortly to be re-opened by the North American Mines & Smelter Company.

Of the smelters that have in recent times been in operation in Colorado, the following list shows their present condition:

Name.	Remarks.
DENVER.	
Globe	In operation at one-half capacity
Grant	Dismantled
Argo	Closing down
Modern	Starting
PUEBLO.	
Pueblo	In operation at about one-half capacity
Philadelphia	Dismantled
Eilers	Being dismantled
LEADVILLE.	
Arkansas Valley	In operation at one-half capacity
Bi-Metallic	Dismantled
Elgin	Dismantled
Union	Dismantled
SALIDA.	
Salida	In operation at about one-half capacity
DURANGO.	
Durango	In operation at about capacity
GOLDEN.	
Carpenter	Closed
FLORENCE.	
Rocky Mountain	Closed

There are then five smelters in operation at about one-half capacity, and under these circumstances pyritic smelting seemingly will stand but a poor chance, for even if successful the matte must be sold to lead or copper smelters. The crying need of metallurgical circles is more ore, and without the discovery of new camps or a better price for silver—which is not likely to occur—the only alternative is to find a cheaper method of ore reduction. Perhaps it is too much to say that existing metallurgical processes are perfect, but the smelters have reached a very high stage in saving and little more can be done to decrease the small metal losses now made.

JAMES' ANNUAL CYANIDE LETTER.

Written for the MINING AND SCIENTIFIC PRESS
By ALFRED JAMES.

Once more Africa has become, if not the centre of interest, for the year, one of the most interesting centres. For many years, with the exception of the period of the Denny controversies, attention has been directed to Western Australia, New Zealand, and Mexico for the latest improvements in practice. That Africa is once more calling favorable attention to its practice is due in no slight degree to the enterprise and caution of W. A. Caldecott, who, since the retirement of J. R. Williams, of cyanide renown, has apparently been the ruling force in the adoption of solid improvement in practice. Sound in judgment, cautious in committal, and yet enterprising in policy, Mr. Caldecott first came into prominence by his extremely accurate forecasts of the advantages which would result from the adoption of tube-mills in local practice. His recently published paper, showing the work which has led to his recommendation of heavy

Caldecott Slime Table.

Interior of Tube-Mill.

stamps, has gained him a gold medal from the Institution of Mining & Metallurgy, and amply justifies the attributes with which this sentence opened. In boldly adopting a vacuum-filtration table for the classification and collection of his sand-pulp Mr. Caldecott has once more shown enterprise and earned high encomium from such experts as J. R. Williams, who is naturally enamored of a sand-product carrying only 1% of slime.

African practice is clearly in a transition stage. The suggestions of the Denny brothers—made too early, possibly, for their general adoption—although received with incredulity and ridicule, have undoubtedly borne good fruit, and while these suggestions may be modified by later available methods and practice, the results accruing from them are undoubtedly materially altering metallurgical practice on the Rand.

From time to time editorials and letters from correspondents assert that filter-pressing on the Rand has been tried and thrown out, but I can find little justification for such a statement. It is true Mr. Albu stated his intention of dispensing with filter-presses at the New Goch because of the difficulty of taking reliable 'lip-samples' when cyanide solution was flowing through the battery boxes (though at the same time retaining them at the Meyer & Charlton), but not only is the original Delme-press plant at the Meyer & Charlton still at work, but a number of other Delme plants have since been and are still being installed in South Africa—not on the Rand—as the result of the Denny plants.

It may be taken that the trend of practice on the Rand is to use heavy (2000-lb.) stamps as coarse crushers only, and to crush fine in tube-mills, avoiding the use of amalgamation plates after battery screens, and to amalgamate after the tube-mills only. In some mills the battery screens are as coarse as 3-mesh.

In Western Australia interest has mainly centered on the treatment troubles of the Lancefield and on the introduction of fixed submerged filters at Oroya Brownhill, Lake View, and other Bewick-Moreing mines.

In Mexico good work is being done all the time investigating the conditions for solution of the various silver-carrying minerals, and improving tube-milling, agitation, and filter-pressing.

In the United States new plants appear to conform to Mexican practice, the Homestake still standing as the notable example of original methods successfully adapted.

Crushing.—In these notes for last year a prophecy was hazarded that the era of 2000-lb. gravitation stamps would soon arrive. Already stamps of this weight are actually in use. It appears to be established on the Rand that particles 0.25-in. diam., are the largest economically suited for subsequent tube-milling, and experiments there are consequently on a screen of 9 holes (of 0.27-in. aperture) to the square inch. Cabled reports show an output of 17 tons per day from the 1890-lb. stamps of the West Rand Consolidated, and it is suggested that the 2000-lb. stamps at the City Deep will output 20 tons per day. All new stamps appear to be designed from a development of Mr. Boss' suggestion, with long heads, short stems, and low, open-fronted mortar-boxes, without anvil-blocks. Mr. Caldecott's paper in the Institution of Mining & Metallurgy, referred to above, is most interesting and useful, and gives tabulated results with varying factors such as

weight, water-feed, and screen-area. Truscott, however, shows the increased duty to be only directly as the increased weight of the heavy stamps, yet the saving in convenience, cost, and labor on the fewer and larger units is such as to secure their adoption. A most remarkable point the author makes is that, whereas using 8 of water to 1 of ore the crushing duty on the Simmer Deep was only 5 tons per stamp per day containing 11% of plus 60 particles, at the present time using tube-mills as fine grinders, the crushing duty with only 6½ water to 1 of ore is no less than 8⅓ tons per day with only 1.61% of plus 60 for exactly the same cost. They thus obtain a higher tonnage and a higher extraction for the same cost per ton, and effect a saving in water.

In Rhodesia practice is not infrequently materially different from that on the Rand. Just as the Giant for some years pioneered in practice, getting a heavy output per stamp (10 tons per day) so now Rhodesia makes a departure from Rand practice by the adoption of the Chilean mill, though we have as yet no information as to better results having been obtained there than those of Francisco Narvaez at Pachuca, to which I referred in my last notes.

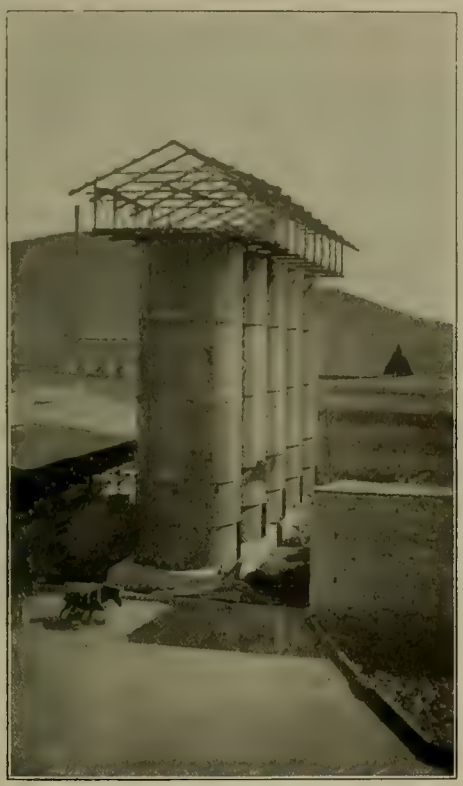
Tube-Mills.—I have in another paper referred to the coarse material (0.25-in.) now being fed into tube-mills on the Rand. From elsewhere one enthusiast advises me of his successful practice with a 1½-in. tube-mill feed. Opinion is still divided as to the most suitable proportion of tube-mills to stamps. At El Oro a much higher proportion is used than in Africa, but the outside figure seems to be that of the Waihi Grand Junction Co. with 9 tube-mills to 40 stamps. At the Benoni, in South Africa, it is proposed to put in 3 tube-mills to every 40 stamp-heads, which is a great advance on local practice. Walter Neal, of the Dos Estrellas, Mexico, wishes me to call attention to a rational development of all-sliming practice. This is to separate at once the original, impalpable slime from the tube-mill slime (granular particles), so that the former may receive separate and usually much more rapid treatment than the latter.

The battle over tube-mill liners is still undecided. Iron plates are used in Western Australia, honeycomb blocks and rib-liners in New Zealand; silex blocks in South Africa; and rib-liners in Mexico. Rib-liners appear to increase the efficiency of the tube-mill, and also the power-consumption, and they also appear to overcome 'slip' of the pebbles. It looks as if rib-liners would be more and more widely adopted, though one is a little surprised at the non-adoption of Barry's convenient and rapidly renewable system of mine-material cemented in honeycomb shells. Mr. Neal's open discharge appears to be gaining ground in Mexico. The convenience of doing away with the pierced baffle-plate or screen is obvious.

Dewatering and Classifying Pulp.—Probably the most original work of the year has been along this line. In America, Canada, Mexico, Australia, and Africa, new and original schemes have been evolved and put into practice. Possibly enthusiasm of the inventor has caused him to dream of displacing filter-presses, decantation plants, and vacuum filters, but without for the moment looking at it from this point of view one has to take note of at least two systems which have come prominently forward during the year. In the first place the Dorr classifier has taken a forefront position in Mexican and American practice. Designed by the engineer who made a success of the Moore filter after the original failure at Mercur, it was a practical solution of one of the two difficulties at that time faced, apart from the operation of the filter itself, namely, (1) the separation of the sand, and (2) the thickening of the slime-pulp. By a simple system of reciprocating scrapers, working in an inclined trough, Dorr separates the sand up to 200 mesh or any required degree of fineness, handling about 700 tons of pulp per day with less than ½ hp. The product is clean and attractive. Mr. Caldecott has been working on quite other lines. By placing a circular board or baffle near the discharge-end of a small (8-ft.) cone, right over the discharge but at the same time clear of the sides except at the point of support, he overcomes the irregular action of those cones caused partly by the collapse at intervals of material settled on the sides, and he keeps the fine-slime in suspension. The sand is delivered to a filter-table somewhat similar to that illustrated by Parrish or Hunt. Mr. Caldecott describes his method in detail in the *Journal* of the Chemical, Mining & Metallurgical Society of South Africa for May 1909, and J. R. Williams tells how he produces a clean product of sand containing only 20% of moisture and 1% of slime. Mr. Caldecott's spitzkasten diaphram—not to be confounded with the baffle used in tube-mill feed-cones (spitzlutten) to divert the upward flow of water from the bottom—appears to be an ingenious contrivance for which he deserves much credit, and his adoption of a filter-table enables him to provide a much drier product (he claims 15% of moisture only) than that from a Dorr classifier. This is, of course, of no little importance where the pulp is to be mixed with KCy solution, but we have no note of the increased cost resulting from the use of Mr. Caldecott's filter, scraper, and vacuum-pump. On the other hand, Mr. Caldecott appears to accomplish, without power, by the mere addition of a fixed diaphragm, what Dorr requires power (little, it is true) and moving apparatus to accomplish.

Solution of Metals.—The use of the Brown agitator has progressed by leaps and bounds. In Mexico and the United States no new plant appears to be considered up-to-date without it, and already its use has spread to eastern Asia, India, South Africa, the West Coast of Africa, and to South America. Singularly enough, Australia appears to be the one gold mining territory, though the agitator originated in New Zealand, in which this appliance has not yet been adopted. The reason for this may lie in the cessation of construction of new plants rather than in a lack of appreciation of the efficiency and economy of the new method of agitation. Already, indeed, operators seem to be trying to still further improve the work of the agitator. Henry L. Swan proposes to economize by his patented system of re-heating the air and thus to make it go further as well as to obtain the advantage in extraction and settlement resulting from the employment of heated solutions. In Mexico, C. V. R. Cogswell proposes the adoption

of ozone instead of air. To the lay mind it may appear to be a rather expensive substitute, but facilities for the manufacture of ozone appear plentiful at Guanajuato and we may yet hear more of the suggestion. The method proposed by Messrs. Grothe and Mennel, of continuous treatment in Brown agitators, can scarcely, however, be favorably considered. A system of continuous decantations, using these tall tanks for this purpose, would not only involve what the industry is now trying so hard to avoid, namely, the handling of the huge quantity of solution per ton of slime treated, but also the idea of settlement in tanks not so fitted for this process as the shallow tanks of great superficial area in use in South Africa. Thus, if slime settles 6 inches in one hour, in a 60 ft. diam. tank 10 ft. deep, this



Brown Agitating Tanks at Pachuca.

means 1414 cu. ft. of clear solution per hour, as against only 88 cu. ft. in a much more costly tank 15 ft. diam. by 45 in. deep. What the industry is set on obtaining is a high extraction with the handling of only one, or at most two, tons of solution per ton of dry slime treated.

Recovery of Gold or Silver-Bearing Solution.—This, in other words, is the crux of the slime-treatment question, and has probably during the past year attracted more attention from skilled men than any other phase of the metallurgy of the precious metals; nor have the efforts put forth been successful. New methods on entirely new lines, with both natural and assisted settlement, have been promulgated. Their success in practice has yet to be accomplished.

It is of course well known that originally J. R. Williams evolved a decantation system for South Africa, and Messrs. MacIntyre and Sutherland a filter-pressing system for Australia. The former method has been carried to a remarkable degree of efficiency, superior to the results obtained by the Mexican pressure-filters, and practically equal to those of the fixed submerged filters, by means of huge and costly plants, costing in some cases upward of £50,000, and handling up to and above 12 tons of solution per ton of dry slime treated. There now seems little reason to doubt, however, that even on low-grade African slime the adoption of filter-pressing would have been of great advantage, and would have saved heavy loss and much capital expenditure. Apart from the greater cheapness of a filter-press plant, and the heavier cost of working, amounting to more than 5d. per ton, there is the question of depreciation, which in decantation plants is a heavy figure, even if one takes the life at 15 years. It is now admitted that on the best Rand plants there is a loss of not less than 8d. per ton of dissolved gold run away with the residue. Filter-presses would have recovered 7d. of this, and would have saved the cost of handling of huge quantities of solution. But it must be remembered that the good decantation results shown may only obtain at the best plants. The letter published by George Mackenzie of the Adair-Usher Process, Ltd., in the MINING AND SCIENTIFIC PRESS, July 17, 1909, shows how much behind these figures some of the other plants were. The best Rand slime-plants now have four transfers, and handle three of water to one of settled pulp at each transfer. Treatment-costs, however, are low, varying at the mines of the four chief groups (Eckstein, Rand Mines, Gold Fields, and East Rand) from 10.33d. at Knights Deep, including cyanide and supplies, to 1s. 6d. at Simmer Deep, 2s. 6d. at Jumpers Deep, 2s. 10d. at French Rand, and 4s. 7d. at a well known mine (for accumulated slime, current pulp being handled much cheaper) for the months reviewed. Experiments with vacuum filtration have shown, however, that a final residue of 0.15 dwt., or an extraction of, say, 92.5% is possible with a dissolved value remaining in the residue of under ½ grain of gold per ton of dry slime. The best present practice appears to show an extraction of close to 88%, allowing for gold in solution flowing away with the residue. To revert, however, to the newer natural or assisted settlement methods of recovering solution, that which first occurs to one as possibly the best tested is the Dorr pulp-thickener. Dorr, however, does not appear to claim, as do others, that his thickener is available as a complete treatment scheme, but regards it as an accessory to filtration. This thickener consists of an ordinary slime-settling tank to which is fitted a scraper arrangement revolving at a very slow rate, say five revolutions per hour, and thus taking very little power. The scrapers deliver the settled, thickened pulp at an outlet at the centre of the bottom of the vat. If the delivery is continuous the pulp is reduced from, say, 10 of water to 1 of dry slime to 1½ of water to 1 of dry slime. If worked intermittently an output of 1 of water only to 1 of slime appears to be maintained without difficulty.

An enterprising endeavor in Mexico to obtain a highly thickened pulp ought here to be mentioned. A cone 34 ft. diam. by 35 ft. high is fed with 400 tons of dry slime per day, containing 9 of water to 1 of dry slime. The underflow contains not less than 3.5 to 4 tons of water to every ton of dry slime, with an absolutely clear overflow. If, instead of one cone only, a series of smaller cones had also been used, results might have been obtained more nearly resembling those of the Messrs. Denny in Africa. From their 35-ft. cone H. S. and G. A. Denny obtained an 18 to 25% product from a feed of 3000 tons of pulp, that is, dry slime plus solution, per day. This was further thickened in eight small cones, worked in two series of four each, down to 35% of solid matter. Another method of settlement comes from Australia. Pulp is settled in a cone, and the thickened pulp-overflow at the bottom is received on a belt caught between consecutive series of rollers which squeeze the pulp between the upturned sides of the belt until a thick, somewhat caked product is delivered. This scheme does not appear to have yet established itself practically.

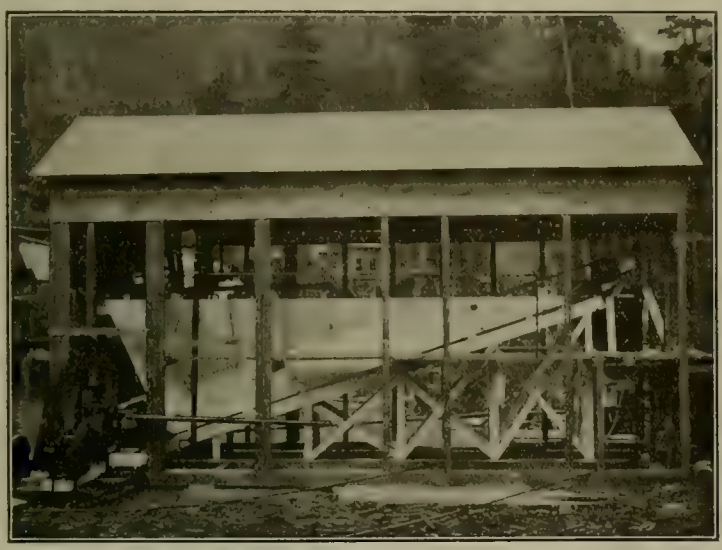
From Africa comes the Arbuckle process. In this system the pulp flows into a cone, and the thickened pulp is caught between rollers which deliver it sausage-fashion. I understand the experiments originally conducted by one of the most enterprising of the local groups did not result sufficiently favorably, but other groups appear now to have acquired an interest in the process, which is stated to take the sand-pulp as it comes and to deliver an absolutely continuous output of thickened pulp, sand, and slime together, containing only 20% of moisture. From a glance at the patent illustrations it would appear as if the arrangement of rolls were not yet sufficiently practical for ordinary usage. But even if the machine will do all that is claimed, it is still a long way from a simple one-treatment equal-solution process superior to decantation, and equal in recovery to filter-pressing, though the figures certainly look attractive; for, assuming that the ordinary mill-pulp is de-watered down to 20% moisture, and that the thickened pulp is diluted with KCy solution to 2 to 1, and agitated, and again de-watered to 20%, then there is a recovery of $1^4/_5$ tons, or 90%. This is not nearly a high enough recovery of dissolved metal, and the pulp is again handled for another recovery of $1^4/_5$ tons, or $3^3/_5$ tons of solution in all, and a 99% recovery of dissolved metal, which, for reasons to be shown later, is the lowest recovery one can afford to be content with in practice even on low-grade (1½ to 2 dwt.) slime. There would be three transfers, two agitations, and two precipitations, with $1^4/_5$ tons of solution for each ton of slime, using the second wash as original solution for the next charge, with a consequent slight lowering of the percentage of recovery.

The most recent settlement process comes from Canada and differs from the others in that the inventor delivers his settled thickened pulp under water, and thus avoids the difficulties incidental to all other methods arising from the pressure of fluid above the thickened pulp outlet that is liable at any time to rush through channels of least resistance. Horace G. Nichols has described his apparatus in a paper to the Institution of Mining & Metallurgy (Vol. XVII, p. 293) and more recently in *The Mining Magazine* for November 1909. Briefly, his apparatus consists of a V-shaped inclined trough with a box-bottom in which a continuous belt operates under the longitudinal opening along the bottom of the V. The thickened pulp is deposited through the opening at the bottom of the V onto the belt which, operating in water or pulp at an angle of 18°, which is also the angle of the bottom of the trough, has its upper end emerging from the water at the end of the trough. The thickened pulp adheres to the belt and is stated to be not disturbed during its slow travel through the water. The thickened pulp is detached at the upper end of the belt after it emerges from the surface of the pulp by a system of water jets or by a scraper. Mr. Nichols claims a settlement to 27% moisture, and it will be seen that the considerations applying to the Arbuckle settler apply with still greater force to the Nichols apparatus, and that a very large amount of solution, say, 8 to 1, must be handled and precipitated to effect a 99% recovery. The idea, however, is certainly ingenious, and seems more practical than the Arbuckle in its patented form. Even if it is not as useful as a treatment-process as the author hopes, it would appear to have a field as a de-waterer or as a de-solutionizer prior to thorough washing-filtration, though it would be well to know more of the working of the method for keeping the box-bottom, in which the belt moves, clear of the thickened pulp.

Having thus dealt with the recent settlement-processes, it becomes necessary to consider the results of the much advertised vacuum-filters. If one regard the work of the fixed immersed type of vacuum-filter in Mexico or elsewhere, that type being most generally adopted, it is found that its function appears to be mainly that of a settler, and that whether one uses natural settlement and drainage, a pressure-filter, or a fixed immersed filter, the resulting recovery is almost the same, namely, the total solution less the 33% or so remaining in the thickened pulp. Recovery is therefore increased by the dilution of the original pulp; the more dilute the pulp the higher the recovery. My observations in Mexico led me to ascribe to the fixed submerged type of vacuum-filter in Mexico a recovery of 77 to 89% of the metals in solution. The latter looks like a high figure, and is obtained usually by taking the original solution, say 2 to 1 of dry slime, and deducting from it the 30% of moisture still remaining in the thickened cakes or settled pulp, representing a recovery of 85%. When the proportion of solution is higher, say 2½ to 1, the recovery is still greater, being 89%. Of course it will be found that the cakes discharged from the filter usually carry more than 30% of moisture. At one of the well known plants, for instance, the moisture is 45 to 50%, but this may be taken as mainly water introduced at the time of discharge. This result, apparently high, is confirmed by taking the advertised records and omitting the washing, which shows 87% extraction. Prior to the introduction of these filters much higher metal values were simply flowing away, so that in spite of low re-

coveries the introducers of these filters have done a great service to the industry, but even taking an ore worth only 30s. per ton, and assuming an extraction of 90%, equivalent to 27s., then the loss is not less than one-tenth of 27s., or 32d. per ton of ore, almost the whole of which would be recovered, at an extra expense of 6d. only, by Dehne presses, or without extra expense by the employment of thorough washing instead of mere settlement.

In the above remarks I have not referred to the traveling basket filter of the Moore or Barry type, as this is on quite a different footing from the non-washing, fixed, immersed, or pressure-filters. The Moore and Barry filters do good work, and it has been a matter of some little surprise that the former has not been more widely adopted in Mexico. Indeed, the decision of the Dos Estrellas company not to install the Moore filter so impressed me that I had special enquiry made into the matter. It appears



Nichol's Slime Settler.

that the Moore costs are higher than those of the fixed submerged filters, and that there is a liability to breakage of baskets which is extremely costly and inconvenient; that twice at Pachuca the baskets have been dropped, intentionally or otherwise, and smashed. This seems a poor argument for not adopting a high-recovery filter unless costs are very much higher, which might show bad design or bad management—or more probably that the Moore filter is handling at Pachuca straight slime, that is, slime not previously treated by decantation, instead of the decantation residue frequently fed to filters of the submerged type. Even so, the cost at Pachuca should not exceed 8c. per ton of dry slime or 6c. per ton of solution recovered. As for the smashing of frames, this is a mere question of mechanics which has been satisfactorily dealt with at the Liberty Bell, Waihi, and elsewhere, and can be as readily disposed of in Mexico.

There can be no question of the superiority of the results of the traversing type to those of the present fixed submerged type, and anyone can see this who will take the trouble to read the remarks of the workers of the latter type (see, for example, A. M. Smith in the MINING AND SCIENTIFIC PRESS, July 10, 1909). They actually at Goldfield run their discharged submerged filtered residue into a pond with wash-solution, settle the residue behind a dam, and decant the gold-carrying wash-solution, and then run on a further 15,000 or 20,000 gal. per day as a further wash to absorb and save the gold-bearing solution remaining in the residue. This water they subsequently decant and return.

To recapitulate, the position of slime-treatment appears to be as follows: The only methods giving really efficacious results, recovering not under 99% of the gold dissolved, are the Ridgway filters and Dehne presses. The former is handicapped by the necessity for a feed of thick pulp (not over 50% moisture) for cheap work (4d. per ton), but now that slime-settlers are advanced to such a degree as above indicated (the effluent containing 20 to 30% only of moisture) the securing of a proper thickness of feed should be a relatively simple matter. Again, the Ridgway is handicapped by the requiring of skilled supervision. I am inclined to agree with this view, but on the other hand the skilled supervision, as well as the repairs, are all included in the above working cost of 4d. per ton. Similarly, the Dehne press is limited by the greater cost of operating it, namely, 1s. per ton, but it can handle thin pulp and gives a high recovery.

Next to the above, and close to them in point of high recovery, comes the Barry (crush) filter. This appears to have the advantage over the Moore of a better plate and of no blowing back of displaced metal-carrying solution. The necessity of acid treatment of Barry's filter-leaves is unknown; the cloths are brushed or washed when taken off for repairs, and they last for months, in some cases for more than a year, and the cost appears to be between 4d. and 6d. per ton of dry slime handled.

It says much for the Dehne press that no instance has yet occurred to my knowledge of it being displaced by a vacuum-filter, with the possible exception of the Ridgway at the Great Boulder and of the Barry at Waihi. I have to place the Moore after the Barry, owing to its less efficient frame and the loss of dissolved metal-value from the blowing back or reverse pressure of fluid, that is adopted for dislodging the cake. There was much trouble to get over this with the Ridgway when it was found that the metal-values blown off were not of valueless wash, but rich in gold. The amount of loss from this cause varies with the construction of the frame; for the above type it may be assumed at under 5 per cent.

I said at the beginning of these notes that one could not afford to be content with a less recovery than 99% of the dissolved metal-content. With a

1½-dwt. extraction and a pulp containing 40% of solid matter a washing displacement of 69% (equaling a total recovery of 96%) shows on 100 frames, handling eight charges per day, a loss of £2500 per annum in unrecovered metal. If better designed plant operating at precisely the same expense gives 92% washing displacement (readily obtainable in practice) the loss of unrecovered metal is only £700 per annum. Even if one allow ½d. per ton higher cost for more efficient washing, the total net gain would be not less than £1500 per annum. I calculate the efficiency of the machines or methods as below:

	Recovery of dissolved metal values.	Cost per ton of dry slime.
(A) Ridgway (automatic)	99.5% (averaged over a month on 500 tons per day).	4 to 5d. (actual).
(B) Dehne (filter press)	99% (with efficient washing).	1s. (actual).
(C) Barry (Crush) (traversing basket vacuum filter).	96% (as used at Waihi).	5 to 7d. (actual).
Barry (possible).	99% (with modified wash).	
(D) Moore (traversing basket vacuum filter).	91%.	I estimate at 8d. plus royalty (stated in Mexico to be higher than (F) Brown (old costs) 31c.
(E) Rand Decantation.	Either side of 85%.	6 to 8d. omitting solution costs.
(F) Fixed Immersed Filter (coir leaves non-wash).	77 to 89%.	I estimate at 6 to 10d. (acid alone may be 2d.) Bosqui (old costs), 26c.
(G) Pressure Filters Non-Wash (without power).	61 to 76%.	3½d. (filter by gravitation without power).
(H) New Ridgway Non-Wash (500-ton unit).	66 to 70%.	1d. (actual).

I purpose here to refer to the new type of Ridgway filter (500 ton per day unit), regarding which I hitherto have given no details, as it appeared to me that, working without washing, the results could scarcely command serious attention. In view, however, of the enterprise which has induced them in Mexico to recover considerable metal from their decantation residue by means of pressure-filters, figures on this machine will probably be of interest. This filter differs from the standard Ridgway filter in that each flat plate is substituted by a basket or group of five vertical plates; the machine has eight times the surface of the standard Ridgway. It has been in regular use in Australia for some 2½ years, has never failed to treat the whole product sent it, amounting at times to 687 tons (dry weight) per day. It is reported to work automatically and without attention save for one man of superior grade on the day shift, no labor being employed on the afternoon or night shift. The costs, approximating 0.906d. per ton, are stated to be as follows, including purchased power at a high cost measured by ampere metre:

Power for vacuum and for turning machine, 45 hp., at 3s.	13s.	6d.
Labor for running filter, one man at 10s. per day	10s.	
Repairs and upkeep have proved infinitesimal, say	5s.	
Cloth, 10 yd., at 7½d.	6s.	3d.
Light, oil, waste, and sundries	3s.	
Total	£1	17s.	9d.

The feed into the machine is 50% solid, or apparently precisely similar to that fed into the pressure-filters at Mexico El Oro. They claim a high figure for recovery, based on the paucity of value in the treated product. Working as they do, however, I estimate it at 70% only. From the above figures this filter would appear to have some value as a cheap final method of recovering metal from decantation residue. For some time past, however, they have been using this machine on direct pulp with washing, but for this purpose I have as yet no figures which enable me to recommend its use.

Difficulties.—The chief difficulties in treatment encountered this year appear to have been due to pyrrhotite and graphite. Investigation on the former was carried out years ago by A. C. Claudet, who obtained entirely satisfactory results from fine grinding and agitating with dilute cyanide solutions. A plant on these lines, namely, stamp-mill, tube-mill, agitator, and filter-press, was laid down in Korea and operated by Mr. Marriner with entirely satisfactory results, without roasting. Graphite has, however, caused much more difficulty. Finely divided, and resembling an oily scum or film on the surface of the solutions, it has caused much trouble in Australia and in India. On looking up previous experience on the subject I find that at Charters Towers an old sailor made £30,000 by sun-drying and disintegrating, prior to cyanidation, heaps of old graphitic residue previously deemed untreatable. By this means 4 to 6-dwt. tailing was reduced to ½ to 1 dwt. at a cost of 3s. 6d. per ton, including carting. Generally, the difficulty caused by graphite has been overcome when roasting (which is the natural remedy) is not employed, by agitation with air, or by exposure to the sun for a period of six months or a year, with subsequent disintegration and aeration.

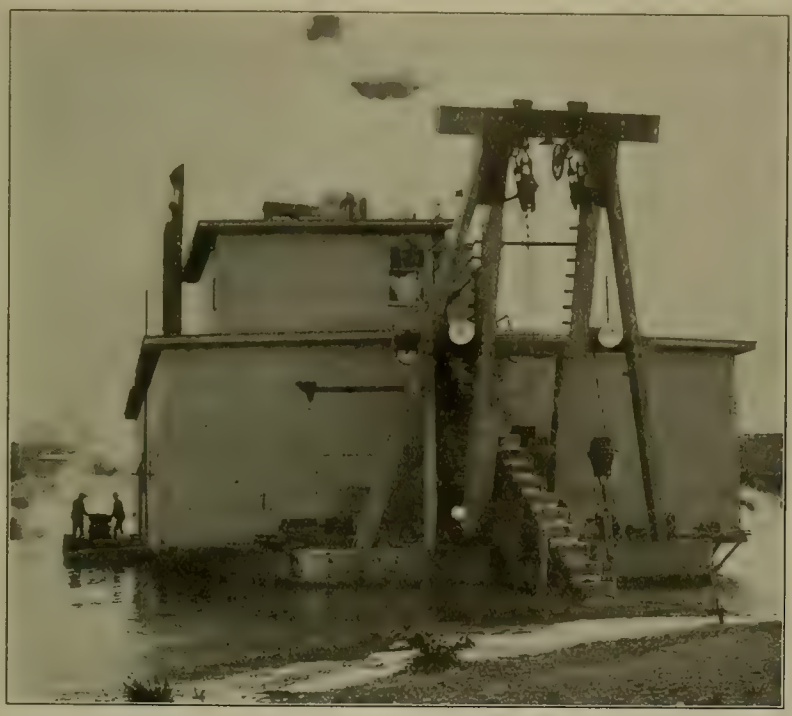
Errors in Estimation of Gold in Solutions.—Whitby states (*Journal*, Chem. M. & M. Soc. of S. A., May 1909) that he could show figures giving losses as high as 70% of the total gold in slime-pulp residue by simple evaporation, and in practice, using the greatest care, the loss seldom fell below 30%. All solutions should be evaporated gently with litharge.

Cleaning Up.—Tilting furnaces gain in favor as the use of them extends. A tilting furnace, with oil-burner, as used by Mr. Yates is ideal for running down gold precipitate. Unfortunately, however, when power runs short, the amount of air used by such a burner becomes no longer a negligible factor.

DREDGING AT NOME IN 1909.

Written for the Mining and Scientific Press
By Our Special Correspondent.

Seward Peninsula is on the eve of great development in dredging. At the beginning of the season of 1909 five dredges were in commission and two more were started by midsummer after remodeling and repairing them. Before the close of the season four more were completed and tried out to the satisfaction of their owners. At least eight additional dredges will be shipped here on the opening of navigation in 1910, and the promoters of these new ventures have every confidence in their success. Those that have operated the entire season are the Three Friends Mining Co., the Nome-Montana-New Mexico Mining Co., the Sievertson dredge, the Blue Goose Mining Co., and the Wonder Dredging Co. The Nome Mining Co.'s dredge and the Kimball dredge operated the latter half of the season, while the Gold Beach Mining Co., the Gold Bottom dredge, the Warm Creek dredge, and the Goose Creek dredge, were completed near the close of the season and operated just long enough to insure the harmonious working of their various parts.



'Three Friends' Dredge on Solomon River.
Built by the Bucyrus Company.

The dredge of the Three Friends Mining Co. was built on Solomon river in the summer of 1905 and was operated about 30 days at the latter end of the season. This is its fourth full season, and while it is difficult to obtain exact figures as to its output, it is well known to have paid handsome profits every year since it was built. It is a 5-ft. close-connected Bucyrus dredge driven by steam-power and averages 75,000 cu. yd. per month from the middle of June to the middle of October, which is the full dredging season in this climate. Its fuel is coal and is shipped here from the outside at a cost of $20 per ton laid down by the boat. Its actual operating costs are 11c. per cu. yd., and its total costs, including winter care, repairs, and amortization of capital are 18c. per cu. yd. I can state with certainty that more than 50% of its gross output is net profit.

The dredge of the Nome-Montana-New Mexico Mining Co. is also on Solomon river, and was built in 50 days last season. It ran 55 days at the latter end of the year and has had a season of 143 days this year. It was necessary to close down the dredge for the crew to make the last outgoing steamer; otherwise, the season would have been considerably longer.

The dredge has a 5-ft. open-connected bucket-line with revolving trommel and pan stacker, and the machinery was built by the Risdon Iron Works, of San Francisco. It is driven by steam power, uses 4.6 tons of Wellington coal per day for fuel, and averages 60,000 cu. yd. per month. It is credited with an output of $200,000 for this season, and its profit over operating costs has paid for the dredge and a large tract of ground upon which it will operate for several years to come, and has left a substantial cash balance in the treasury besides. For some months the operating costs were 1½c. per cubic yard. The ground averaged 9 ft. in depth. High bedrock and frost were encountered in the earlier months, while in October frozen overburden was a detriment to high capacity. It would seem possible to operate dredges far into November in this district where it is possible to flood the ground ahead, thereby preventing the freezing of a crust and where there is no liability of ice jams. Two men for each 8-hr. shift were employed as a rule, but in June and October, when the rigors of the winter were in evidence extra labor was employed. The digging efficiency of this machine was 89%; of the total lost time 10% was employed thawing frozen spots. The plant is equipped with compound condensing engine, surface condenser, and locomotive type of boiler, and is considered one of the most economical to operate in power and labor in the district.

The Sievertson dredge, also on Solomon river, is a small machine driven by gasoline engines, and having a 1-ft. open-connected bucket-line. This machine would probably be regarded by dredge men gen-

erally as a toy or plaything, but the fact remains that it has made over $15,000 profit for its owners this season, and is good for like returns for several seasons to come.

The Blue Goose Mining Co.'s dredge is on Ophir creek in Council City district. This has a 5-ft. open-connected bucket-line with shaking screens and belt stacker and was built by I. B. Hammond of Portland, Oregon. It is driven by steam-power, burns wood for fuel, and averages 30,000 cu. yd. per month. Wood costs $12 per cord laid down at the dredge. It has been operated on Ophir creek for three years on leased ground and has paid 30% of the gross output as royalty to the owners of the ground. It has paid dividends to its stockholders amounting to more than the cost of the dredge and has a cash reserve in its treasury of over $20,000. Owing to extensive repairs which were made at the beginning of this season the dredge is regarded as being as good as new.

The Wonder Dredging Co., operating on Wonder

Nome Dredging Fields.

creek near Nome, has a 9-ft. close-connected bucket-line, revolving screen, and belt stacker, and is driven by electricity. The power is generated by the Nome Mining Co., which is closely affiliated with the Wonder Dredging Co. The power-plant is situated near the mouth of Bourbon creek, and burns crude oil, which is piped from the coast to the plant. The generator is direct-connected to a turbine engine and generates 500 hp. The Wonder dredge pays one-half the costs of operating and maintaining the power-plant, and I am informed that the average cost to the dredge for this season has been $3000 per month. The dredge has averaged 50,000 cu. yd. per month, and the gold tenor has averaged 50c. per cubic yard, or about $1000 per day gross output.

The Nome Mining Co.'s dredge operates on Bourbon creek near Nome. This dredge was built last year, but seems to have been an ill-starred enterprise from the beginning. It is a 9-ft. close-connected dredge of Bucyrus type, and its construction was undertaken by a man by the name of Smith, who contracted to build it for $97,000, and it is said that a complete machine of that size and type should have cost at least $140,000 in this district. The result was that the machine was poorly constructed throughout. It is driven by electricity which is generated at the company's own plant already described.

The Nome Mining Co. and the Wonder Dredging Co. are both flotations of E. E. Powell, and while operated under separate heads are closely affiliated. They are backed by Eastern capital. Shortly after the Bourbon Creek dredge was started last year, and before they had dug a pond large enough for swinging room, they had the misfortune to tear the side out of the port pontoon with the bucket-line and the dredge immediately sank. It rested on an uneven bottom and was warped out of shape and the machinery was thrown out of alignment. After several attempts it was finally floated, but no further operations were attempted last year. At the beginning of this season, under new management, the boat was completely overhauled, the hull and gauntrees strengthened, and many expensive changes and additions were made to the machinery, and finally near the end of August it was again started to work. It has had about 50 days of running, but has had delays and mishaps for which the present management is in no way responsible, but due entirely to faulty construction. I have no definite data as to its output, but am informed that the results have been fairly satisfactory.

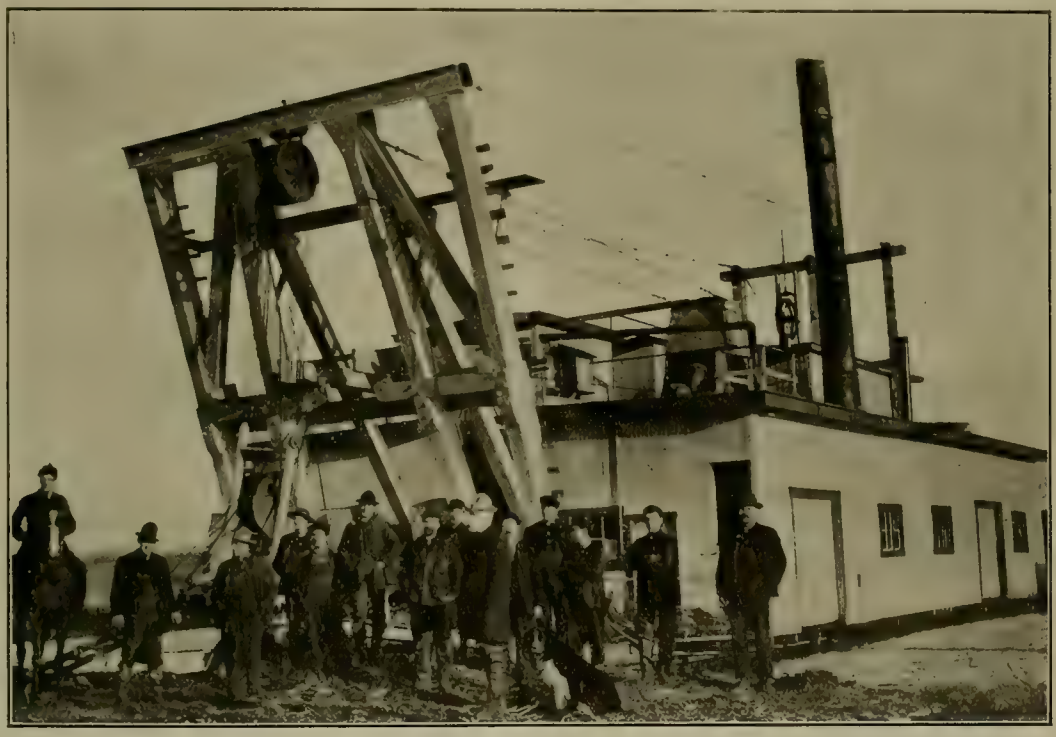
The Kimball dredge on Ophir creek was also remodeled early this season, and it is now a fairly complete dredging plant. It is mounted on wheels and leaves an open drain behind it. It has 1-ft. buckets, and handles an average of 300 cu. yd. per day. It is driven by gasoline and has paid a good profit over operating costs the last half of this season.

The Gold Beach Dredging Co. has recently completed a dredge on Dry creek near Nome. It has a 5-ft. open-connected bucket-line, a revolving screen, and belt stacker. It is driven by steam-power and burns crude oil, which is delivered by gravity through pipe and hose from a tank on the high bank of the stream. This is a Hammond dredge and was built in Portland to be used somewhere in Oregon, but the enterprise fell through and the dredge was bought at a bargain-counter price and shipped to Nome last spring by its present owners. It was completed too late in the season to do more than test it this fall, but it appears to be a substantial machine, and will probably give a good account of itself.

Jere Wilson, the Ophir creek pioneer, has built two dredges in the Council City district this season. One is on Gold Bottom creek and the other on Warm creek. They are essentially duplicates and were built from Mr. Wilson's own designs by the Byron Jackson Iron Works of San Francisco. They have 2¾-ft. open-connected bucket-lines, revolving screens, and belt stackers. They are driven by gasoline engines; each machine having a 40-hp. and a 25-hp. Western gas-engine. The hulls are 26 by 50 ft. and they draw 30 in. of water. They cost $40,000 each complete and ready to run. About $5000 of this amount was for river freight from the mouth of Fish river up the Niukluk river to where they were built. They were built to dig in shallow ground (6 to 12 ft.) with soft schist bedrock, and containing gold in amounts that will just pay to shovel into sluice-boxes. Mr. Wilson expects these machines to average

1000 cu. yd. per day each, and he has ten years work ahead of each machine. He ran them just long enough this fall to try them out and to confirm his expectations both as to the dredges and the ground.

Another small dredge was built this summer at the mouth of Goose creek, a small tributary of the Casadepaga river. Its designer is Ben Benard, and he and Messrs. Moore and Ryan, of Portland, Oregon, are its principal owners. It was built in Portland. It has a 1-ft. open-connected bucket-line, revolving screen, and pan stacker. It is driven by a gasoline engine and cost about $6000. It would probably give reasonable returns on the investment if it were on some one of the many small rich streams with which the country abounds, but they were so unfortunate as to build it on a high bar of the Casadepaga at the mouth of this small tributary, and they found when they were ready to launch it that their pit would not hold water, so now they will probably mount it on wheels.



Nome-Montana-New Mexico Dredge on Solomon River.
Built by Risdon Iron Works.

Of the new dredges for which arrangements are now being made, one is to be built on Otter creek, a tributary of Nome river. It is to be a 3-ft. steam-power dredge, and will be owned by a local company, of which Rowley Andrews, of Seattle, is president, and Joseph Plien, of Nome, is vice-president and manager. They have a large tract of promising ground near the mouth of Otter creek. Another is to be built on Arctic creek, a tributary of Cripple river, about 20 miles west of Nome. This one is to be built by Mr. Braucht, who is one of the large stockholders in the Gold Beach Dredging Co. that has just completed a dredge on Dry creek. Another is to be built on Solomon river just below the mouth of Hurrah creek. This one is fathered by C. Floding, of Chicago, who is heavily interested in the Solomon River Hydraulic Co.'s ditch on Solomon river. Another is to be built on Solomon river above the mouth of East Fork. Frank I. Reed is the leading spirit in this venture, and I understand that Mr. Pearson, manager for the Nome-Montana-New Mexico Mining Co., is taking an interest in Reed's venture. Another is to be built on Spruce creek, which flows into Bering Sea about eight miles east of the mouth of Solomon river. This one will be built by Mr. Sievertson, who has had such signal success with his small gasoline dredge on Solomon river. Another is to be built on Pine creek, which flows into Bering Sea about midway between Solomon river and Spruce creek. This one will be built by Mr. Condee, who has long been connected with the Three Friends Mining Co. on Solomon river, and who after this year will be its general manager. Mr. Condee will build a 3-ft. close-connected dredge with revolving trommel and pan stacker. After having made careful comparisons between the belt stacker on the Three Friends dredge and the pan stacker on the Nome-Montana-New Mexico dredge operating in the same area, he has become convinced that the pan stacker is more economical in this climate. He will use distillate engines to generate his power. Another is to be built by Bernard Peterson and Linder on Saunders creek, a tributary of Hastings creek, about ten miles east of Nome. Another is to be built by Frank H. Waskey on lower Iron creek, a tributary of Pilgrim river. The plans for all these dredges are already well under way, and there are rumors of others that may possibly materialize before spring. There can be no doubt the output of gold from Seward Peninsula will be vastly increased by all these machines,

and it will shortly exceed its banner year when the Third Beach at Nome was so productive.

There is undoubtedly a great field in Seward Peninsula for dredges of about 3-ft. capacity, and even though the operating year is only of about four months duration, the gravels are so loose and free from boulders and clay and so rich, as compared with other dredging fields, that the profits will compare excellently with the most favored localities in other parts of the world. I say this, too, with full knowledge of the fact that Seward Peninsula has been condemned as a dredging field by no less an authority than C. W. Purington, who, after spending a part of the summer of 1904 here, published a letter in the MINING AND SCIENTIFIC PRESS of July 28, 1906, in which, after recounting the disadvantages of short seasons, permanent frost, etc., he used the following language: "I therefore unhesitatingly condemn the Seward Peninsula as a dredging province. By this, I do not wish to say that rich placers do not occur there. The gold is there, but among the methods of working, dredging is not to be considered." I will grant at once that the dredging of frozen ground is not to be considered, but the whole of Seward Peninsula is a succession of hills and valleys, and in every valley is a stream-bed. These stream-beds are rich in gold, and the flats over which the streams meander are not frozen, but are loose gravel and sandy sediment, and offer ideal conditions for dredging; the one drawback being that the year must be crowded into four months, from June 15 to October 15. The real consideration, however, is the profit to be derived from the operation. We are told by D'Arcy Weatherbe, in his excellent work, 'Dredging for Gold in California', that the dredges at Oroville, California, which is considered by Mr. Purington to be an ideal field for dredging, are making from $2000 to $5000 profit per month. This means $24,000 to $60,000 per annum. I think I may say that Seward Peninsula in its scores of stream-beds offers much greater area in square miles of dredging ground than are reckoned to be in the three great dredging districts of California, and our past experience warrants the belief that dredge for dredge, the advantage for annual profit lies with the Peninsula. Our stream-beds are mostly shallow, being from 10 to 25 ft. deep. We have no cemented gravel and few large boulders. The bedrock is usually decomposed if schist, and much shattered and broken, if limestone. We do not need such enormous strength in our dredges, nor can we use advantageously such monster machines as are in use at Folsom, but for dredges of 3 to 5-ft. capacity we have here a splendid field, and there is plenty of room for all who will earnestly investigate it.

Lime in presence of calcium carbonate may be determined, according to Heyer, as follows: In a 500 c.c. flask shake up 2.5 gm. of the sample with 125 c.c. water. Then add 125 c.c. of 2% NH_4Cl solution, stopper, and shake at intervals for some time. Then dilute to the mark, mix well, and allow to settle. Withdraw some aliquot part of the clear solution and titrate with N/10 acid. The alkalinity represents CaO as $CaCO_3$, does not react with NH_4Cl in the cold.

YUKON TERRITORY IN 1909.

Written for the MINING AND SCIENTIFIC PRESS
By Our Special Correspondent.

The gold output for the past season will probably exceed that of 1908 by $500,000, making a total of approximately $4,000,000. This increase is due to the new production of The Yukon Gold Company. The dividend of 8%, declared by that company this season was a matter of much satisfaction. It demonstrated beyond doubt that the Klondike is still capable of producing gold at a profit. We, of the Territory, of course know this, but there is nothing like a dividend to impress outsiders. The management of The Yukon Gold Co. deserves much credit, since they have overcome difficulties that the engineer not conversant with Arctic conditions wholly fails to realize. The record of their dredges for the past season is noteworthy, especially as all the ground dredged had to be thawed by steam, and there were also constant difficulties due to working over previously drifted ground. The company owns 7 dredges; 6 of these worked all summer and dug approximately 2,250,000 cu. yd.; the seventh boat did not get to work in earnest until late in the season. These boats started digging late in May, and were all closed for the season by October 7; 139 days work, including many trifling delays. The record is excellent, and credit is due to E. E. McCarty, superintendent of dredging for the company. There was 750,000 cu yd. of gravel hydraulicked during the season. The water for this purpose came from the reservoir at the head of Bonanza creek, and also from the big ditch completed this summer. The ditch was the main source of supply and furnished 2500 in. of water all summer. It would have been possible for the ditch to have carried fully 4000 in., but owing to lack of equipment delayed in transit, it was not necessary to force the ditch to its capacity. The missing equipment finally arrived, and was at once installed, but too late to do much work. It is, however, ready for next year. A remarkable record was made at the power plant, at the head of Little Twelve Mile river. The loss of time at the power house was only twenty minutes in the entire season. No shut-down was necessary anywhere for want of power. The capacity of the plant is 2000 hp. This fall sees all contemplated construction work finished. The last of the work to be completed was of a group of buildings situated at the mouth of Bonanza creek, which is the centre of the company's holdings. The group includes: a machine shop 40 by 128 ft. will contain machinery for all dredge repairs of a general character; a plate and bucket shop 60 by 40 will contain rolls, shears, and all plate machinery, for either making or repairing buckets, and screens; a dredge-repair parts warehouse 100 by 40; a cold and warm storage warehouse 100 by 50; a cold storage warehouse 100 by 40; a barn 125 by 40 capable of taking care of 40 head of horses; a two-story mess and bunk house, large enough for 50 men. These buildings are all of the same character, that is, substantial frame, covered with galvanized corrugated iron, and so symmetrically grouped that they present an ad-

vantageous appearance. They will enable the company to do its work more cheaply, and in many ways cut down expenses now unavoidable on account of the scattered condition of the plant. O. B. Perry, general manager, left for the outside late in September. C. A. Thomas, resident manager, remains in the country for the winter.

Joe Boyle is again at the head of the Detroit Gold Mining Co., and is operating a 7-ft. Marion dredge, in the Klondike valley, on what is known as the Boyle Concession. Mr. Boyle has had a long hard legal fight over this property, covering several years, this he has finally won. It is understoood now that all law troubles are over, that this property will be worked on a larger scale possibly by the addition of two new dredges of latest design and large capacity. This company also expects to install a hydro-electric plant on some of the tributaries of the Klondike river. The present power is generated by a steam-plant. Fuel for this plant, wood being used, costs the company $15 per cord. This is too expensive. It is likely that the water-plant will be installed next summer. Mr. Boyle will probably remain in the country during the winter. The Lewis River Gold Mining Co.'s dredge, of which Edward Simpson is manager, has secured a lease of four more creek claims on Bonanza creek. This will keep the boat steadily at work for about two years more. The past season has been a successful one. R. H. Milvain, manager for the Walkers Fork Gold Dredging Co., has had the first really successful year of work. The boat worked smoothly and handled a lot of dirt that contained gold in excess of $1 per yard. The boat was built by the Risdon Iron Works of San Francisco, and is a 5-ft. open-connected dredge, of the usual design. There is every reason why this company should duplicate the success of the past season, as the ground is well prospected, the management will be the same, and a large property is controlled.

A new company made up of Canadian and English capitalists and known as the Northern Power & Light Co. began business with headquarters in Dawson last spring. It has absorbed the Sour Dough Coal Co., The Dawson Electric Light Power & Water Co., The Dawson Telephone Co., and the Grotcher Concession, which is a mining location at the mouth of the Klondike river. The new company is installing a 3000-hp. steam-plant at the mouth of their coal mine on Coal creek, 30 miles by power-line from Dawson. This will allow them to burn their waste coal. The plant will, it is expected, generate approximately 3000 hp. The plant will be complete in all details, and the power-house will be made of reinforced concrete. The company is capitalized for $3,000,000, the securities being held principally in Toronto and London. It is planned to supply power to the Forty-Mile river and the Dawson dredging fields during the early and latter part of the open season. Water-power plants in the North are not ready to start as soon as dredging can be commenced, on account of being situated at greater elevation than the dredging fields. Two weeks in the spring and two to three weeks in the fall may be added to the dredging season when this company's power is available.

RAND PROGRESS IN 1909.

Written for the MINING AND SCIENTIFIC PRESS
By Our Johannesburg Correspondent.

Labor.—To open this review with the statement that 1909 has been a 'remarkable year' in the history of Rand mining, might not only be orthodox journalism, but would constitute at the same time a glaring truism. Every year has its events and changes of importance. A mining industry producing $150,000,000 and supporting 200,000 workers which can pass 12 months without remarkable experiences ceases to conform to natural laws and thus becomes more remarkable than ever. It is only necessary to mark the most significant events and tendencies of progress. Several advances have been made in the technical methods, which promise to influence the course of future events most beneficially. But above all else the lessons of the year have taught us (what a period of good fortune almost tempted us to forget) that with an abundant supply of cheap, unskilled labor the Rand can attain to vastly greater heights of accomplishment than it has yet reached, that this supply is ever an unstable and disturbing factor, and that especially without the aid of the 'constant' represented by 50,000 Chinamen, all our plans for expansion may at any time be frustrated by seasonal variations in recruiting results.

At the end of 1908 and early in 1909 there was an influx of native labor of unexampled magnitude. The following figures will demonstrate this fact:

Period.	Whites.	Natives.	Chinese.	Non-whites.
January 1904.....	12,814	75,027	.....	75,027
January 1906.....	18,582	93,933	47,166	141,099
January 1908.....	17,522	133,515	33,849	167,364
January 1909.....	19,801	169,537	11,534	181,071
March 1909.....	20,548	180,103	10,021	190,124
April 1909.....	20,756	181,389	8,308	189,697
June 1909.....	21,620	175,895	7,317	183,212
August 1909.....	22,062	168,357	5,354	173,711

The March figures constitute a record for total unskilled laborers, and April for natives. The drop of about 20,000 in a few months has had a crippling effect upon certain mines. When labor was so plentiful the stock market was buoyant, and a policy of expansion prevailed. The demand for laborers began to increase more rapidly than the supply, and when the latter fell, the demand showed even a further growth, as new plants and extensions were completed. To find a simple metaphor, the influx of labor enabled new ships to be built which the exodus now left without crews. The labor question is always a highly controversal one, full of speculative factors, and there is hope of the industry being able to adapt itself to the less favorable position.

Industrial Movements.—The various features of the year's industrial expansion may be surveyed under four heads: (1) production; (2) mill enlargements or construction; (3) development and exploration; (4) amalgamation.

1. The records of production do not truly reflect the activity of the year, for the reasons that floods in January and February adversely affected operations, and that the chief progress has been in work preparatory to milling, the results of which are yet

to come. Tabulated, the returns have been as follows, the last three months of 1909 being estimated:

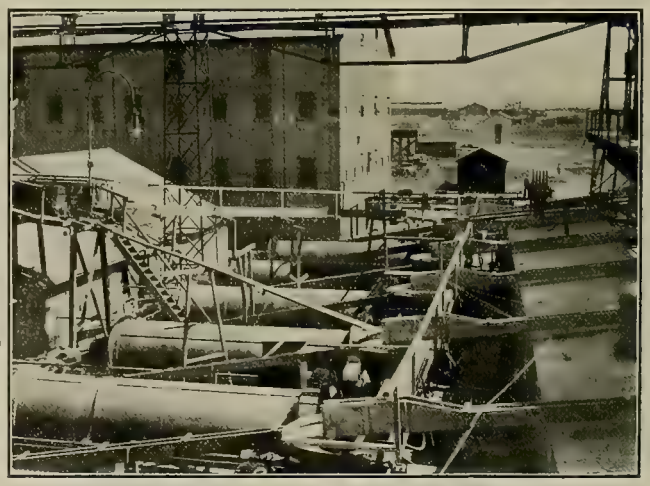
Year.	Tons milled...	Stamp duty per 24 hr., tons..	Waste sorted, tons	Value of yield.	Yield per ton, shillings ...
1908.....	12,196,589	6.27	15.5	£28,810,393	31.39
1909, estimated	20,750,000	6.80	15.0	30,000,000	28.90

These figures are for the Rand only, the outside districts accounting for an additional 4 to 5%. The drop in yield per ton is an important point. The contribution from new low-grade mines has influenced the average, but nearly all companies have individually been treating lower-grade ore, which the reduction of costs has thrown over the margin of payability, and which cannot, as actuarial principles would prove advisable, be left for treatment till all the richer ground has been exhausted.

Village Deep, Capacity 50,000 Tons per Month.

2. New mills have been completed during the year upon the Knight Central (22,000 tons monthly capacity), Bantjes Consolidated (10,000 tons per month), and Vogel Deep (10,000 tons). The first-named has been producing for several months, but the Bantjes has postponed milling pending the duplication of the plant, and the Vogel Deep has been awaiting labor. A large number of companies have increased their milling capacity, either by the erection of stamps and tube-mills, as the Robinson, Van Ryn, New Modderfontein, Cinderella Deep, Nourse Deep, Consolidated Main Reef, and Main Reef West, or by the addition of tube-mills alone, as the Village Deep, Ferreira, and Durban Roodepoort Deep. The aggregate influence of the large-scale producers—apart from those represented by recent amalgamations—has been rapidly on the increase. In 1906 there was only one company crushing over 40,000 tons per month; in 1909 there have been 14. Or, to look at the advance in a different light, the average tonnage crushed per company monthly is now 29,000, as compared with 10,000 tons five or six years ago.

3. The most significant results of the year's activity have been apparent in the accomplishments of the developing mines. The record of work done in shaft sinking and development has been exceptional. Over a dozen mines call for notice. In the East Rand, the Cloverfield, the Apex, and Van Ryn Deep have all cut the Main Reef in their new vertical shafts. The Brakpan, Rand Collieries, and Van Dyk have continued an active development policy—the first with particularly favorable results, closely corresponding with those obtained in the New Modderfontein mine two miles away. Shaft sinking has been commenced upon the Springs Mines and the Welgedacht. The East Rand Extension and the Boksburg Gold Mines have been re-opened. At the Modderfontein 'B', shaft sinking and development have been proceeding with payable results. The eastern district of the Rand, in which all the above properties occur, has been progressing far more rapidly than any other region. The rich ore found in the Brakpan No. 2 shaft and the steady advance of the Modderfontein-Kleinfontein properties have been largely responsible for stimulating operations throughout the area. In the Central Rand, the most cheerful quarter has been at the City Deep, Ltd., in which development started in September 1908. The early results, at a depth of 3000 ft., were good—too good to last, was the common opinion. As the drifts proceeded east and west, and were eventually connected up between the two shafts (4000 ft. apart), it became evident that the zone of highly payable ore, of better average grade than that of the corresponding outcrop mines, is of great extent. There are today developed fully 1,600,000 tons of ore, going approximately 8.8 dwt. over a stoping width. The proportion of unpayable ore is very small.



Village Deep. Battery and New Tube-Mill Plant.

It is indeed a remarkable fact, the possibility of which would scarcely have been credited a few years ago, that the connecting level between the shafts and beyond (6000 ft. in length), has revealed

payable ore throughout. All these encouraging results have been obtained on the Main Reef Leader—the South Reef having been disappointing to date. The adjoining mine, the Village Deep (including the old Turf Mines), has also done a great deal of development at depth, and unfortunately has a different tale to tell. During the year the Turf shaft cut the South Reef at 3815 ft., and the Main Reef Leader and Main Reef at 3894 ft. vertical. The assay results, more or less confirmed by subsequent development, averaged the same as the upper portions of the Village Deep—payable and little more. Better grade has lately been exposed on the 4000-ft. level. There seems to be little chance of getting the mine out of the ruck of a 6-dwt. mine grade, though there is still a big gap between the Village Deep workings and the Turf Shaft, in which City Deep grade has a chance of showing itself. There is also hope of improvement below the Turf shaft. In the westerly districts the most noteworthy developments have been in the Bantjes Consolidated, where the South Reef is opening up well, in the Vogel Deep, which has been prepared for production, the Main Reef West, where some high-grade Main Reef Leader has been exposed, and, away in the Far West, in the Randfontein Central where (presumably, for little is heard of the operations of the ill-controlled Robinson group), active development is proceeding in preparation for the 600-stamp mill under erection. Whether the results are good and whether the mine will be ready for the mill are trivial questions beyond the knowledge or concern of the 'investor' in Randfontein stocks. An annual statement is the utmost to be expected.

4. The policy of amalgamation, under which adjacent companies are consolidated (sometimes with previously unfloated ground added), and placed under a single management, has been practised with notable results during the year. The consolidations have all taken place between mines of the same control—with certain unimportant exceptions, when equipped but poor or practically exhausted properties have been involved. This feature, no doubt, consequent upon the obvious difficulties of amalgamating differently controlled mines, promises to provide a constant check upon many fusions, which would be advantageous and are prompted by natural conditions. The chief amalgamations of the year have included the following: (1) Crown Mines, Ltd., comprising Crown Reef, Robinson Central Deep, Crown Deep, Langlaagte Deep, Paarl Central, South Rand, Langlaagte Royal, and other ground. The Crown Mines, Ltd., under the management of R. C. Warriner, has been producing since July. With 675 stamps and 15 tube-mills, it crushes 130,000 tons for a profit of £110,000 per month and a yield of £220,000. (2) Randfontein South G. M. Co., Ltd., comprising the North, Porges, Robinson, South Randfontein, and Stubbs Randfontein. With 400 stamps in four mills, it crushes 90,000 to 95,000 tons per month, for a yield of 29s. per ton. (3) Randfontein Central G. M. Co., Ltd., comprising all the subsidiaries from the Block A to the Johnstone Randfontein. Preparations are in hand for the equipment of this northern area with a 600-head mill (heavy stamps), and 16 tube-mills, designed to treat 160,000 tons per month. (4) Geldenhuis Deep, Ltd. The fusion of the Jumpers Deep, Ltd., and Geldenhuis Estate (almost exhausted) with the Geldenhuis Deep has lately been accomplished. (5) Rose Deep—Glen Deep, long regarded as an 'obvious' case for amalgamation. (6) Lancaster—Lancaster West.

The negotiations proceeding during the year for the acquisition from the Government of the right to mine under water-rights, bewaarplaatsen, and machine stands are of importance. Whether the Government is justly entitled to take the full proceeds of these proposed sales is open to doubt, but it is generally manifest enough to what parties the rights should be sold for maximum profit. The direct interests of the State in Rand mining possibly will be increased further by the leasing of large areas of Government ground in the East Rand, for which tenders were called during the year. The terms of flotation and the scale of royalty participation determined by the Government have not proved attractive to financiers. Investigations have also been made, jointly by Government and the Chamber of Mines for the acquisition of a mine for use as a training place for miners. The York mine, at Krugersdorp, was examined with this view, but the conclusions arrived at have not been made known.

Mining and Metallurgical Improvements.—While the use of electric power has been gradually extending, it will be in a later review that the wide adaption of power supply from central stations—generating electricity and compressed air—will call for description. The Victoria Falls Power Co. has two large power stations in the East Rand. It remains for the new Rand Mines Power Supply Co. to effect the electrification of the mines of the great Wernher-Beit-Eckstein group. The trials of the machines entered for the Stope Drill Competition have been continued steadily throughout the year, under hard working conditions, which should leave no doubt as to the superiority and reliability of the finally adjudged winner. The six drills surviving the tests have been: (Hammer) Climax Imperial; (Reciprocating) Chersen, New Century O. O., Holman 2¼ and 2⅜, and Siskol. In regular practice, some remarkable machine work was done at the New Modderfontein, where a drift was advanced 826 ft. in 156 successive shifts, with two 3¼ Ingersoll-Sergeants. Ventilation has come in for a greater share of attention. At the East Rand Proprietary Mines, Ltd., a 10 ft. 6 in. diameter Sirocco form, with a nominal capacity of 300,000 cu. ft. per minute at 4-in. water gauge, has been installed for the ventilation of the Angelo-Driefontein portion of the mine. It is reported that the Village Deep is also to be equipped with mechanical ventilation.

The erection of great mills and the advance of the big-scale operating policy have tended to create changes in underground development systems. The influence has been a gradual one, bearing toward long backs, mechanical haulage in main levels, supplemented by some scheme of mechanical or gravity-delivery of broken rock from the stopes to the drifts. Whether gravity planes, air-winches, or steep passes to foot-wall cross-cuts are the most economical is an

open question, largely governed by variable local conditions, with strong advocates on opposing sides. The system of sand-filling old stopes with cyanide residue has been introduced experimentally at the Robinson mine. The sand is sluiced down a small launder to the wide workings or Main Reef and Leader, nearly below the mill and not only is it providing greater security against cavings, but enabling rich pillars to be extracted.

In the field of metallurgy, there have been several important developments. With the increasing weight of stamps and adoption of coarser-mesh screening, the utility of amalgamation below the stamps is becoming less evident. The tendency is to amalgamate only on the shaking tables below the tube-mills—a principle embodied in the new Bantjes mill, at which all gold extraction occurs under one roof. In some old mills the plates have been removed from the mortar boxes to a separate room, allowing better control and increasing the aggregate plate efficiency. The necessity under the new law of covering plates (as well as zinc boxes) has prompted some mill-men to increase the intervals between the dressing of plates—with satisfactory results.

The influence of heavy stamps in Rand battery practice has attracted much attention and has been fully discussed by W. A. Caldecott before the Institution of Mining & Metallurgy. It thus calls for no further reference here. At the Knights Deep, a number of the trials have been undertaken under the auspices of the Mines Trials Committee, to determine the economic limit to coarse-crushing in stamp-mills, for certain ratios of stamps to tube-mills. It was found that for 20 stamps to one tube-mill, 9-mesh is the coarsest practicable, though 4-mesh was tried. With stamps of 1400 to 1500 lb., the 9-mesh screening gave a duty of 14 tons per 24 hours. At the present time, plants are equipped with tube-mills on the basis of one to about 40 to 50 stamps; at the Village Deep, however, the ratio is 1 to 30, and the 180 stamps are expected to treat at least 50,000 tons per month—when the ore can be provided.

The Caldecott filter-table, one of the important improvements erected at the Simmer Deep and Simmer & Jack, for the collection of practically slime-free sand, has been doing good work throughout the year. Adequate descriptions have already appeared in the Mining and Scientific Press.

Next year it will probably be possible to give data regarding the local applicability of two metallurgical methods, as to the financial and technical efficiency of which no reliable data are yet available—namely, milling with cyanide solution (without amalgamation) and the vacuum filtration of slime. In this connection, it is most satisfactory to observe that Eckstein & Co. have engaged the services of F. L. Bosqui, whose positive qualifications are too well known to readers to require statement. But Mr. Bosqui is also equipped with one negative qualification of no little importance when he is called upon to pass judgment upon these moot questions. He is unbiassed by Rand history and free from the influence of those subtle indefinable prejudices which are apt to spring up in every mining centre.

PROGRESS AND PROBLEMS IN ORE DRESSING.

By Courtenay De Kalb.

Science has not done as much as it should for concentration in the last 60 years. A few more things have been learned concerning principles, but Von Rittinger told us nearly all that we know today. Progress has been mainly along mechanical lines, in the perfecting of machinery, in the handling of larger tonnages with no greater expenditure of power, and without reducing the percentage of saving. The progress of an art must be gauged by its practical application of new knowledge. By that measure the conclusion is inevitable that concentration has lagged behind other arts practised by the mining engineer. The new principles introduced have, with few exceptions, received only a limited application. Whatever may be the ultimate importance of radically new systems, the percentage of the world's ore-tonnage treated by them today is small as compared with the quantity of ore still concentrated by methods which have an ancient lineage.

The most important novelties in ore dressing may be quickly summarized. Advance has been made in magnetic concentration, and where these methods are feasible they have attained prominence as standard practice. The zinc industry depends upon it to separate certain iron minerals from sphalerite, and to take up sphalerite, leaving the accompanying galena behind. The magnetic permeability of a mineral is affected by such minute quantities of FeO that the so-called 'concentrated field magnets', with a current of 10 to 14 amperes, will discriminate between two such closely similar substances as corundum and emery, containing respectively about 0.05 and 0.3% FeO. The electro-static process likewise represents the introduction of a new principle into concentration. This depends upon the repulsion between particles carrying electric charges of like sign. The minutiae of the process need not be given. Suffice it to say that this represents one of the higher examples of the application of science to ore dressing. It still requires perfection of detail to overcome difficulties due in part to atmospheric conditions and loss of potential; its limitations can not be predicted in any individual case in advance of direct experiment, but it has its own important field of usefulness, which will enlarge as investigation continues.

Along with this may be mentioned the flotation processes. Here accident has led the way to a study of selective action between oils and gases for certain minerals. This promises to admit of an extremely wide application in the arts. It is said that some careless boy tending concentrators in the plant of the diamond mines at Kimberley, South Africa, used a greasy rag to wipe the tables, and that the diamonds adhered to the greasy surface that was thus produced. Being quicker of wit than energetic of body he applied more grease, and saved the diamonds with less attention to the concentrator. This discovery by a 'do-less' boy has now become

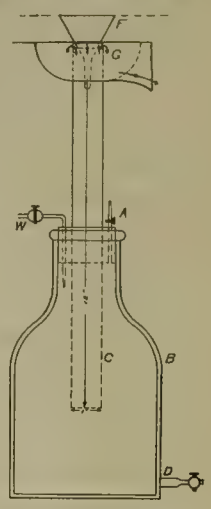
the accepted method for recovery of diamonds from their gangue. The extension of the principle followed naturally to other minerals. The metallic sulphides, particularly those of a greasy nature, such as stibnite, molybdenite, galena, chalcocite, argentite, tellurides, and even gold, silver, and copper, display such selective preferences. In the Elmore process heavy oil, such as the black oil remaining as a residuum after petroleum refining, is agitated with the pulp, the oil adhering to the sulphides and causing their flotation to the surface. If this selective action were perfect, concentration would at once settle down to a matter of mixing pulp with oil, but it is not perfect; the oil will stick to the gangue to some extent; it will fail to stick to the sulphides sometimes; it will float up the middlings.

There is no panacea for all the ills of the ore dresser. Use of sulphuric acid has been resorted to; this in part renders the quartz gangue incapable of holding the oil; in part it liberates carbonic acid gas from the pulp which forms bubbles around the sulphide particles, giving them such buoyancy as to float them, with or without the aid of oil. In the Potter and Delprat process buoyancy caused by liberated gas is relied upon, aided in Delprat's application by densifying the solution with common salt. In all cases the surface tension of the minerals is increased by heat, so that the temperature of the pulp is brought up to over 100° F. by steam coils. These processes fail precisely where practically every concentration process fails, that is, in the treatment of slime. In magnetic concentration the fine gangue is caught up in the nests formed; or is mechanically conveyed with the magnetic minerals through interference; the same difficulty interferes with the electro-static method. Slime concentration is perhaps the most difficult problem in ore dressing, and the farthest from a satisfactory solution.

An interesting adaptation of the principle of surface tension is that of the Coates tube, better known as the Macquesten flotation method, used at the Adelaide Star mines, Golconda, Nevada. Sulphides do not become wetted as readily as quartz and silicates; hence if the ore is presented at a proper angle to a quietly flowing body of water, certain sulphides will float away, while the gangue will sink. As Robert H. Richards remarks, "the process depends upon a delicate balance of small forces."

Nevertheless the present attempt to turn to economic account the persistent tendency of small particles of metallic sulphides to float, which has always been a cause of loss in concentration, is a welcome effort of inventive genius. Decrepitation has also been advantageously employed, different minerals decrepitating at different temperatures. Thus barite flies to pieces at a lower temperature than zinc blende. Common salt can be purified from magnesium chloride in like manner, and the decrepitated salt is less ready to absorb moisture from the atmosphere than it was before such treatment. The decrepitated mineral can be separated from the unaffected substance by subsequent screening.

Pneumatic concentration has made but little advance. The control of air currents is even more difficult than that of water currents. The formation of currents is a matter so obscure that but little real knowledge exists regarding it. The hydraulic engineer will bear testimony as to the uncertainties of determining weir contraction, and the difficulties there found are magnified as soon as water or air is forced through a confined space. From this results a series of baffling obstacles to accurate separation in classifiers and jigs, which theoretically should be extremely perfect instruments. Prof. Richards sought to overcome the abnormal behavior of classifiers by giving a whirling motion to the separating column in a classifier. The result was highly beneficial, but a simple rotation of the water-column was not obtained; other currents are nevertheless present in the revolving mass. He also undertook to correct the work of a jig by supplanting the reversal of direction in the concentrating medium with a body of water moved constantly upward by rapidly alternating impulse. This has produced a jig of extraordinary efficiency, and one that takes advantage of the moment of greatest difference between the rates of falling velocities of the heavy minerals and their associated particles of gangue. The efficiency of any hydraulic separation depends primarily upon the absence of interfering currents. The anomalous conditions met in this respect may be illustrated by the peculiar behavior noticed in a glass laboratory classifier, an apparatus which is not unlike the Robinson coal washer. The pulp is fed through a funnel F concentrically into a separating cylinder C passing through a cork and extending at least as deep as the centre of the bottle B. Through the cork pass two tubes, one for fresh-water feed W, and an air-outlet tube A, admitting of a complete replacement of air from the bottle. When full of water and overflowing into the gutter G, the pulp is fed, and the particles of greater mass fall to the bottom of the bottle, while the lighter material discharges into the gutter. This is a classifier of superior merit, but under the best conditions the erratic motions of particles within the cylinder C give evidence of disturbing currents. Moreover these currents are not continuous as to position, direction, or velocity. If now the discharge-cock D at the bottom of the bottle be opened to admit of even an insignificant discharge, an elliptical current will be induced in the lower part of the cylinder C, utterly destroying its efficiency as a classifier. An example of this kind, showing what small factors will exaggerate the tendency of currents to develop in a moving mass of water, reveals why most classifiers perform such erratic and unsatisfactory work. The same difficulty has been experienced in settlers, and in spitzkasten. A steady onward sweep of a



superficial mass of pulp over a quiescent body of water beneath, would be an ideal condition. This is what mill-men supposed they were obtaining until it was shown by means of glass spitzkasten some years ago that such a relation never exists. It may be rudely approximated by a careful adjustment of the angle at which the pulp is fed into the settler. The Von Rittinger spitzkasten was a pointed box with the water-surface constituting a segment of a circle. The friction along the sides of the box formed another disturbing element. Since the principle of the settler was to cause a current to successively drop finer material carried in suspension by reducing the velocity through an enlargement of the width of the channel, the logical thing to do was to feed the pulp centrally to a round tank discharging peripherally. This form of spitzkasten is superseding other designs of settlers, although the feed-sole used is generally so imperfect as to greatly interfere with efficient settling. The pulp-stream must be diverted to such an approximately horizontal direction as not to create seriously disturbing currents within the tank. As in the case of classifiers, the settler should theoretically discriminate so perfectly between particles of varying mass that these should be susceptible of accurate grading by such means. Indeed, the results should be apparently more accurate than with classifiers, because under ideal conditions the particles are dropped out from a shallow layer of pulp, so that the effect of interference should be less. In effect, however, settling from currents of progressively decreasing velocity yields less accurate classification than the vertical current or spitzlutte type of apparatus, because erratic currents are evidently present in even greater degree. Once more it is worth while to emphasize the fact that to a large extent efficiency in classification depends upon controlling interfering currents, and this difficulty, which has proved so serious in hydraulic classifiers, is greater where air is used as the separating medium.

Notable mechanical progress has been made in the development of belt and table-concentrators, both of which date back to early periods in the art of ore dressing. Two principles are employed in this branch of concentration, namely, that of simple friction between the particles and the supporting surface, and that of difference in momenta of particles of different mass; with the carrying power of the current as a factor present in both cases. The ancient form of inclined plane, and the fixed convex buddle, are examples of the type utilizing friction alone in conjunction with a thin sheet of water to sweep away the gangue. The buddle is theoretically a highly perfect instrument, giving an expanding surface over which the water flows with decreasing velocity toward the outer rim. Its disadvantage lies in relatively high cost of plant for a given capacity, large floor-space, large quantity of water needed, and an excessive demand for labor, together with the fact of its operation being necessarily discontinuous. Automatic continuous buddles have not overcome all these disadvantages, and disturbing currents are more readily developed upon them than need be the case on fixed buddles. The riffle-table is a development from the plane percussion table. The riffles reduce the erratic influence of cross-currents, and keep the pulp from being too swiftly carried down to the tailing-discharge. These machines also utilize the principle of momentum. The heavier minerals and large gangue-particles settle upon the table, and remain there by reason of the friction during the forward impulse of the table. At the end of the stroke the particles of greater mass (which is the product of the weight into the volume) are projected farther than the lighter particles, thus effecting a separation. Manifestly the ideal condition would be to suddenly depress the supporting surface at the end of the forward stroke, so as to relieve the particles from further friction against the table, permitting them to describe their trajectories as free-moving masses suspended in the sheet of water. This problem has not been satisfactorily solved. A differential velocity between the forward and the return stroke would also facilitate the separation. It is evident that the opportunities for improvement in riffle-table concentrators have not yet been exhausted.

Vanners hold an even course as competitors against the riffle-tables. Their efficiency is unchallenged, and many of them afford a fair approximation to the vanning motion of a shovel-point in the hands of a Cornish miner. The degree of economic concentration attained by any form of slime-concentrator, however, is relatively low. It seldom exceeds 75% of the contained metallic minerals when those minerals are chalcopyrite, pyrite, zinc blende, and others of moderately high specific gravity. The percentage of recovery usually increases with a higher specific gravity of the mineral, for obvious reasons.

There are, however, fundamental difficulties in the concentration of slime which must be briefly considered. The definition of the word 'slime' would give rise to dispute. The fact is that slimes are of many kinds, and they may be only rudely classed into distinct varieties. So far as the shapes of the particles are concerned the extremes may be represented by finely comminuted granular quartz at one end, and the exceedingly fine and infinitely thin scales of sericite at the other. These promptly become complicated by argillaceous matter, and by colloids which are never absent. Considered merely as a mechanical problem it is evident that in proportion as the number of particles in a given volume increases the number of interferences to settling is multiplied. Thus Prof. Richards found that when the smaller sizes of particles are reached the laws so carefully worked out for the falling velocities of ore-particles in water fail completely. The difficulty, however, is not purely mechanical. Whitney and Ober announced, "We seem forced to recognize electro-static charges on suspended particles, and it seems just as necessary to accept the conclusion that, as a result of these charges, suspended particles whose masses are small enough are equally distributed throughout the liquid, and are prevented from ever coalescing or settling because of the mutual repulsion of these charges. This mutual repulsion might also cause measurable osmose and correspond-

ing osmotic pressure." Colloids also assume such charges, and the static charges of electricity must be neutralized before coagulation is possible. In the process of crushing silica, silicates, and some other minerals in water, colloids are produced, the quantity so formed depending upon the time of trituration. Every grain will be found enveloped by a film of colloid, in addition to that which may be present as free colloid, either as gel or sol, in the solution. Here is a powerful agent for the prevention of settling. In some ores the reactions occuring between the substances present may result in the formation of electrolytes, serving to effect coagulation. Thus is explained the more ready settling properties of certain slimes. The presence of an acid, a salt, an alkali, in fact any electrolyte, will coagulate colloid particles, the acids flocculating the electro-negative colloid particles, and the alkalies the positive. The subject is full of complexities, which have been only imperfectly studied as yet, and the practical application of such theoretic investigation as has been made awaits the labors of future experimenters. (See W. B. Hardy: on the Mechanism of Gelatin in Reversible Colloid Systems. Proc. Roy. Soc. Vol. 66, 1899.) Until further research has elucidated the problem it is uncertain how far colloids interfere with the concentration of slime, but that they do affect it adversely appears certain, and the importance of coagulation as a preliminary to treatment on slime-tables has been shown in a few cases in practice where the addition of lime to argillaceous ores has improved the recovery.

It is also clear that the deliberate production of colloids by crushing in water may often be detrimental to subsequent concentration. Cushman has shown that the amount of colloid produced by wet grinding is dependent upon the time, which offers a valuable hint. The quantity may become as great as 20% with rock containing no clay or kaolinized minerals. It would not be surprising to find that preliminary drying of ores would in some cases promote free concentration to such a degree as to prove economical in practical operation. Experiment is the only way to determine the point. Each ore is a problem in itself.

Consideration of the fact that colloids are formed by crushing wet, calls attention to the absence of careful studies of the phenomena of ore crushing. The effect of the moisture absorbed in the ore as it comes from the mine is a matter regarding which no detailed investigations have been made. The distribution of compressive strains through a rock must be greatly influenced by the water present, and the manner in which these strains are distributed is important in the degree of communition which results. A spherical mass under compression between two opposite points of contact behaves much like a beam under compression. An elongated ellipsoid resists the compressive strain, expanding transversely until rupture occurs, but before the limit of rupture has been reached that part of the sphere outside of the ellipsoid, that is not under compression, is sheared off. Thus a number of coarse pieces are broken away which do not suffer comminution except along the surface of the ellipsoid where cohesion is overcome at the moment of fracture of the surrounding mass before the ellipsoid yields to rupture. The amount of fine material produced may therefore depend greatly upon the quantity of water held in the pores of the rock. This is true particularly of rock-breakers and rolls, which apply the crushing force along radii making an angle with each other, and to stamp-mills which crush diametrally. Shearing machines, which crush tangentially, are little used in this country except in laboratory work, but the effects obtained by grinding in Chilean mills, where radial, diametral, and shearing strains are all successively induced, are worthy of critical investigation, especially when crushing is being done for the sake of subsequent concentration. Fine comminution has become more common in American milling practice within the last five years, both for concentration and for cyanidation. In both cases the production of colloids is disadvantageous, and it has but recently been recognized that they are a direct result of crushing. The next line of enquiry should be to ascertain how to reduce the amount of this substance, while attaining the same degree of fine-grinding by economical means. As division of labor increases the economic efficiency of men in manufacturing, so the division of duty between machines must be carefully studied. In South Africa costs are being reduced by coarser crushing in stamp-mills, followed by tube-milling of a better adapted product. Incidentally it may be remarked that if dry crushing prove advantageous, the tube-mill is the ideal dustless machine for that purpose.

The tendency in American ore dressing has been steadily in the direction of simplification of processes. The European methods incline to greater complexity. Differing labor conditions are doubtless responsible for this variation in practice. Refinement of detail demands more men. Hence the American is complaisant in the face of losses which would shock a German metallurgist; but the excuse offered is that of 'economic waste.' It is worth while, however, to question our procedure and compel more frequent demonstration that the waste is truly economic. It is easy to err by following a fashion to which the euphonious name of 'standard practice' is applied. The obstacles to clean extraction, as I pointed out, are chiefly three; interferences between the particles themselves, which applies to every stage of concentration processes; erratic currents which defeat the ends of separation in classification, jigging, and table or belt-concentration; and the electro-static repulsions between the particles in the pulp. To a considerable extent the law of probabilities is operative in these various processes. Division of the process into stages increases the probabilities in favor of effecting the separation desired. Only painstaking experiment on a working scale, with comparison of costs, can determine the proper balance between simplicity and greater elaboration of method. My only purpose in directing attention to this matter is to sound a warning that the practice of today need not necessarily be taken as the best to be slavishly followed tomorrow.

SINALOA AND WESTERN CHIHUAHUA.

Written for the MINING AND SCIENTIFIC PRESS
By G. L. SHELDON.

When I left Culiacan about the middle of last May, T. Desmukes, who is manager of the Bismuth King mine, of Chacala, was bringing in a plant of machinery. John Wilkinson, in charge of the Quebrada Honda, at Realito, was also hunting freighters for machinery for the mine. J. T. Canfield had made arrangements with H. G. Zeigler to install a plant at

San Blas Mountains.

the San Fernando mine for an interest. They had gone up on the mountain, more than a mile from the former works, and had opened up the same vein. It was here 20 ft. wide, and assayed 1 oz. gold and 15 oz. silver per ton. At Naranjos, Ysabel Serrano is developing the Bueno Suelto, a large vein of silver, gold, lead, and zinc. James Fitzgerrald, at Santiago de Los Cabelleros, is continuing the development of the Los Tajos; he already has silver ore blocked out, containing a million ounces. The intention is to put on a plant of machinery after the rainy season. Juan Ibarra had just sold his interest in the Los Reyes, a recent discovery of high-grade silver, to people from Culiacan. E. C. Scott and D. H. Friesbe, were working the Rosarita at Nogales on a bond and lease, and had already taken out several thousand dollars worth of high-grade silver ore. Near them Wm. Gordon had just discovered some high-grade silver ore in his Frinijita, which he had been working faithfully for 18 months. At Copalitos are some large silver veins capable of producing upward of 300 tons per day of 20-oz. ore, with some gold, awaiting capital for development. The San Javier silver mines of the Martinez de Castro family are idle; also the mines at Lobitos in charge of Tom Roe. The Geo. Holmes property at La Cumbre de San Manuel, just over the line in Chihuahua, was being examined by an English company.

At the Santa Matilda mine near the Rio Guisinora, which is the east fork of the Sinaloa river, one day's ride from Guadalupe y Calvo, Mr. Cowan and son, and Mr. Lewis were erecting a 30-ton stamp, concentration, and cyanide mill. About 15 months previous they commenced to clean out the old mine. There was not much ore in sight, but it turned out better than expected. They now have two years' reserves of ore blocked, that will mill $40 per ton, two-thirds of the value being gold. This ore is a free-milling oxidized red quartz. In cutting hitches for stulls in the old works in the wall-rock, they discovered an 18-in. quartz vein, full of native silver. In some places the rock hangs together with the silver. The property is only a few hundred yards distant from an extensive lime-andesite contact, the ore being in the latter.

At Calabacillas the last 10 stamps and cyanide plant recently completed by Fred Pelham are running satisfactorily; each month a gold bar is shipped. The development at the tenth level shows wide orebodies. A. J. Underwood who has been manager for the past three years, is now the consulting engineer. He also developed the Lluvia de Oro for two years. He is succeeded in the management by a Mr. Husper, from Cananea. The Calabacillas vein is on a contact between andesite and rhyolite which can be traced some distance to the south, but there are no known ore-shoots near the surface.

Near Tollana, Norman Tracy is continuing development on his El Patagón mine. He has a lot of high-grade ore stoped and awaiting treatment during the rainy season when water is available. Near the State line between Chihuahua and Sinaloa on Peñasco creek, is a pretty gold prospect called Pasadena, occurring in the lime. The owner has been four years getting the title. The surface conditions are similar to the veins on the Rosario property just over the hill on the Sinaloa side, which has been a dividend payer for 25 years and now is in 'chispa' ore.

At the Jesús Maria Anexas mine at San José de Gracia, one mile from the Rosario, M. A. Newman,

Piramida Mill and Offices, San Jose de Gracia, Sinaloa.

the manager, is finishing a complete modern 100-ton cyanide plant. This is one of the best gold mines in the State of Sinaloa. It is owned by Mexicans, two of whom are now in Paris; but it has able American management.

Near Yecorato, Mr. Deenlavy is working a gold property under bond and lease with satisfactory results. Above Minitas on a small arroyo some Milwaukee people installed a small dredge, to work the placer gold; but they are changing the machinery. Everything is quiet around Choix; the Lluvia de

Oro company expects to have its 100-ton plant completed and in operation within this year. Water for the mill will be raised from the Fuerte river, a distance of four miles, the difference in elevation being 3340 ft. On Babahuahua arroyo near the State line between Sinaloa and Sonora, Mexicans and a couple of Americans are taking out a little placer gold. At La Mina, near Villacetas, D. H. Livingston, manager for a Michigan company, is developing a large copper vein in lime. The sulphides have come in, and it looks favorable. Near Agua Caliente de Avila is a large copper prospect known as the Copper Iron King, with an iron gossan 150 to 250 ft. wide, showing copper ore assaying 2 to 5% on the surface with gold and silver.

At Aduana, near Alamos, the Quintera mine is still idle. This is owned by a French company, which has exhausted its reserves, and after paying dividends for years is now idle. The old Promontorio adjoining,

Part of Northwestern Mexico.

which has produced high-grade silver ore through the last 200 years, after being idle for several years, has again commenced work under American ownership and management; there are hundreds of thousands of tons in the old dumps, much of which will pay to work now; there are trees 2½ ft. diam. growing on the old dumps.

To the south of the Promontorio there has recently been discovered the extension of the vein, with high silver content. To the north of the Quintera, James Hendry, manager for Chicago people, on the old Santo Domingo is continuing his policy of developing the mine before erecting a plant. A mile or more farther north, on the same vein, Mr. Yeager, manager of the Zamboni property, is completing a large up-to-date cyanide plant with Pachuca tanks. This mine has a large recorded production.

North of Mayo river, about 35 miles from Alamos, C. W. Smith, representing Chicago people, is developing a 70-ft. free-gold vein, and some smaller veins. He has a 10-stamp mill, and has made some preliminary mill-runs. He is installing a hoist on the large vein. At Baucari the Zeigler brothers are finishing the cyanidation of tailing from the old Baucari mine. Three years ago they bought them for ₱300, expecting there were only 3000 tons, but they have treated 12,000 tons, which were covered by the wash.

THE LLUVIA DE ORO MINE.

Written for the MINING AND SCIENTIFIC PRESS
By E. A. H. TAYS.

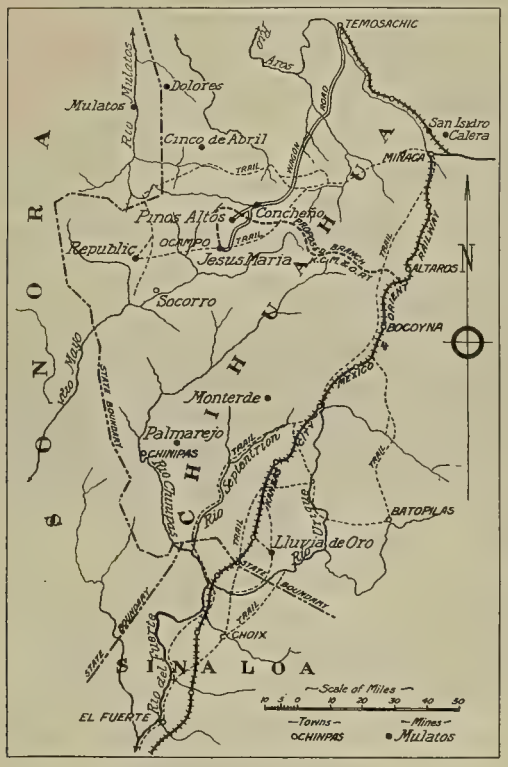
The Lluvia de Oro mine is probably one of the most unique geologically in the world. Its geographic position is almost exactly 108° longitude, west, and 27° north latitude; is almost due east from Alamos, Sonora, about 70 miles, and just over the Sinaloa line, in western Chihuahua, Mexico. The present, most practical route to this camp, after reaching Fuerte, Sinaloa, is by way of Choix, from which place it is about 40 miles distant to the northeast.

The mine itself is situated on a precipitous ridge lying between the Reforma arroyo to the north and the Fuerte river to the south. The elevation of the mine is probably 4200 ft., while the river, five miles to the south, is only about 1200 ft. above sea-level. This is one of the few orebodies that escaped the early Spaniard, who was an indefatigable prospector, it being discovered in 1900. I have seen several accounts of this discovery, but none quite agree with the one I have from the principals themselves. It was long suspected that there was a rich gold deposit in the vicinity, but years of prospecting failed to reveal it until one night a Mexican, an employee of Bernardo García, who lived at Realito, a small place on the Batopilas trail, on the river about 10 miles southeast of the mine, who found himself in a Tarahumari camp, during a drunken feast, overheard some of the Indians talking about a lode of rich ore from which they obtained gold. They described it so minutely that the man had little trouble in going to it the next day. He took some of the rock to his 'patron', Don Bernardo García, who denounced the ground at once. So rich were the samples that he gave the claim the appropriate name of 'Lluvia de Oro', or Shower of Gold.

What the Indians got out of the Bonanza was the beef of a bull, while the man who got the knowledge of the lode, thinking he owned the world, proceeded to spend everything in sight until Mr. García had to cut him off entirely. He is now a half demented pitiable object whose family Mr. García supports.

From the beginning Mr. García put such a stiff price on the prospect that no one cared to buy, or even take it on bond, and by the end of 1902 he had only developed the property to the extent of a 20-ft. shaft on the Cuatemoc side, and another 13 ft. deep, 10 by 29 ft., seemingly across the orebody, but in reality following it, as afterward shown. At that date he was asking $2,000,000 for the property, on almost impossible conditions, and though he had not $150,000 worth of ore blocked out, he was justified in a measure, for he had a little 3-stamp mill which he could run only four hours per 24, but his

clean-up every day yielded from 5 to 6 lb. of gold. At that time much of the ore not only showed free gold, but native silver also. Assays revealed a ratio of 10 oz. silver to each ounce of gold. The bullion, however, is high grade, as most of the silver is secured in the concentrate, which often assays 600 to 700 oz. per ton.



Map of Western Chihuahua.

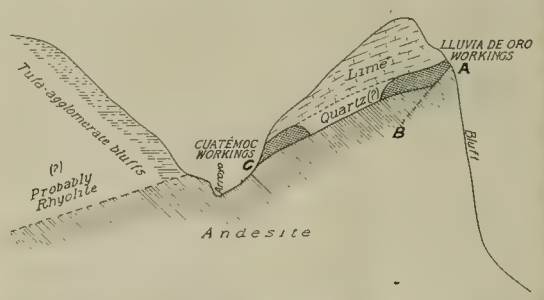
Finally, in 1903, Mr. García found parties, Americans of course, who took the property on his terms, and luckily, explorations justified the action. By January 1905 over $4,000,000 worth of ore was blocked for stoping, but the orebody had developed along unexpected lines. In 1902 it looked as though the vein ran north and south, with its dip to the west, the body apparently lying on a supposed foot-wall, A, B (see geological section), which is judged to be that of a fault-plane.

The geological conditions are unique. The orebody, for it is not a vein, outcrops on the east side of the ridge near the summit, and is here known as the Lluvia de Oro. On the west side it again outcrops near the gulch, and is there known as Cuatemoc. At first sight one is led to believe that the Lluvia body is a contact lode, but explorations have proved otherwise. The main formation in the vicinity is andesite, partly altered, and, for the most part, along the river five miles south, the formation is granite. South of the river the country rises in a series of granite ridges to a height of 5000 ft. 15 miles away, in the tufa-capped peak of Santa Gertrúdis. To the north the granite disappears under the andesite almost immediately, and the whole country consists of andesite up to the Lluvia de Oro mine, where there is a cap of limestone, probably Cretaceous, but the limestone here is simply an island, a remnant of an earlier formation, raised to over 4000 ft. in elevation during one of the periods when the world 'humped' its back and never got it down again. The remnants cap the peak, only a few acres in area.

Farther north are other bodies of limestone, out of place, near the top of the main east and west ridge. In one place, if my memory fails not, the lime rests on an andesite agglomerate. The bluffs to the west of the Cuatemoc are mostly a tufa agglomerate, resting on the andesite. Near the contact of the limestone with the andesite, at the Lluvia de Oro outcrop, the latter is fine-grained, greenish-blue in color, and is finely brecciated in spots. Here it is easily confounded with diorite, and has been so called, but this immediately blends into coarse porphyritic, unmistakable andesite.

Explorations have proved that the orebody at the Cuatemoc side does not go down, but that it does go up, following the lime along the contact on an angle of perhaps 20°. The Cuatemoc explorations have developed large bodies of ore, some of it of phenomenal richness. In sinking on the Lluvia de Oro it was found that the ore, in the lime, followed the plane B C, practically the line of contact. This, for the first 20 ft., took the dip A B, but from there on flattened, becoming almost level for a considerable distance. Here, also, large bodies of ore have been blocked out, most of it being high grade. Here the gangue is quartz, seemingly a replacement of the lime. The main body is about 60 ft. wide, dipping toward the Cuatemoc workings. About 50 ft. to the north of this another 50-ft. body of ore has been found, but not as rich ore as the original mass. Explorations have been carried northward on a level along the contact, with the dip of A B for quite a distance, but I understand no new orebody has been found.

The sketch is not drawn to scale, but simply gives an idea of conditions on the contact, that is approximately correctly proportioned. From the work done



Cross-Section Showing Geological Conditions of the Lluvia de Oro Orebody, Chihuahua, Mexico.

it would seem that probabilities were still favorable for finding more ore, and I have learned recently that new orebodies have been found, and much of it extremely rich. So far no vein, in the andesite, directly connected with the orebodies in the limestone, have been found, although there are several well defined veins outside of the limestone rim. That the present quartz orebodies are replacements of the lime is evident. After several years of preparatory work that would have swamped an ordinary mine, this property is about to become productive.

TIN IN 1909.

Written for the Mining and Scientific Press
By H. W. Turner.

The price of metallic tin per pound in New York gradually increased from 28 cents in January to 32 cents in December. The total yearly output of the world has exceeded 100,000 short tons of metallic tin for several years. From the reported production up to September, it seems likely that the output for 1909 will be somewhat less than in 1908, when it was 116,648 short tons, according to the estimates of the United States Geological Survey. In the Malay peninsula, the old method of washing the tin-bearing gravels is still mostly in use, but in Kelantan, Siam, dredges are in operation, as also in Australia and other places. While the bulk of the tin still comes from alluvial deposits, lode-mining in Cornwall, Queensland, Tasmania, Bolivia, and South Africa adds an increasingly important quota.

Tin is found in nature chiefly as cassiterite, an oxide of tin, frequently accompanied by tourmaline, fluorite, wolframite, topaz, and the sulphides of iron, copper, and arsenic, and sometimes bismuth. Cassiterite is usually in or near acid igneous rocks (granite and quartz-porphyry) and is regarded as originating from solutions and gases emanating from the granite and porphyry magmas. However, it has been found as an original constituent of granite in Germany, and Winkler has shown that many granites and hornfels contain tin not as cassiterite, but chemically combined with silicates. Sandberger has found tin in muscovite, a potash mica, and Verbeek describes a tin-bearing silicious sinter from a hot spring at Malacca in the Malay Federated States, which contains 0.5% of tin, showing that ordinary thermal waters may hold tin in solution.

United States. In South Carolina, near Gaffney, and near Kings Mountain, in North Carolina, tin has been mined in recent years and shipped to England for smelting. Extensive operations have been conducted in the Black Hills of South Dakota, but not with good results. The cassiterite is there found in pegmatite dikes. The Harney Peak Tin Mining, Milling & Manufacturing Co., of South Dakota, has recently commenced active prospecting on some of its numerous claims after a long period of litigation, and the Tinton Milling Co. of Tinton, South Dakota, is reported to have started its 150-ton mill, which is equipped with Gates crushers, shaking screens, Wilfley tables, and a Callow cone, followed by a Wilfley slime-table.

In Texas, the deposits in the Franklin mountains, north of El Paso, are being developed. The tin ore occurs in veins in granite. Cassiterite is also reported from Streeter, Mason county, both as stream tin, and in place in granite. Two adits are being driven to reach the veins in depth. So far seven cassiterite-bearing veins have been found and partly stripped. The mineralized zone in the granite is said to be about one mile wide, and within this space, float ore shows that other veins have not yet been found. The longest vein has been traced up a granite hill for 1000 ft. and is cut at the upper end by a diabase dike.

In Washington is a cassiterite deposit in pegmatite at Silver Hill, southeast of Spokane, which, however, was not being developed in 1908. At Chelan butte, Okanogan county, 60% ore is reported on the mine dumps.

In Alaska, from the western end of the Seward Peninsula, near Cape York, about 160 tons of cassiterite were extracted from gravel from 1902 to 1908, inclusive. These alluvial deposits in places contain from 8 to 27 lb. of 60% ore per cubic yard. The ore also occurs in place in lodes in altered quartz-porphyry dikes; along the contact of granite and limestone; in quartz veins cutting limestone and granite; and in actinolite-rock. The deposits, according to Knopf, warrant future cautious prospecting. The geology is described by Knopf,[1] and the tin ores are ascribed to emanations from the granite and quartz-porphyry magmas. According to Collier, one mineralized dike of granite-porphyry in Silurian limestone, on Lost river, shows cassiterite, tourmaline, galena, garnet, and lithia mica, and a piece on assay showed gold to the value of 0.36 oz. per ton. Knopf found 22.9 oz. of silver in the average ore of another tin and galena-bearing dike in the same locality.

Mexico. In acid lavas (rhyolite, etc.) in Mexico, tin oxide has been found and mined at a number of localities. It occurs in Baja California, Durango, Zacatecas, Jalisco, Querétaro, Guanajuato, and San Luis Potosí. It is reported that tin mines have recently been acquired by Americans in Aguascalientes, and that tin has been found recently in Coahuila, opposite Boquillas, Texas. No important deposits have thus far been discovered in Mexico.

Bolivia. The extensive lode deposits of Bolivia produced from 1884 to 1908, inclusive, about 166,000 long tons of metallic tin. The principal district is the State of Oruro, but important deposits are likewise found in the adjoining States of La Paz and Potosí. According to Minchin at Huanuní in La Paz and Avicaya, in Oruro, some of the lodes are still rich at a depth of 1000 to 1300 ft. Rumbold[2] describes in detail certain of the tin lodes of Oruro, showing them to be confined chiefly to quartz-schists, probably of Devonian age, which are intersected by quartz-porphyry dikes, also tin bearing. It had formerly been held that these deposits were, at least in part, in the overlying lavas, and that the Bolivian deposits were unlike those of other portions of the world. Rumbold shows that the lodes contain much tourmaline, with sulphides of copper, iron, lead, zinc, and bismuth. The origin of the ores is ascribed to emanations from the intrusive quartz-porphyry and granite magmas. The Bolivian tin mines are now chiefly in the hands of Chileans, are badly managed, and are over-valued.

England. In Cornwall, the rich gravels have long been exhausted, but the production from lodes is still important, about 6500 tons of black tin having been produced in 1908. From 1884 to 1893, inclusive, Cornwall produced about 100,000 tons of metallic tin. The new shaft of the Dolcoath mine is now down about 2600 ft. During the first six months of 1909, 45,880 tons of ore were hoisted, from which over 2% of black tin was recovered. The Botallack, Wheal Kitty, Penhalls, Carn Brea & Tincroft, and

[1] *Econ. Geol.*, IV, 214-223. [2] Ibid, 231-364.

other mines, are operating. H. W. Hutchin[3] treats of ore dressing at the South Crofty mine, where California stamps are used for crushing, and Buss tables for concentration. It is also interesting to note the use of American machinery in the Clitters mill, where Frue vanners and Wilfley tables are installed. At the Dolcoath mine, the Elmore vacuum process is said to be effectively separating the sulphides from the black tin. Levy and Ewen[4] experimented on the recovery of tin and arsenic from 'hard-head' which is a sulph-arsenide of tin and iron, a smelter product, by bessemerizing. It was found possible to convert hard-head into a highly ferruginous slag, and a fume consisting to a large extent of arsenic oxide with some tin oxide. As hard-head commands a fair price for smelting lead and antimony ores, it is doubtful if bessemerizing will pay.

Europe. Tin ore is produced in relatively small amounts in Austria, Germany, Spain, Portugal, and Russia.

South Africa. In at least five regions in South Africa, workable tin deposits have been found, the most important being the new Waterberg district in the Transvaal. Ore is likewise found on the Kuils river near Cape Town, and in Bushveld and Swaziland in the Transvaal, as well as in Zululand. The Waterberg mines produced in the year ending June 30, 1909, ore to the value of $748,686. The deposits occur along a well defined granite belt, in granite, felsite, and quartzite, the richest being in the granite. In addition, there are workable alluvial deposits. Concentration mills have been erected.

West Africa. Nigeria has long been known as a tin-producing State, and the natives have mined the gravels and smelted the concentrate. The tinfields are in the Bauchi province. In 1908, 500 tons of concentrate was shipped. The Nigeria Tin Corporation was formed in London in December 1909 to work these deposits.

Australia. In the past, the chief production has come from the gravels of New South Wales, but Queensland is now the larger producer, the tin coming chiefly from lode-deposits. From 1872 to 1894 inclusive, New South Wales produced about 120,000 tons of metallic tin. The gravels are now worked in part by dredging, and in addition there is a small amount of ore mined from lodes. In Queensland, the product, from 1872 to 1892, inclusive, was about 74,500 long tons of metallic tin. In 1908, Queensland produced 5404 tons of black tin. The lode of the Vulcan mine at Irvinebank is a cylindrical pipe 10 to 20 ft. diam. The shaft is now down 1440 ft., and stoping is in progress on the 1220-ft. level. Some tin is also mined in Victoria and in Southern and Western Australia.

In Tasmania, the chief deposits are those at Mt. Bischoff, where the ore is found in veins in quartzite and slate, and in dikes of quartz-porphyry, so that the occurence is similar to that in Bolivia. About 88,000 long tons of tin were produced from 1873 to 1899, inclusive. The Mt. Bischoff company has its smelting plant at Launceston, Tasmania. At the tin, bismuth, and wolfram mines, near Sheffield, 500 to 600 tons per month of lode-material is treated. At Mutual hill stripping of alluvial deposits is in progress. Placer tin is also being mined at Cascade river. A new tin deposit is reported from Scamander river, St. Helens.

Malay Peninsula. The Malay peninsula, and the islands of Banca and Billiton, have for many years supplied the bulk of the tin of the world, chiefly from alluvial deposits. Lodes containing cassiterite have been found in granite and limestone in these regions, and mined to some extent in Perak and Pahang. The Malay Federated States in 1908 produced nearly 57,000 short tons of metallic tin. Judging from the output up to September, 1909, the output in 1909 will be nearer 50,000 short tons. Of these States, Perak is the most prolific. This State produced from 1874 to 1893, inclusive, 199,104 short tons of metallic tin. Chinese do most of the mining, and formerly much of the ore was locally smelted by them. Salangpore produced from 1878 to 1891 about 76,000 long tons of metallic tin, and Sungei Ujong and Pahang are also important producers.

The island of Banca produced 68,388 long tons of metallic tin from 1880 to 1894, inclusive, and Billiton 64,695 long tons from 1880 to 1893, inclusive. The islands of Sinkep, Sumatra, and Carrimon are relatively small producers.

From the Siamese States of Bantaphan, Chomphom, and Faungswan about 25,000 short tons of metallic tin were produced from 1887 to 1891, inclusive. The bulk of the ore is sent to Penang and Singapore for smelting and refining. Smelting costs from $25.20 to $33.60 per ton of black tin, according to the grade of the ore, in 1890. Tin is also produced in the Mergui district in Burma. In southern China, in the province of Yunnan, there is an important production of tin, but it is chiefly consumed in China, and not much is known of the deposits.

Recovery of Tin.—In the United States and Germany, a large amount of tin is recovered from tin scrap, type metal, and other sources. The amount recovered in 1908, in the United States, is given by the Geological Survey as 2790 tons, worth $1,641,476.

At the Rooiberg mill, where the ores vary greatly, provision is made for preliminary sorting and coarse concentration. The ore is reduced in a rock-breaker to 1½-in. size, elevated, and passed over grizzlies. The undersize drops into the mill-bin and the oversize is washed and sorted on a traveling belt which delivers the sorted ore to the mill-bin. Mechanical feeders supply the 10-stamp mill where it is crushed to 10-mesh. The stamps weigh 1050 lb. The battery pulp is elevated, unwatered to a certain extent by a Callow tank, and the pulp passed on to Callow screens, where the separation of the pulp above and below 20-mesh takes place. The oversize is treated in a 3-compartment Harz jig, and the undersize passes through a classifier which separates the pulp suitable for treatment on Wilfley tables from the slime. The latter is thickened in four Callow tanks and then treated on Frue vanners. The middling from the jigs and from the Wilfley tables is reground in a Holman pan and the re-ground material joins the pulp flowing into the classifiers. Sorted ore to the amount of 1100 tons yielded 75 tons of 70% concentrate, or 4.77% of metallic tin.

[3]Bull. 50, 51, 52, Inst. Min. & Met. [4]Ibid, 56.

COPPER DEPOSITS OF PRINCE WILLIAM SOUND, ALASKA.

Written for the MINING AND SCIENTIFIC PRESS
*By U. S. GRANT.

Prince William sound is an embayment extending northward from near the centre of the north side of the Gulf of Alaska, lying west of the Copper river and east of Cook inlet. The sound is not a sound according to the common usage of that term, but is an extensive bay with many islands and deep arms, some of which are in the nature of fiords and contain glaciers reaching to tidewater. High mountains surround the district on the east, north, and west, and to some extent on the south. The principal towns are Valdez and Cordova, the latter of which is the tide-water terminus of the Copper River railway.

Prince William Sound and Eastern Part of Kenai Peninsula, Alaska.

Copper prospecting on Prince William sound dates back probably to the Russian occupation of Alaska, but no serious work was done until the discovery of the Gladhaugh claim (now the Ellamar mine) on the northeastern shore of the sound (see acompanying map) in 1897. The Bonanza mine, on Latouche island, was staked later in the same year. From 1897 to the present time prospecting for copper has been active, and was especially active from 1903 to 1907. The two mines mentioned above are the only ones which have made regular shipments of ore, although small shipments have been made from certain other properties. The ore goes to the Tacoma smelter.

The sedimentary rocks of Prince William sound are separable into two divisions, known as the Valdez and Orca groups. The former is the older and outcrops along the northern part of the sound. The rocks of the Valdez group are slates and graywackes. The Orca group lies unconformably on the Valdez rocks and occurs especially on the eastern and southern shores of the sound and on the islands of the central part of the sound. The Orca rocks consist essentially of slates and graywackes, which are less crystalline than those of the Valdez group, and greenstones. The greenstones are to a large extent altered basic lava flows with which are some dikes and probably also some intrusive sheets. The greenstones frequently have the ellipsoidal structure which is so common in the greenstones of the Lake Superior iron districts. Most of the ore deposits occur in or close to these greenstones, and where these rocks occur prospects are common. The most important prospects are about Orca, on Port Fidalgo, on Landlocked, Boulder, and Galena bays near Copper Mountain, and on Glacier, Knight, and Latouche islands. A belt of these greenstones occurs on the east side of Resurrection bay, southeast of Seward, and some prospecting for copper has been done there. Granites, intrusive into both the Valdez and Orca rocks occur, but bear no relation to the orebodies.

Chalcopyrite is by all means the most important copper-bearing mineral on Prince William sound. It occurs in practically all the mines and prospects and is the mineral which forms the ore of all the shipments. The chalcopyrite is usually intimately mixed with pyrrhotite, which in itself carries probably a little copper sulphide as an impurity. These two minerals, chalcopyrite and pyrrhotite, are closely associated and the relative proportions of the two vary greatly, even in the same deposit. Pyrite, also probably carrying a little copper, occurs in some places, and chalcocite has been found in at least one

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prospect, and original native copper has been reported from another. Secondary copper minerals are of small importance, as weathering has extended only a short distance below the surface, but malachite, azurite, covellite, and native copper occur in small amounts. The other metallic minerals in the ore deposits are galena, sphalerite, and magnetite, but these are unimportant. The associated non-metallic minerals are quartz, calcite, epidote, and chlorite.

The copper deposits occur in zones along which there has been fracturing and usually shearing of the country rock. Many of the deposits are clearly in shear zones in which it is possible to distinguish two parts; first a more or less solid layer of metallic sulphides, and second the rest of the zone which has been only partly impregnated by these sulphides. The solid layer is the most important part of the zone and has a tendency to swell and pinch, sometimes disappearing entirely. The thickness of the solid sulphide layer varies from a fraction of an inch up to several feet, but at most of the prospects thicknesses

The Ellamar Mine, Ellamar, Prince William Sound, Alaska.

of over 5 ft. are not common. The ore in such layers varies from almost pure pyrrhotite to almost pure chalcopyrite. Assays of these layers show copper running up to 25 and 28%, but the average is considerably lower than this. The sheared rock outside of this solid sulphide layers varies largely in width and in copper content. In some zones there are several feet of this rock, but as a rule it does not carry high enough percentages of copper to pay for working under present conditions. These shear zones occur mainly in the greenstones and in some places follow closely the contact of the greenstones with the adjoining sediments. An exception to this statement should be made for the deposits at the Bonanza mine on Latouche island, where the country rock is slate and graywacke and where no greenstone is known close to the ore deposit. In addition to the ore deposits occurring in shear zones, there are a few lens-shaped bodies of considerable size. The best known of these is the orebody at the Ellamar mine. Another occurs near the eastern shore of Knight island, and another on Latouche island. In a few localities chalcopyrite and pyrrhotite are disseminated in basic igneous rocks, such as gabbro and diabase. Near Orca the country rock is a much-crushed, reddish, amygdaloidal basalt with irregular stringers of epidotized rock. The basalt has been fractured and contains irregular vein-like forms. The ore minerals at this place are chalcocite and native copper, sometimes occurring in amygdules.

Positive conclusions as to the origin of the ore deposits are not warranted by the information at hand. The close association of the deposits with the greenstones points to these rocks as a probable source of the ore minerals. The deposits are, however, clearly of later date than the solidification of these rocks, and the shear zones in which the ores occur are as late or later than the folding of the country rocks. If there are other basic rocks later than, or contemporary with the folding and fracturing, they are not always clearly recognizable; yet in a few cases basic dikes are known which do not seem to have been affected by the folding of the district. That the ores originated from basic igneous rocks seems clear, but whether from magmatic waters derived from rocks later than the greenstones, or from ground waters acting on these greenstones, is not so clear. The decrease in thickness of the ore deposits in depth, at least as far as present information would lead one to conclude, points to the fact that the deposits are in the main in the nature of secondary enrichments. Such enrichments by downward moving waters probably took place before the district was glaciated. During glaciation the upper leached parts of the deposits, as well as some of the enriched portions, were removed.

The two most important deposits known in the district are that of the Ellamar mine and that of the Bonanza mine. The former consists in a lens-shaped body of ore (chalcopyrite and pyrrhotite in varying proportions) which outcrop between tides. The maximum length of the major axis of this orebody, on the 200-ft. level, is approximately 190 ft., and the maximum minor axis is 80 ft. The strike of the major axis is approximately N. 35° W. The dip is very steep—80 to 90°—toward the northeast, and the pitch is about 35° toward the southeast. This orebody has been opened upon the 100, 200, 300, 400, and 500-ft. levels and is reported to have pinched out before reaching the 600-ft. level. The Bonanza mine is near the northwest side of Latouche island and about a half mile back from tidewater. The orebody outcrops on the face of a steep hill and the mining up to date has consisted mainly in quarrying the rock from the face of this cliff. Mining has also been done in an adit about 30 ft. below the floor of this quarry, and recently considerable exploratory work has been carried on in drifts 90 ft. still lower. The ore consists of chalcopyrite which fills fractures in and also impregnates the country rock, which in this vicinity is slate and graywacke. But at the mine and holding much of the ore is a peculiar hard, fine-grained, gray to greenish rock whose exact nature is not clear. The orebody is nearly vertical and strikes northeast and southwest. Many of the prospects are on or close to tidewater, so that ore can be easily shipped.

QUARTZ MINING IN YUKON TERRITORY.

Written for the Mining and Scientific Press
By Guy A. R. Lewington.

The Lone Star quartz mine has been brought to the point of production by William Catto, president, and F. R. Chute, vice-president, with a board of directors composed of prominent business men of Dawson. This is of vital interest to the whole Yukon Territory as it is the first step to a more permanent camp. The workings are situated at the head of Victoria gulch, a tributary of Bonanza creek. Victoria gulch is the up-stream end of the placer gold on Bonanza creek, and as the gulch is rich in gold from its mouth to its source it is generally believed that the Lone Star vein was an important source of the supply of placer gold on Bonanza and on Eldorado creeks. An extension of the lode cuts the latter creek well up toward the end of discovered pay.

The lode was located nine or ten years ago, and has always been considered valuable, but unfortunately litigation has prevented its development. The deposit has been described by R. G. McConnell, of the Canadian Geological Survey, as a stockwork paralleling a fissure vein. The hanging wall consists of contorted schist, and the apparent foot-wall is made up of solid gray schist, possibly an altered porphyry. Lying next to the foot-wall is a lode of quartz 4 ft. wide. Between this and the hanging wall there is a body of blue clay fully 10 ft. wide on the surface, containing a large percentage of iron pyrite of undetermined value. The trend of the lode is north and south. The stockwork before mentioned is cross-cut by this fissure at an angle of about 45°; showing the fissure to be a newer deposit. It consists of contorted ribbon rock, containing a fair amount of gold, and dips slightly toward the hanging wall of the fissure. This older deposit has been traced for a distance of 400 ft. in length; its width has not been determined. An open-cut has been run on this deposit at a depth of 20 ft. along its general course. This cut shows a stockwork of schist and quartz veins more or less parallel. The trend is southeast. The north and south fissure has been definitely traced for a distance of 1500 ft. For this distance it carries its width of 4 ft. The clay is also found to continue and maintain its character for this distance. The vein for its whole determined length shows free gold which may be obtained by panning. Twenty tons crushed some years ago as a test, gave $407 gold, and the many samples taken would indicate its value to be from $17.50 to $20 per ton free gold. Whatever gold is contained in the concentrate must be added to this. The clay carries small amounts of free gold. The pyrite, of which there is a large percentage, has not yet been properly tested, but is known to be valuable.

Two shafts, one 40 and the other 50 ft. deep have been sunk on the vein. These show the ore to be of the same width, character, and value as on the surface. An adit has also been started at a point which will tap the lode at a depth of 100 ft., in a distance of 210 ft.; this will be used as a drain for the first level, and also for taking out the rock. Toward the end of the season a mill-run of 410 hours was made on rock from the stockwork or older deposit, 100 tons of unselected rock being crushed, returning $1334. During the last 30 hours of this run an amalgam trap was used, recovering 3½ oz. of amalgam, leading those in charge to believe gold had been lost before.

The equipment consists of a 2-stamp Hendy mill placed 200 ft. below the level of the open-cut and about 300 ft. distant, a Challenge ore-feeder, Blake crusher and ore-bins, 30-hp. steam boiler, and 20-hp. horizontal engine, a dynamo and all necessary tools, 3000 ft. of rails, a gravity tram, and self-dumping cars which discharge directly into the ore-bins. All necessary buildings have been put up in a substantial manner. It is expected that the mill will be enlarged just as soon as the orebody has been definitely traced and its value established. The small plant now at work will keep development going.

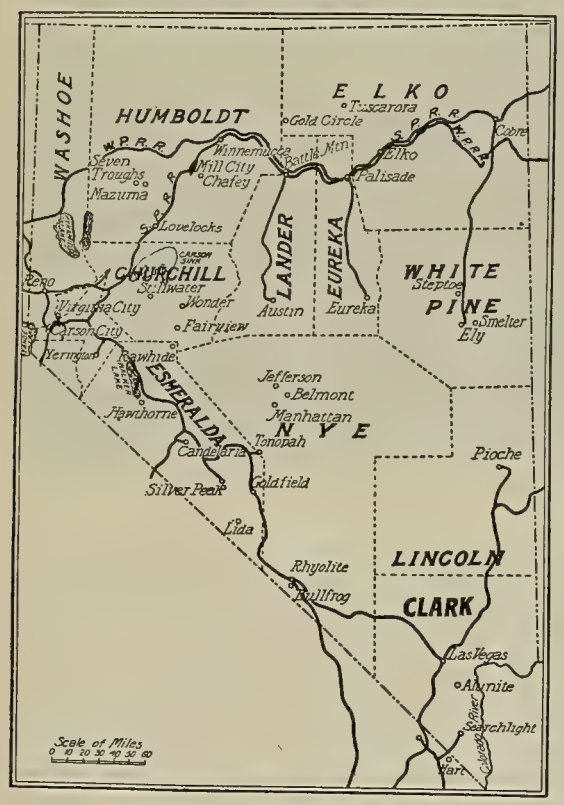
Open-Cut, Lone Star Mine.

Development work is also well under way on the property of the Dome Quartz Mining Co. This mine is situated on a divide between Lombard and Dominion creeks, and is owned principally by Hartman and Davidson. During the latter part of last winter an adit was started for the purpose of cutting the lodes, of which there are five, at a depth of 600 ft. below the outcrop. This adit has always seemed an ill-advised undertaking, on account of the risk and cost. However, nothing succeeds like success. It is now in about 1000 ft. and has tapped two of the veins which are found to show their full width and value. The other three veins, it is hoped, will be cross-cut some time next year. This will require about 500 ft. of additional driving. The property is generally believed to be of value. The cross-cutting of two lodes at a depth of 600 ft. and the finding of 3 ft. of ore in each vein with gold that will certainly pay, places the property in a most enviable position, and is a matter of great satisfaction to all concerned.

MINING IN NEVADA FOR 1909.

Written for the MINING AND SCIENTIFIC PRESS
By JAY A. CARPENTER.

Despite the dull times over the State due to lack of capital for the extensive prospecting and development work of former years, the metal output of 1909 marks it as a banner year. The extraordinary increased production of gold and copper has caused the total value of the metals produced during the year to exceed $27,000,000; a figure almost double that of 1908. Of this amount Esmeralda county produced over 12 millions, White Pine and Nye counties 6 and 5 millions respectively, Storey and Eureka about 1 million apiece. No county failed to add its quota. The great increase in gold production is in the main due to the continuous operation since early in January of the new 100-stamp mill of the



Map of Nevada.

Goldfield Consolidated. The Florence mill at Goldfield and the 100-stamp mill of the Pittsburg Silver Peak Mining Co. at Blair also have maintained a high bullion output. The camp of Round Mountain has shown a marked improvement, and a feature of the year is the revival of the Rhyolite-Bullfrog district due mainly to the discovery of the Pioneer with its rapid and successful development, and to the Montgomery-Shoshone which, noted as "comparatively a failure" in last year's review, faces the new year with a debt of $275,000 paid, large ore reserves blocked, and 25% increased milling capacity. The new gold camps of the year of note are National, near the Idaho line, with a production of about $250,000; and Bannock, near Battle Mountain, credited with $100,000 from surface workings in three months. Rawhide has made a production in the neighborhood of half a million, but its future depends upon its low-grade milling ores. The present gophering for high-grade ore and the building of small experimental mills is not encouraging. Manhattan, Seven Troughs, and Chaffey have made little or no improvement, while the mills of the Homestake King at Rhyolite and the Bamberger mine at Delamar have closed down under unfavorable conditions.

The silver production of the State has been maintained mainly by the mines of Tonopah. The 200 stamps of the Tonopah Mining, Tonopah Belmont, and the Montana Tonopah have dropped almost continuously during the year, and the MacNamara, West End, and Midway have shipped steadily to the smelters. Although the question of profitable orebodies on the deeper levels remains unsolved, the progressive development of the Tonopah Mining and Tonopah Belmont is highly commendable. Of especial note for the year is the excellent work of the Montana Tonopah in paying off its large indebtedness, the paying of dividends by the MacNamara, the erecting of a 30-stamp mill by the Tonopah Extension, and the development of new orebodies in the westerly claims of the Tonopah Mining Co. The old bonanza silver camp of Virginia City has more men working than for years past. The greater footage of exploration work has already shown good results in the Crown Point, Ophir, and Mexican. The large open-cut on the Chollar croppings on Potosi ground by Charles Butters, though hardly profitable on such a large scale, is a tribute to his energetic methods. The year has marked the completion of the wooden stave drainage pipe through the main Sutro Tunnel, which gives the mines, with shafts long since abandoned, an easy and cheap method of handling their rock. The Sutro mill has been kept busy of late on ore from these properties. The old camp of Eureka has also prospered, taxing the rolling stock of the railroad with ore to the Utah smelters. Pioche, until the Tintic smelter closed, made steady shipments of low-grade ore. Austin, Wonder, and Fairview districts have had a quiet year.

The past year marks the entrance of Nevada among the large copper producing States as a result of the starting of the Steptoe concentrating and smelting plants of the Nevada Consolidated and Cumberland-Ely mines. Through steady construction work the January output of 2½ million pounds was more than doubled in the closing months of the year, and at a cost of production given at 7c. per lb. The Giroux promises to be rapidly brought to the producing stage by the Cole-Ryan interests. The copper mines of the Yerington district in Lyon county have been developed to such a stage as to warrant the building of the Copper Belt railroad with plans for the erection of smelters.

Except for the strike at the Veteran mine at Ely, the labor conditions over the State have been a pleasing contrast to the stormy days in 1907. The bullion

tax suits have been peacefully settled and whatever may be said of the justice of this tax, that has amounted to $250,000 for the year, or of the methods of the bullion tax collector the commendable results are being obtained. The outcome of the injunction suits brought by Goldfield mining companies to prevent the buying of high grade by local assay offices will be followed with interest by mining men. In the mines the year's record was marred by the caving of the Hampton stope at Goldfield with its loss of life, and by the fire in the Sutro Tunnel at Virginia City which threatened to flood the mines through the choking of the tunnel by caving debris and which was conquered only by the sheer grit and heroic efforts of the Virginia miners. The pumping situation at the Ward shaft at Virginia City is not far ahead of where it was a year ago because of the failure of the newly installed express pump under the trying temperature conditions. The new management plans to cope with the situation by using simpler pumping units of quintuplex vertical-plunger pumps geared direct to two-speed motors and with modifications in construction to meet the special conditions—these to be placed in units at different levels

Ward Shaft.

to avoid the dangers and difficulties that beset one large pump placed on the lowest level.

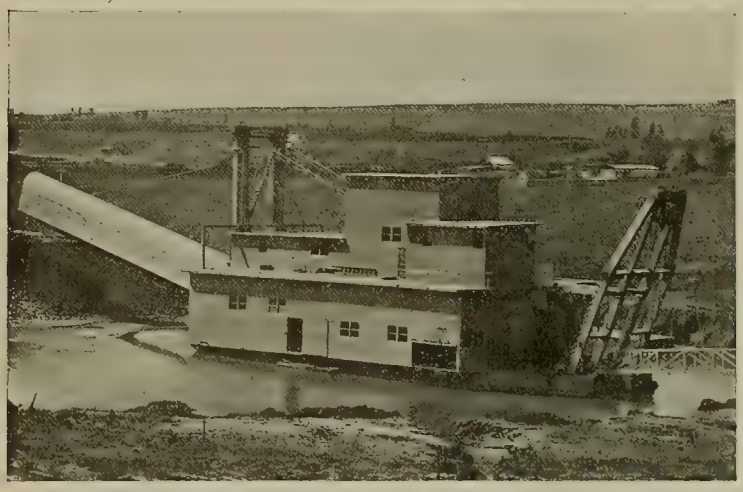
In mining progress for the year is to be noted the extensive use of the churn-drill and steam-shovel at Ely, the use of the diamond-drill at Ely and Tonopah, and the rapid increase in the use of the air-hammer drill. In metallurgical progress there is to be noted the erection of the large modern copper concentrating and smelting plants at Ely; the installation of Chilean mills behind stamps or rolls at the Goldfield Consolidated, Round Mountain, and Montgomery-Shoshone mills, instead of Huntingtons as in the earlier Tonopah mills to increase the milling capacity; the substitution of blankets and carpeting at the Goldfield Consolidated and Florence mills for amalgamating plates; and the general tendency for greater aeration in the agitation of slime either by air alone, as in the Consolidated mill, or by air and mechanical agitation together as in the Trent agitators at the Montgomery-Shoshone. An index to the sound basis of the mining industry of the State is the extension of the Bishop power lines into Round Mountain and Manhattan with plans for a 100,000-volt line to Ely, the increased tonnage and earnings of the Nevada railway lines, and the proposed road from Ely to Goldfield.

DREDGING IN MONTANA AND IDAHO.

Written for the MINING AND SCIENTIFIC PRESS
By W. A. SCOTT.

The most important gold dredging operations in Montana are at Ruby, in Madison county, where Alder gulch opens into Ruby valley and spreads its auriferous gravel and sand over an area of many hundred acres in the valley named. Alder gulch, on which Virginia City is situated, was the most productive of the placer diggings of the State from 1864 to 1875, and, when at the height of its prosperity, had a population of 50,000. The branch line of the Northern Pacific railroad, that extends from Whitehall up Ruby valley, terminates at Alder station. The distance from this station to the mouth of Alder gulch is about four miles; and extending from the mouth of this gulch nearly to Alder station is the large area of dredgeable ground belonging to the Conrey Placer Mining Co., whose operating headquarters are at the little town of Ruby, situated adjacent to the tract; this company's holdings also extend up Alder gulch to Adobetown. The most of the stock of the Conrey company is owned in Boston, New York, and Washington, Harvard University holding one of the largest interests, which came to that institution as a bequest from Gordon McKay, a manufacturer at Newport, Rhode Island. A. H. Wiseman, former manager for the company, who prepared an article on this dredging field, is authority for the statement that N. S. Shaler was responsible for tests which proved the portion of Ruby valley that receives the wash from Alder gulch, to be profitable dredging ground. This was in 1898. After various attempts at dredging, first with Orange Peel excavators, then with various types of steam dredges, the actually successful work began in September, 1906, when the Conrey company's No. 3 dredge was put in operation. Dredges No. 1 and No. 2 were built in 1908, No. 1 having started work in May and No. 2 in June of that year. The three dredges are operated by electric power from the plant of the Madison River Power Co., in Madison canyon, 50 miles east. A transmission line connects with the Conrey company's sub-station and transformers at Ruby. The three dredges have a combined capacity of 350,000 cu. yd. per month, based on actual operations. No. 3 was designed by company engineers. Its hull is 138 ft. long, 48 ft. wide, and has the mooring-line system of anchorage. The digging chain has a length of 96 ft., carrying forty-two 13-cu. ft. buckets, open-connected, operated by a 150-hp. electric motor, the speed of the buckets being 8 ft. per minute. The dredge is swung from side to side by a 10-hp. motor, direct connected to a winch; a 30-hp. motor connected to a massive winch serves to move the dredge under its mooring lines. The revolving screen is 18 ft. long, 61 in. diameter, and has equally spaced 4 by 6-in. holes through which the smaller material passes into the sluiceway on the upper deck. In this 90% of the gold recovered is saved. The oversize from the screen passes out at the end, thence through rock-chutes into the pond. The screen is revolved by a 10-hp. motor. The necessary water for the screen and

sluiceway is pumped by three electrically driven pumps which lift 12,500 gal. per minute. The material passes from the upper sluiceway into a 135-ft. tail flume, 66 in. wide, lined with angle-iron riffles, discharging the tailing evenly on the worked over area. Below the tail flume are two under-current flumes, each 50 ft. long, 12 in. wide, discharging upon a plate 5½ ft. square, having ¼-in. perforations, through which the material passes to a riffled table below. The main part of the boat is heated by two Hart & Crouse hot-air furnaces, and a steam-boiler radiates heat through a system of pipes to other essential parts. The ground in which No. 3 dredge operates is from 34 to 40 ft. deep, the buckets cutting from 1 to 4 ft. into the bedrock. The gold in this ground is said to be quite uniform from surface to bedrock. This dredge worked 34 acres in 20 months to an average depth of 34 feet.

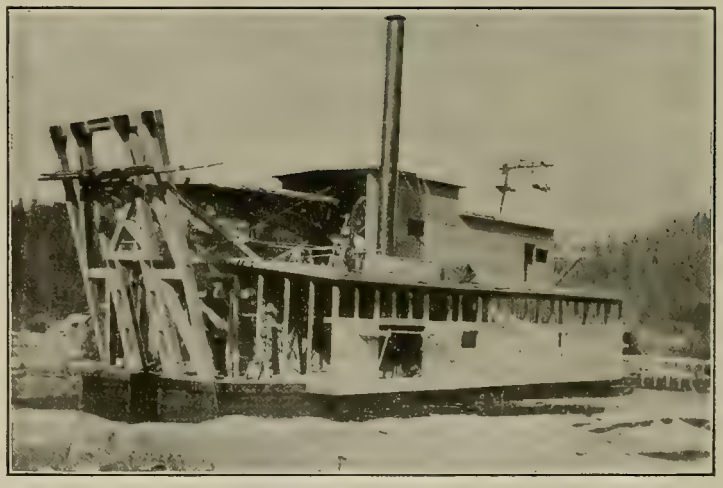


Dredge at Ruby, Montana, Built by Marion Steam Shovel Company.

Dredges No. 2 and No. 1 were built by the Marion Steam Shovel Co., and are of the stacker type, and use spuds. No. 2 operates in ground half a mile nearer the mouth of the gulch than does No. 3, the latter being farther down in the valley. No. 2 has thirty-six 10-cu. ft. buckets, open-connected, on a 76-ft. ladder, the material being dumped from the buckets into a hopper, from which it passes through a revolving screen 35½ ft. long, 6 ft. diam. at one end and 4½ ft. at the other, the screen having ⅜ and ½-in. perforations, through which the finer material carrying most of the gold, passes to pans and tables lined with angle-iron riffles. There are 10 of these on either side of the screen, each 18 ft. long, 30 in. wide, all emptying into sluice-boxes which carry the gravel and water to the stern of the boat, where they fall into the pond; the oversize from the screen passes to a belt-conveyor which carries it to the stacker. The gold which is caught in the riffles is cleaned up weekly. The water for screening and sluicing is supplied by one 8-in. and one 12-in pump, electrically driven. The wooden spud, for use in stepping or moving ahead, is 48 ft. long, 24 by 36 inches in size. The steel spud, which rests in the ground while digging, is of the same dimensions; it acts as a pivot from which to swing the bow of the boat sidewise, and to hold the boat up to its work.

No. 1 dredge operates in 24-ft. ground, up Alder gulch, 2½ miles east of Ruby. It has 8-cu. ft. buckets, close-connected; in other respects it is the same as No. 1, in each boat the hull being 96 ft. long, 44 ft. wide, the lower deck being 50 ft. wide. The stacker on each boat is housed and the heating system is complete; all three dredges operate through the winter season as well as during other seasons of the year. The electric voltage received over the transmission line at Ruby is 46,000, which is transformed down to 2200 volts at the Conrey company's sub-station. Charles Kammerer, well known to dredge operators, is general manager; T. D. Prier, assistant manager and engineer. Hennen Jennings is the company's consulting engineer.

The Kansas City Commercial Co. purchased, within the last two years, the La Casse placer grounds situated on Cedar creek, 18 miles from Iron Mountain, in the western part of Missoula county. Since making the purchase this company has installed an electric-power plant, built a dredge, and began operating late in November, 1909. La Casse Bros., of Missoula, who sold the property, had built two 4-ft. flumes and had operated on a part of the ground in recent years with two hydraulic giants. The dredgeable part of the ground has been tested and the out-



New York Engineering Co. Dredge Being Built.

look for next season's work is favorable. Efforts will be made to operate during the winter.

Dredging operations at Pierce, Nez Perce county, Idaho, are in the hands of the Idaho Company, Ltd., which has 450 acres of placer ground at and close to the confluence of Oro Fino, Rhodes, and Canal creeks. About 250 acres of this is capable of being successfully dredged. This material has an average depth of 13½ ft., and lies on a bedrock of decomposed granite, about one foot of which is taken up by the buckets. Approximately 80% of this dredgeable material consists of tailing resulting from former placer operations. It is said to have sampled 21c. per cu. yd., and the recovery of gold does not fall far short of this figure. The reported estimate of the cost of operating is 8c. per yd. Much of this ground had been worked over twice before this company acquired it. The company has a Risdon dredge, with 3¼-cu. ft. buckets, which has just finished its fourth season of operation, having maintained, it is reported, a capacity of 1000 cu. yd. per day; and having operated 10 months of each year since work began.

The second dredge, finished and put in operation the latter part of November, was built by the New York Engineering Co.; it has 3¾-cu. ft. buckets, close-connected, and has an estimated capacity of 2000 yd. per day. It is thought the latter dredge will be operated throughout the winter. The ground, especially that which was formerly worked over, is quite free from boulders that hinder operations. The gravel is said to contain 1% black sand. E. S. Hare is superintendent for the company, Marquis Eaton, A. B. Cody, and R. R. Bailey, of Chicago, being president, vice-president, and secretary-treasurer, respectively. It is claimed that nine years' work for two dredges is assured.

At Elk City, the Idaho Dredging Co. and the Jennings Dredging Co., both managed by P. J. Jennings, built two dredges of the Hammond type the past autumn, one of which operated but a short time before closing down for the season. The former company has a considerable area of dredgeable gravel on American river; the latter has ground on Little Elk river, three miles north of Elk City.

In the Boise basin the Moline Mining Co. has operated a Risdon dredge near Placerville for the past 4½ years, having averaged 8 months per season, 27 days per month, handling 1400 cu. yd. per day, working three 8-hr. shifts. This dredge has 5-ft. buckets, open-connected, is equipped with a compound, condensing steam engine, the fuel for the boilers being wood that costs $3.25 per cord to chop and deliver to the dredge, the company owning the timber land from which the wood is taken. An area of about 80 acres of dredgeable ground is owned, the gravel being from 30 to 45 ft. deep, and overlying a soft sedimentary bedrock, which is easily cleaned. This material tested 35c. per yd., but in working over some of it with traction dredges several years ago only 28c. per yd. were recovered. The operating season for 1909 was slightly shortened by reason of the dredge being dry-docked November 1, so as to overhaul and re-inforce the hull, an unusual operation that was successfully accomplished, and the dredge put afloat again before the winter freeze-up.

MINING IN MONTANA, 1909.

Written for the MINING AND SCIENTIFIC PRESS
By CHARLES COPENHAVER.

Although the metal market during 1909 was unsatisfactory and the accumulating surplus of copper discouraging, mining in Montana was maintained about normal throughout the year, and the total production of copper exceeded 300,000,000 lb. Practically all of this came from the mines of the Butte district. Considering the small returns on the metal, at the prices prevailing throughout the year, an unusually large amount of dead-work was done together with development work, opening of new mines, making changes for the introduction of economies, and planning for the future. Although the experience of the large producers has not been encouraging in that direction,

Map of Butte District.

some of the new companies continued development, and several important mines have been added to the Butte list of copper producers. Half a dozen other companies are maturing plans for resumption of work, indicating faith in the future of the copper industry. The production of 1909 exceeds that of 1908 by about 40,000,000 lb. The Amalgamated company has matured plans for the expenditure of $2,000,000 during the coming year in making changes and improvements at its mines at Butte, much of this money to go into an installation of electrical machinery and power to take the place of all the present steam plants. One of the largest electrical power-plants in the world is being built at the great falls of the Missouri river, at Great Falls, Montana, and when completed it will furnish power to a central plant in Butte from which it will be distributed to all the mines. Amalgamated interests own the Great Falls electrical enterprise.

A number of changes and improvements are being made at the two large smelters of the Amalgamated

company at Great Falls and Anaconda. The largest stack in the world was put in commission at Great Falls during the past summer, and with its extensive system of flues is giving splendid results. The smelter and the concentrator are being enlarged, and when the improvements are completed the plant will have a capacity of about 5000 tons of ore per day. Its present capacity is about 3500 tons. At the Washoe smelter at Anaconda the company is building a new system of dams and reservoirs to settle and clarify the water from the concentrator before discharging into the Deer Lodge river. There will be a crescent-shaped dam near the stream itself, more than a mile and a quarter long and about 26 ft. high, with wing-dams branching from the main one so as to form compartments. It is anticipated that this improvement will do away with the remaining causes of complaint by farmers in the Deer Lodge valley, who allege damage from deleterious substance in the water.

The Amalgamated company is engaged in opening two new mines, the Badger State for the Boston & Montana company, and the Right Bower for the Anaconda. The Badger State claim carries the western extension of the Jessie vein of the North Butte company. A shaft has been sunk 1500 ft. deep. It will be made 500 ft. deeper before cross-cutting and driving. The Right Bower shaft is 525 ft. deep, and several levels have been run to connect with adjoining properties of the Anaconda company, including the Modoc, which is 1400 ft. deep. Sinking is continuing in the Modoc and it is the intention to make it as deep as the High Ore, which is down 2850 feet. In the Right Bower several good veins, one large, and of high-grade ore, have been opened. This property includes the extension of several of the best veins of the Butte-Ballaklava company. The Leonard shaft of the Boston & Montana company is also being deepened below 1800 ft. The Diamond shaft, an Anaconda property, is now the deepest working in the Butte district, being down 2960 ft., 600 ft. having been sunk during the year. The Mountain Consolidated shaft of the Anaconda company is 2290 ft. deep and is still going down. Sinking is proceeding at the Belmont mine of the same company, a depth of 1200 ft. having been reached. As this is a four-compartment shaft sinking has been slow. At the 1100-ft. level the Belmont has been connected with the 1600 in the Anaconda mine, there being a difference of about 500 ft. in the elevations of the shafts at the surface.

The Trenton company, owner of the Gagnon mine (Amalgamated), has found practically a new mine on the 2200 and 2300-ft. levels of that property, after the property was believed to have been practically worked out, and it has justified the company in deciding to sink a new, vertical shaft to replace the old incline. The new shaft is down about 400 ft., and will be deepened 2300 ft. where it will be connected with the lowest level of the mine.

The Amalgamated companies did 141,858 ft. of new work during 1909. The most important development done during the year in the Butte district was by the Butte Coalition company, which has been deepening the Tramway and Rarus shafts and opening new levels. The Tramway is now 2000 ft. deep and will be sunk another 200. Three new levels have been opened from the Tramway into the Minnie Healy, the lowest being at 1700 ft. Three new veins have been opened on the 1600 and 1700-ft. levels of the Tramway, and reports show that they contain the richest copper orebodies ever opened in Butte. The Tramway is the main working shaft for the Minnie Healy, the shaft of the latter mine having been abandoned on account of caving and because of fire in the upper levels. Practically a new mine has been opened under the fire zone, the fire being confined to old stopes on the 1200-ft. level. Between the fire and the next lower level there is solid ground 100 ft. thick, which will remain undisturbed as long as any fire lingers in the property. The Rarus shaft is 2200 ft. deep, the lowest level being 2000.

The North Butte company completed its main working shaft to a depth of 2200 ft., and is opening two new levels at the 2000 and 2200. Considerable lateral work has been done on the 1600 and 1800-ft. levels. During the past year the North Butte secured control of the Granite Mountain claim, owned by the Lewisohns, and the shaft is being raised from the lower levels to connect with the old openings which were down 900 feet.

Considerable development work has also been done in the Clark mines, the Original, Steward, Elm Orlu, and Poser. The latter is not yet producing, but the Elm Orlu is a new mine, which is yielding about 300 to 400 tons of ore per day. It carries a high percentage of zinc, and a concentrator for zinc has been added to the Butte Reduction Works for the purpose of handling the Elm Orlu ore.

The zinc industry has offered encouragement to some, and a 500-ton concentrator is to be erected near the Black Rock mine of the Butte-Superior company. The mine will be able to yield 500 tons of ore per day for ten years.

The most important new company that has entered the producing list is the Butte-Ballaklava, owner of a mine east of the Speculator and Edith May mines of the North Butte company. It has been developed to a depth of 1400 ft., and four large veins have been opened. One of them, on the 1400-ft. level, has 8 ft. of copper glance and bornite. A new steel headframe has been received and will be put up at once.

The largest independent company in Butte is the East Butte Copper Mining Co., which recently absorbed the Pittsburg & Montana. It is operating both the old East Butte mines and the Pittsmont, and the Pittsmont smelter, turning out copper at the rate of 7,000,000 lb. per year. Since the East Butte took over the Pittsmont the cost of production has been reduced from 13 to 10 cents per pound, and the mines have been placed in excellent condition. They are capable of yielding double the present production without effort. The Tuolumne Copper Co. has also developed a producer at the Tuolumne mine. The Davis-Daly Copper Co. has been confining its work entirely to the Colorado mine, which has been opened by levels to a depth of 1500 ft.

The British-Butte Mining Co., which promised much and loudly, has suspended operations with its gold dredge just west of Butte.

During the year 1909 the Butte mining companies

produced 310,532,474 lb. of copper, compared with 269,165,640 in 1908, and 240,887,516 in 1907. The production by months in 1909 was as follows:

Month.	Pounds.
January	26,502,608
February	24,871,730
March	28,077,510
April	25,347,128
May	26,443,244
June	25,268,888
July	26,580,820
August	26,070,130
September	26,584,180
October	28,166,166
November	27,889,140
December	18,643,830
Total	310,445,658

The production of the different companies for three years is as follows:

Companies.	1907.	1908.	1909.
Boston & Montana...	63,053,655	77,010,800	79,049,150
Anaconda	64,154,636	67,064,000	78,660,550
Butte & Boston	9,209,650	10,349,640	14,010,500
Washoe	6,438,420	8,569,170	11,669,970
Parrot	5,403,010	6,281,080	7,921,930
Trenton	6,794,475	6,229,940	8,547,378
North Butte	29,534,240	38,526,480	41,260,230
Butte Coalition	24,971,800	21,488,580	37,905,510
Original	17,296,940	24,936,700	19,088,260
*Pittsburg & Montana	4,785,090	4,295,100	7,789,830
Davis-Daly	.....	.....	878,250
East Butte	3,965,480	.....	.....
*La France	2,168,975	.....	.....
Miscellaneous	3,111,145	4,414,150	3,658,100
Totals	240,887,516	269,165,640	310,439,658

*East Butte absorbed the Pittsburg & Montana, and the La France is idle.

Activity in mining throughout the State was somewhat retarded because of the financial depression. Outside of Silver Bow county, mining is confined chiefly to Beaverhead, Broadwater, Madison, Chouteau, Jefferson, Missoula, Park, Fergus, Deer Lodge, Flathead, Cascade, Lewis and Clark, Ravalli, Lincoln, Powel, and Granite counties. Considerable gold dredging is being done in Madison, and prospecting for good placers is going on in other counties. The old Marysville mines in Lewis and Clark county are yielding the customary amount of ore, and some placer mining is being done near Libby in Lincoln county. The silver-lead mines near Libby and in Ravalli county are being developed into good producers. In the old silver mines around Granite some leasing is being done and lately there has been renewed activity by several of the old companies. The most important development in Montana has been in connection with the gold discoveries in Deer Lodge county, and in the Little Rockies country around Zortman and Landusky in Chouteau county. Some rich gold mines have been opened. In the Radersburg district, Broadwater county, the Ohio-Keating Gold Mining Co. has also opened a good property from which there are now regular shipments of high-grade ore. Attention has been directed to the Cook City district near the Yellowstone National Park, where a number of lead, silver, and copper properties are being opened. The district is so far from railroads, however, that transportation costs make mining at present unprofitable.

COPPER IN ARIZONA IN 1909.

Written for the MINING AND SCIENTIFIC PRESS
By C. F. TOLMAN, JR.

The year 1909 has been the most noteworthy in the history of the mining industry of Arizona. The four old camps, Bisbee, Clifton-Morenci, Globe, and Jerome, have not only been able to maintain, but some have increased their product, in the face of the continued demoralization of the copper market, and have placed Arizona still farther ahead as the banner producer of the United States. Arizona has demonstrated beyond peradventure that the law of supply and demand has not governed in the business of copper mining this year. The lower the price of copper, the greater has been the tonnage pushed through the reduction works, including more of the cream of the

Map of Arizona.

mine, for a shut-down is disastrous to a great copper mine, involving as it does a large investment of money, and open to rapid deterioration under such conditions. Those closely in touch with the copper industry know that here 'hide hunting' is practised in its most acute form, and that the rights of the future must be respected in regard to the copper supply as well as coal and iron. The general belief that some regulation of the copper output must come, and that whoever has a big proposition must be taken care of in the adjustment, has stimulated prospecting and copper hunting on the part of the energetic copper operators to an astonishing degree, and developments during the last year have been unparalleled.

The magnitude and rapidity of the developments can be appreciated by reference to Waldemar Lindgren's article on the copper resources of the United States, which was presented to the National Conservation Commission, February, 1909. In this contribution he states: "These four principal centres of production [Bisbee, Morenci-Metcalf, the old Globe

mines, and Jerome] must be chiefly relied on for many years if Arizona is to maintain her output." At that time the possibilities of the metallized zone along the contact between the Pinal schist and the Schultze granite were not appreciated, and the results of the developments at Ray have been made public since that time. Even so Mr. Lindgren states that "the prospect of discovering new important copper fields in Arizona is perhaps brighter than in any other State or Territory"; the truth of which has of course been abundantly proved.

The year 1909 has seen the development of an entirely new class of copper ore deposits, namely, disseminated chalcocite deposits in schists, which differ in many important respects from the disseminations in porphyry. A noted authority, writing of the Globe disseminations, states that they show no outcrop. The truth of the matter is that these are more certain and decisive than in any other class of copper deposit, and that both the primary mineralization and the secondary leaching above and enrichment below are plainly indicated in the outcrop. It is necessary to utter a word of warning here, for the wide-awake copper miners are already schist crazy, and the disease will probably become more acute as soon as the Globe and Ray mines begin producing. The fact that the United Verde and the Ray deposits are both in a schistose rock does not predicate further similarity between the ore deposits, and the fact is that these two are unlike in every respect except that both are of great value. Because a copper deposit is in schist is no evidence in itself of intrinsic value. Large areas of copper-bearing schist are known to me which carry copper in small scattered lenses, and in no way resemble schist disseminations. No two deposits could be more dissimilar than the rich small chalcopyrite fissure-veins of the Gibson properties of the Globe district, and the huge cone-shaped dissemination of the Miami, both of which are in the Pinal schist. Fortunately the evidences of primary mineralization, and secondary concentration and leaching, so well shown both at Ray and Globe, will be recognizable about other schist disseminations, and without these indications search for disseminated orebodies is not a legitimate mining gamble.

The main features of the Ray and Miami dissemination I have described in recent numbers of the Mining and Scientific Press, and the magnitude of the orebodies and their assay value have been given in the official reports of the companies. Besides the Miami, the Inspiration, the Black Warrior, the Cactus, the Live Oak, the New Keystone, and the Cordova companies, working along the Schultze-granite and Pinal-schist contact, are reported to have developed disseminated sulphide ores. The Ray Consolidated, the Gila, the Ray Central, and the Hercules & Arizona probably cover most of the Ray orebody. The size of this deposit is no longer a live question, for already the interest on the cost of development is becoming an important factor in the operations of the larger companies. The problems now confronting the companies are those of extraction and reduction. The future Ray dividends depend upon the degree of success which the management meets in devising suitable underground mining methods.

The other new camps that are receiving most attention are Silverbell and Ajo. At the former both the Tiro company and the Imperial are developing disseminated deposits in porphyry, with apparently encouraging results, and at Ajo extensive explorations are being undertaken, the results of which are not being made public by the interested parties. The smaller copper camps, namely, Twin Buttes, Helvetia, Courtland, and Johnston, are all developing and producing ore, and it now appears that they will be thoroughly proved in the next two years.

Of the four big camps, the developments at Bisbee have been most interesting. At the Shattuck & Arizona, orebodies have been found reported to be of similar grade to the bonanza stopes of the central portion of the ore-trough, though higher topographically, and geologically as low as anything yet found in Bisbee. Excellent orebodies have been uncovered in the Denn-Arizona, east of the proved ground, and along and near the line of truncation of the ore-bearing trough by the Dividend fault. The operations of the Copper Queen from the Lowell shows that the metallized area extends farther in this direction than suspected heretofore, and while the grade remains satisfactory, the bodies develop greater irregularity in shape than those of the central area. At Morenci-Metcalf the Shannon has been bettering the surface arrangement by building a standard-gauge road from Metcalf to the Shannon smelter. Several new companies have been reported in the daily press as planning to test outlying areas in this district. At Globe the developments on the Miami-Inspiration zone overshadow all other operations, so that the blowing in of the new smelter at Globe, and the generally satisfactory condition of the Globe Hill mines, have not received the notice that they deserve.

The depression in the price of copper appears to have stimulated the efforts of the larger operators in their search for satisfactory prospects, and to have driven the prospectors and small stock companies away from copper in a search for gold. The Gold Road region is at present the most promising of the Arizona goldfields, the development on the Tom Reed attracting most atention. The North Star, in Yuma county, is reported to continue to make good, and the Golconda is rumored as a possible large low-grade gold deposit of promise. The success in Sonora of the Peck machines for the treatment of the cemented gold conglomerate will probably direct attention to cemented placer deposits in Arizona. The operations of the United States Mining & Smelting Co. have caused a renewal of activity in the development of the zinc-bearing ores from the Kingman region.

In conclusion it may be said that in Arizona 'copper is king'. While an occasional gold mine may be found, while with better transportation and reduction facilities more zinc and lead ores may be mined, while better results may be expected from the cemented gravels, if their development be taken out of the hands of wild-cat companies and of cranks, nevertheless southern Arizona and northern Sonora will remain the Mecca for copper miners, and as the indications of the disseminated deposits are better known further successes in this class of mining may be expected.

BRITISH COLUMBIA.

Written for the Mining and Scientific Press
By E. Jacobs.

The value of the mineral production of British Columbia in 1909 is estimated at between $24,500,000 and $25,000,000, in the following approximate proportions: placer gold, $600,000; lode gold, $5,200,000; silver, $1,500,000; lead, $1,800,000; copper, $5,500,000; zinc, $500,000; coal, $6,800,000; coke, $1,665,000; building materials and miscellaneous, $1,200,000. Necessarily the revised returns will show some changes, but it is unlikely there will be any great differences.

Placer gold mining was not active in 1909. John Hopp, of Seattle, Washington, operated in the Cariboo district on a fairly large scale, and is preparing for more extended work next season. Philadelphia

Mineral Resources of British Columbia.

capitalists authorized Howard W. Du Bois to let a contract for the construction of a ditch and flume 20 miles long extending from Swift river to Quesnelle Forks, Cariboo, to supply water for hydraulicking gold-bearing gravel. In Atlin camp, Cassiar district, the season's yield is estimated at less than for any year since 1898, but there is promise of better results next season, water-supply difficulties having interfered with this season's work.

The most important development in connection with lode mining was the sale of the Nickel Plate mine, Hedley camp, Similkameen, by the Marcus Daly estate to men who organized the Hedley Gold Mining Co., of New York, and late in the year proceeded to enlarge the power-plant at the mine and add to gold-saving facilities at the 40-stamp mill. Much development is to be done in 1910. Sheep Creek camp, in the Nelson mining division, made substantial progress, the Queen, Nugget, Kootenay Belle, and Mother Lode having produced gold from milled ores. This camp is attracting attention, and gives promise of becoming important and permanent. The Yankee Girl, at Ymir, was worked by New York men, who mined 3000 to 4000 tons of ore and prepared for extending operations. Owing to the Le Roi mine having been idle several months, the production of gold in Rossland camp was nearly 30,000 oz. lower than in 1908.

Production of silver and lead was larger than last year. More than half the total output was from the Consolidated Mining & Smelting Co.'s St. Eugene mine, East Kootenay. Other large contributors were the Blue Bell and Whitewater, in Ainsworth division; Rambler-Cariboo, Richmond-Eureka, Ruth, Standard, and Van Roi, in Slocan. The Richmond-Eureka and Van Roi are comparatively new mines, producing silver-lead ore of good grade. The Emerald, near Salmo, also shipped much lead ore, while the Silver Cup, in Ferguson camp, Lardeau, was an important producer of silver and lead. Most of the districts from which silver comes made a larger production than in 1908, the Slocan and Ainsworth districts particularly. Portland canal promises to have two or three new properties sufficiently developed to begin the production of silver and lead in 1910. Some timely information relative to this district is given in an official bulletin lately issued by the Provincial Department of Mines, Victoria.

The three chief copper-producing districts each show decreased production in 1909, though official figures will probably be higher than those included in the above estimate, the method of calculation of copper content of ores being different. Boundary mines continue to do remarkable work in mining and smelting. Granby costs per ton of ore—its annual report says, "including all expenses"—are $3.20, making the net cost of producing copper 10c. per lb.; the British Columbia Copper Co. claims even lower costs, namely, "including all charges from ore in place to sale of contained metals, $2.6322 per ton." Cost of producing, refining, and marketing per pound of fine copper, after crediting expenditure with gold and silver value is stated at 9.996c. for the company year. Quite recent announcements show even a lower average cost. Granby improvements at mines and smelter have increased the daily output capacity at both to about 4500 tons of ore. B. C. Copper remains at about 2000 tons, although enlargements are being prepared for.

Zinc, though not yet produced extensively in comparison with old zinc-mining countries, is gradually assuming local importance. In 1909 the Lucky Jim mine shipped in excess of 5000 tons of 52% ore. The Whitewater made 4660 tons of zinc concentrate (in addition to 3570 tons silver-lead) averaging 42% zinc with 15 oz. silver per ton. The Ruth shipped 655 tons concentrate running 50% zinc, with 28 oz. silver. The Van Roi's output of zinc concentrate was about 1400 tons averaging 44.3% zinc and 50.5 oz. silver. The growing value of the zinc-mining industry lately led to an effort to induce the government of Canada to conduct experiments with electro-thermic smelting of lead-zinc ores, of which there is an enormous quantity in British Columbia. New York capitalists recently bonded a group of claims

in West Kootenay having a very large surface showing of zinc ore.

Production of coal and coke was the largest yet made in the province in any one year. The principal producers were the Western Fuel Co. and Wellington Colliery Co., both mining on Vancouver Island, and the Crow's Nest Pass Coal Co., in East Kootenay. Among the new coal-mining enterprises are the Pacific Coast coal mines, which opened and equipped a mine at South Wellington, Vancouver Island, constructed seven miles of railway to Boat Harbor, below Nanaimo, and built there bunkers, docks, etc., and put in a coal washery and all requisite shipping facilities. This company is finding a market for its coal at Mexican ports. The Nicola Valley Coal & Coke Co. added to its plant and output at its Middlesboro colliery, Nicola Valley. The Vermillion Forks Co., on completion of a railway from the south, giving it transportation facilities, commenced shipping on a small scale. In East Kootenay the Hosmer Mines, Ltd., having completed its main entry and parallel tunnel, cutting ten seams of coal, settled down to mining in two or three of the larger of them, and to making coke. The Corbin Coal & Coke Co.

Centre Star Mine, Rossland.

also fairly entered upon a career of production, having opened its mine in an unusually large deposit of bituminous coal of excellent quality, a big market for which is open in the city of Spokane and other populous centres in northeastern Washington and northern Idaho.

Besides the large additions to plant—enlargement of its eight blast-furnaces, provision of bigger copper converters, and installation of more large blowers—at Grand Forks by the Granby company, important improvements were made by the Consolidated Mining & Smelting Co. at Trail. Both copper and lead furnaces were enlarged; another big Root blower, electrically driven, has been installed; more Huntington-Heberlein roasters and converter pots for both low-grade copper and lead matte, put in; lead-handling facilities added to the furnaces, the number of electrolytic tanks increased to nearly 600 in the lead refinery, and other extensions in keeping made to buildings and plant. The Tyee Copper Co. installed a second blast-furnace, 48 by 160 in., capacity about 12,000 tons of ore per month, and made other provision for copper smelting at Ladysmith, Vancouver Island, on a larger scale than in the past.

Certain developments of the year, not included in the foregoing, which is an incomplete summary owing to space restrictions, should not be passed over. One of them is the opening of a new mine in Wellington camp, Boundary district, by the B. C. Copper Co., which has done about half a mile of development, chiefly on a vein of oxidized ore carrying gold of an average value of about $7, with occasional shoots of arsenical iron running in gold and copper up to $20 per ton. A railway spur of three miles is being built to this mine. The Jewel, also in the Boundary district, has nearly finished the installation of a 15-stamp Fraser & Chalmers mill, Wilfley tables, slime-plant, and other gold-saving appliances. These Boundary developments, together with the determination of an important occurrence of bornite ore in the Marble Bay mine, Texada island, and valuable exploratory and experimental work at the Britannia mine and mill, Howe sound, are amoun the evidences of progress made in mining in British Columbia in 1909.

MINING IN WYOMING IN 1909.

Written for the MINING AND SCIENTIFIC PRESS
By A. C. DART.

At the last meeting of the State Legislature the resignation of H. C. Beeler as State Geologist was received and Edwin Hall was appointed. During the past six years the work of Mr. Beeler, who has entered consulting practice with an office in Denver, became well and favorably known. Mr. Hall, who at the time of his appointment was the president and general manager for the Copper Belt Mines Co., of Laramie county, has so far shown a firm intention to keep up the work of eliminating the undeserving properties.

Copper Mountain.—Activity in this district has been greatly stimulated by the prospect of the extension of the Burlington railroad. The Williams-Luman properties were taken over by Montana capitalists for a reported consideration of $100,000. This company has added to its holdings, has several thousand feet of development including a 1000-ft. shaft, and has made several shipments of smelting ore from which, in spite of the long wagon haul, good results have been obtained. The erection of a smelter of their own is under consideration. The Big Horn Copper Mining & Development Co. has been incorporated to work ground adjoining the Williams-Luman group and smelting ore is being shipped. Ground in this district is being tested by the Shoshone Gold Dredging Co., and others, with a view to dredging next spring. Large sulphur deposits near Cody have been purchased by Eastern people who will develop the ground and erect a plant.

Atlantic and South Pass.—A considerable revival of activities in this district has resulted from well directed attempts to apply modern methods of amalgamation and cyanidation to the abundant low-grade ores. Further impetus is given by the advent of cheap electrical power, furnished by the Boyson

Power Co., whose dam and hydro-electric plant, with an output of 6700 hp., have recently been completed. A part of this power will be used by the Boyson Mining Co., but a larger part will be sold by contract. An Eastern corporation, recently organized under the name of the McCandalas Development Co., also has been active. It has purchased the Duncan group of claims and in order to test the ores has leased the Mary Ellen and Dexter mills of 10 stamps each. It is reported that 5 ft. of $100 ore has been opened in sinking the Duncan shaft. The Mary Ellen mine, one of the richest in the district, is still tied up by litigation. The Security Gold & Copper Mining Co. has cut at depth the vein for which a cross-cut adit has been driven. Good ore is reported. Engineers representing California capital have reported a good body of $6 ore in the Carissa vein which answers well to amalgamation and cyanidation tests carried out under working conditions in a 10-stamp mill. Development has been pushed in the Big Chief, Snow Bird, Miner's Delight, Spangler, and several other promising properties. The XL Dredging Co., and capitalists from Lander, have been testing placer ground in the district and machinery will probably be installed in the spring. In the Lewiston district also improvement has begun. The machinery has arrived for a cyanide mill to be erected at the Good Hope mine. The Bullion mine has recently been sold to Duluth capitalists and J. McAvoy has taken a lease on a large tract of placer ground which he will test next spring. During the summer the Northwestern Mining & Development Co. was organized in Lander to operate lode and placer claims. The Anna Held mine, west of Atlantic City, is already being opened.

Encampment and Centennial.—One of the largest mining deals reported in Wyoming for some time is that recently put through by the United Smelters, Railway & Copper Co., of Cleveland, Ohio. For a consideration of $10,000,000 this company is believed to have secured the whole of the celebrated Penn-Wyoming holdings, including, besides the mineral claims, the Saratoga & Encampment railroad, the Encampment water works, and the 17-mile aerial tram. An active campaign of development is being carried on, but the tram, mill, and smelter, are not being used at present. Unusual activity was displayed during the past summer at the properties in the Elk Mountain district. The Walcott Copper Mining Co., owners of the Elkhart mine, have installed a boiler and hoist and are developing a medium grade of ore. In the lower workings of the Elkhorn mine a workable deposit of copper glance has been opened and several shipments, of an average grade of about 15% copper, sent to the Denver smelters. Other properties which have answered well to development are the Charter Oak, West Virginia-Wyoming, Elk Mountain, and Standard Copper. In the Centennial district the Rambler Copper & Platinum Co. has led in shipments and development. At present, tests are being made to determine the best method of treating the lower grades of ore, large bodies of which have been exposed, and shipments of high-grade ore are keeping four teams busy on the ten-mile haul to Holmes. It is of interest to note that these are actually platinum ores. The milling grades average about 8% copper, 4 oz. silver, 0.75 oz. platinum, and often hardly more than a trace of gold. The Lake Creek Gold Mining Co. has been driving a cross-cut to tap the Kansas vein which, in the shaft, shows 5 to 15 ft. of a good grade of gold-bearing copper ore. The old Modena and Joe Davis claims have been responding to further development at the hands of the Topeka Mining Co. At about 1000 ft. from the mouth of the old adit the ore-streak is seen to be perceptibly widening, and shows increased mineralization. The Pollyton Gold Mining Co. and the Mohawk Gold & Copper Co. have both been prospecting the Osceola vein by means of shallow shafts and trenches.

Sundance.—The Bear Lodge Co., of this district, has installed an engine and hoist capable of working to a depth of 600 ft. and is pushing development work. The Gold Cliff Mining Co., backed largely by South Dakota interests, has been organized recently to operate in the Kirwin district, and already several deposits of a good grade of gold, silver, and copper ores have been opened.

Douglas Creek.—The American Gold Placer Co. carried out extensive steam-shovel operations here the past summer but on account of having to handle the material in cars, both before and after sluicing, the returns were not as good as was expected.

Thermopolis.—The Wyoming Sulphur Co. recently tapped the main shoot of its deposit and found a 50-ft. core of almost pure sulphur. The refining plant is entirely unable to handle the material extracted. The present output of about 500,000 tons per year is all contracted and the capacity of the plant is to be greatly increased.

Casper.—The asbestos deposits of Casper mountain have been greatly exploited during the past year and several deposits are being worked. The North Western Asbestos Mills Co. was formed in Cheyenne early in the year for fiberizing the crysotile mined by the North American Asbestos Co., and the Wyoming Consolidated Asbestos Co. The capitalization is $1,000,000, and the par value of the stock $10 per share. The structural work on the mills, situated near Casper, has been completed and the machinery is expected to arrive at any time. It has been rather persistently rumored that the capitalization of some of the companies was excessive and the State Geologist has written to the Denver press a statement to that effect.

Hartville and Sunrise.—The size and importance of the iron mines of the Hartville iron range is little realized. In point of production the Sunrise mine, in 1907, held 17th place in the United States, and, outside of the mines of the Lake Superior region, it ranked as the third greatest producer. The field was first entered by the Colorado Fuel & Iron Co., in 1900, and today the output of well over half a million long tons per year supplies practically all the ore treated by the Pueblo plant. Mining is still being carried on by steam-shovels, two in ore and one stripping waste, but the far-sighted policy of the management is well shown by the rapid development of an underground mine employing the milling system of mining.

UTAH'S MINES, MILLS, AND SMELTERS IN 1909.

Written for the MINING AND SCIENTIFIC PRESS
By ROBERT H. BRADFORD.

Utah's standing among the States of the Union in the production of gold, silver, lead, and copper is enviable, as she does not rank below fifth in any. This high standing is maintained from year to year. While mining conditions and metal prices in general throughout the world in 1909 were anything but flattering, there was marked activity in the Utah properties. Although the production for this year has fallen off in some of these metals, a vital reason has been the prevailing low prices. Extensive development has taken place, and large orebodies are ready for heavy production when metal prices warrant.

Map of Utah.

Utah's metal output alone for 1908 and 1909 fails to show the real activity in mining operations.

Bingham. — The year 1909 has been a record marker for Bingham. The Utah Copper Co., up to September 30, had produced more than 41,000,000 lb. of copper, and increased output for the last quarter brings the total production to nearly 60,000,000 lb. The physical condition of the mine continues to improve. Stripping operations are kept far in advance of the shovels on ore, and at any time increased output can be made to meet the demands of the concentrating mills of the company. The cost of production for the last half year was reduced to 8c. per lb. of copper. The net profit from mining and milling operations of this company for the year reach $2,500,000. These enormous earnings on an ore averaging less than 2% copper are phenomenal, and show the results of careful and painstaking operations on a tremendous scale. The company's report shows a total cost per ton for mining and milling of but 82c. This is on a basis of the ore being extracted entirely by steam-shovel work.

The Boston Consolidated, for its fiscal year ending September 30, produced 16,684,000 lb. copper, 89,326 oz. silver, and 7964 oz. gold. The company has exploited both the porphyry and the sulphide mines, the first by the caving system and the second by square-set stoping. The development in the porphyry mine amounted to 51,060 ft., and in the sulphide mine to 4376 ft., lineal extension. During the year there was destroyed by caving 30,095 ft. of workings and there remained open on October 1, this year, 71,891 ft. of workings. The extraction of porphyry ore amounted to 645,679 tons, which was shipped to the concentrating mill at Garfield for treatment. For hauling this ore 11,592 railroad cars were required. These cars were loaded from the enormous steel bin at the foot of the company's inclined tramway down which all the porphyry ore was lowered from the mine. The sulphide mine produced 69,375 tons of ore during the year ending September 30, and this ore was sent direct to the smelter for treatment. The Boston Consolidated Mining Company's property directly adjoins the Utah Copper on the south and lies higher on the mountain. The disseminated porphyry ore belonging to the two companies is mined from the same monzonite laccolith which makes up a continuous massive deposit. To continue the steam-shovel work, now so well under way by the Utah Copper Co., means to undermine the ore on Boston Consolidated ground. It is, therefore, not surprising to hear of a pending consolidation.

The Ohio Copper Co., whose properties adjoin the holdings of the two above named companies, has had a busy and important year. The 13,000-ft. adit from the concentrating mill at Lark to the mines at Bingham has been put into operation for haulage of ores, and the success has been even greater than was anticipated. The adit reaches the quartzite and porphyry ores at a depth of 1000 ft. below the bottom of Bingham canyon. The ores from the workings above this level are dropped through inclined chutes to bins directly above the track. Trains operated by electric locomotives are loaded and the ore sent direct to the mill. On the second day of December the first section of the large concentrator was put in operation, and since then has been treating 400 tons of ore per day, with excellent results. The final capacity of the mill will be 2400 tons per day. Another section is now ready to begin operation, and the whole mill will be rapidly pushed to completion.

The Yampa mine at Bingham continues to produce about 20,000 tons of sulphide ore per month. This is handled by aerial tramway a distance of 1½ miles down the canyon to the Yampa smelter where, with 4000 tons of custom ore, it is smelted to copper matte. The converter plant installed by the company in the early part of the year has been closed down since November and at present the matte is shipped to the A. S. & R. smelter at Garfield.

The Utah Consolidated's output for 1909 approaches 300,000 tons of copper ore. At present the ore all goes to the Garfield smelter, but by May 1910 the new smelter of the International Smelting & Refining Co., at Pine Canyon, Tooele county, will be in operation, and the ore from the Utah Consolidated

will be sent by aerial tramway, of the Bleichert system, over the mountain direct to the smelter. The tramway, 21,000 ft. long, is now under construction. The smelter buildings are taking definite form. The 7000 tons of structural steel was furnished by the American Bridge Company.

The Bingham mines of the United States S. R. & M. Co. are important producers, although owing to the closing of their copper smelter at Bingham Junction at the order of the Court, because of complaints of the valley farmers, the output of copper ores has been curtailed during the year. The lead ores from the company's mines, along with much custom ore, are treated at the lead smelter at Bingham Junction. Other producers of Bingham are numerous, but for 1909 no heavy output from any of these need be especially mentioned.

Tintic.—The Tintic district continues to hold the distinction of having more dividend-paying mines than any other in the State. The old producers in the class with the Centennial Eureka, Grand Central, Eureka Hill, and Mammoth are showing excellent grades of ore with depth and increased development. Around Godiva mountain to the east many important producers of more recent date are now sending out rich lead and silver ore. These include such properties as the Colorado, Iron Blossom, Sioux Consolidated, Gemini, Uncle Sam, May Day, and others. Most of the ore from these mines goes direct to the Salt Lake valley smelters at present since the Tintic smelter closed late in the year. The Colorado mine has paid as dividends practically 90% of the net receipts from ore, and has thus established a record that few, if any, mines in this country has equalled.

Park City.—Much development work continues to be done in the mines of Park City, and the orebodies show that this district has before it a long period of successful mining operation. The Silver King continues to be the leader in the production of rich silver-lead ore, as evidenced by the quarterly dividends of 15c. per share. The Daly Judge, Daly West, Ontario, and Little Bell show excellent condition, while many of the newer properties are showing flattering prospects of rivaling the older mines for supremacy.

Mercur.—The Consolidated Mercur continues to produce bricks of gold for the Salt Lake Government Assay Office. Improvements in treatment methods for the base ores give promise of still greater success in the future, due to increased extraction of the gold at less cost per ton. The little mill of the Boston & Sunshine Co., at Sunshine, six miles southwest of Mercur, is doing excellent service. The mill treats 125 to 150 tons of ore per day at a cost of 73c. per ton. The extraction is extremely satisfactory for the clayey ore; the tailing runs only from 20 to 40c. per ton. The mining costs are well down, so that the company can reckon on any ore containing more than $2.80 per ton being payable. The dividends since the mill started, in May of this year, have amounted to $13,500.

Other mining camps that space alone compels me to pass with but simple mention include the Alta, Deep Creek, Beaver County, Sevier, Park Valley, and Gold Springs.

Salt.—The brine of the Great Salt Lake continues to be an important source of salt. During 1909 the Inland Salt Co. harvested 40,000 tons. This limited amount more than supplies the inter-mountain States. Were the demand increased many fold the company could readily proceed to supply the same.

Minor Minerals.—Hydro-carbons, iron ore, fire clay, gypsum, sulphur, antimony, phosphate rock, limestone, petroleum, cement rock, building and ornamental stone, uranium, vanadium, and radium minerals are all important in Utah, and are awaiting further development as the country grows.

JOPLIN ZINC-LEAD DISTRICT IN 1909.

Written for the MINING AND SCIENTIFIC PRESS
By OTTO RUHL.

The Joplin district breaks all previous records in the production of both lead and zinc ores for the year 1909. The output of zinc ores reported for the first fifty weeks of the year shows a total of 289,830 tons including both zinc blende and calamine. The lead ores for the same period total 42,426 tons. Such an output is the greatest ever known for the same period, and estimating the remaining two weeks the year will close with the zinc tonnage in excess of 300,000 tons, and the lead tonnage in excess of 43,000. The gross value of the ores was, zinc $11,743,656, and lead $2,325,893, giving a total of $14,069,549 for the first fifty weeks of 1909. Estimating the value of the ore for the remaining two weeks of the year, the total for 1909 should approximate $14,600,000, which was exceeded only in 1907. The year 1909 therefore breaks all records as to tonnage of both ores and all records of value except the year 1907.

The past year marks the first time in a number of years when the data were kept so that the output of zinc blende and calamine were separate, and the results accurate. I inaugurated the system this year, and this makes it possible to arrive at a better general knowledge of the ore resources of the district, and also affords more reliable averages of the prices paid for both blende and calamine. The result will be that the average price of blende-ore will appear much larger, and at the same time it approximates much nearer exactness. The system revealed the fact that the calamine bore to the zinc blende the relation of a little over 1 to 10. Thus the zinc ore consists of 261,411 tons of blende and 27,239 of calamine. The average price of blende for the fifty weeks was $42.23, and the price of calamine $24.08 per ton, while the average of both grades taken together is $40.51. The average price of lead ore for the 50 weeks was $54.82. The highest base price paid for zinc blende ore was $53; for calamine $30; for lead ore $60. The highest prices paid for any lots of these ores were for zinc blende $55; for calamine $37; for lead $63.

As compared with last year's averages the advantage is much in favor of 1909 with the zinc ores and about even with the lead. For the same period last year the zinc blende averaged $34.17; no data were kept of calamine, but the lead ores averaged only $55.21.

The ore-price movements show a consistent advance

for the entire year for the zinc ores, while the lead ores have almost as steadily declined. The first of the year opened with decided strength shown in both the lead and zinc ore markets. Toward the opening of the spring and through the summer there was a slight weakening in both ores, which was speedily changed to an advance for the zinc ores from that time to the close of the year, when the price-level has been above the $50 mark for blende and $28 for calamine. Lead ores on the contrary have shown a gradual weakening to the end of last week, when it closed at $54 per ton, or at a level below the average of the price maintained during the panic year of 1908.

The higher price-level for zinc ores has helped to stimulate the production of all grades of zinc ores. To that reason, however, is due only in a general way the increased output of this year. During the year 1908 while ore prices were low, a large majority of the low-grade ore-producers were shut down, their cost of producing ore being higher than the price received for the ore. Producers of higher-grade ores continued in operation throughout that year, and their successful operation turned other operators toward the exploitation of such orebodies. As a result many new deposits of this class of ores were opened on a lower cost-basis, and when a higher price-level came, and the old low-grade sheet-ground deposits could be again worked at a profit, the producing capacity of the district had been largely increased by the new work.

Still another cause contributing to the present increased production of the district, lies in the fact that just prior to the panic in the fall of 1907, there was coming into the producing list a large number of new mines in the sheet-ground camps of Webb City, Prosperity, Porto Rico, and Duenweg. These mines had been provided with mills that in many instances had never been operated or had been operated just long enough to get the mill into running order. When ore-prices went above the $45 level these properties at once began operation, and the production jumped greatly. In addition to this the men who had faith in sheet-ground mining had just begun the opening and development of a new area west of Joplin during the latter part of 1907. The panic which ensued, while it stopped actual production, did not stop the work of prospecting and development. These went steadily ahead on many leases and when 1909 came there were a number of shafts down to the ore. When prices reached $45 the mills went up and already there is a large production coming from this field which is not strictly a sheet-ground camp but a disseminated ore camp where the ore is found thinly scattered through flint in a blanket formation. There is now in progress a great deal of work which will result in still greater production from that part of the district. The area promises to become a rival of the north sheet-ground field at Webb City.

Another important development lies in the deeper deposits of ore now being mined at Cave Springs in Missouri and at North Empire in Kansas. These ore deposits are found below the ore horizon hitherto defined by the Grand Falls chert member of the Mississippian rocks. As developed at Cave Springs the chert member has a well defined ore deposit down to the 180-ft. level. Below the chert member at 220 to 290 ft. a second deposit is found which consists of blende disseminated through a limestone member, presumably of Keokuk age. The limestone is soft and striated, and the disseminations of the ore in the rock appear to be associated closely with the dolomite which is found throughout the deposit. Identical conditions have been found in the Ihlseng shaft north of North Empire.

Since the development of these two shafts drilling has shown the same deposits in the heart of the old North Empire camp at practically the same levels. These three different showings are on territory near together and seem to demonstrate a new mining area with deeper deposits. The Herald Mining Co., at Cave Springs, has 40 acres well drilled and showing this type of deposit. Across in Kansas, on the Robinson and Ping lands consisting of 50 acres, the drilling so far done reveals the same deposit. On the Murphy land in North Empire 5 drill-holes are in the ore and a shaft is being sunk. Still further west drilling has been done, but more than the fact that it was successful nothing has been announced.

While the above deposits are the first to be developed by shaft they are not the first discoveries of a lower ore-level. Drilling at Springfield, Aurora, Carthage, Spring City, Hornet, and Quapaw revealed the ore some time ago, but there was no development attempted to ascertain the real value of the deposit. More recent drilling south of Galena has also revealed the same deposits. All of this corroborative evidence seems to forecast another valuable addition to the ore reserves of the Joplin district, and is considered by most of the progressive mine operators to be the most important development of the year.

Camp growth has been remarkable in some parts of the district. Especially have the Carthage, Sarcoxie, and the east-end camps grown. These have furnished a large part of the increase in production. The southwestern camps of Miami, Quapaw, and Galena have shown remarkable growth, the first two in actual output and the latter in the number of new enterprises launched during the latter part of the year. There has been much new development east of Miami, at Peoria in Oklahoma, and farther south in that State and east to Seneca, also northeast to Spurgeon, north to Spring City, and on to Joplin, so that the same railway company that put in the new railroad from Miami north to its new camp is now building east and northeast through this newly developed territory. Aided by railway facilities there should be a great increase in production within another year.

The sheet-ground camps at Webb City, Prosperity, Duenweg, and Oronogo have been showing steady progress since the latter half of the year. These camps, together with the new disseminated deposits west of Joplin, are inaugurating the building of much larger mills, and the mill that is smaller than 300 tons is condemned as wasteful. The average is more nearly 500 to 600 in these camps, and the tendency is toward still larger plants. The low percentage of concentrate in the mineral hoisted makes it necessary to handle the ore in large quantities.

Special Correspondence.

WASHINGTON, D. C.

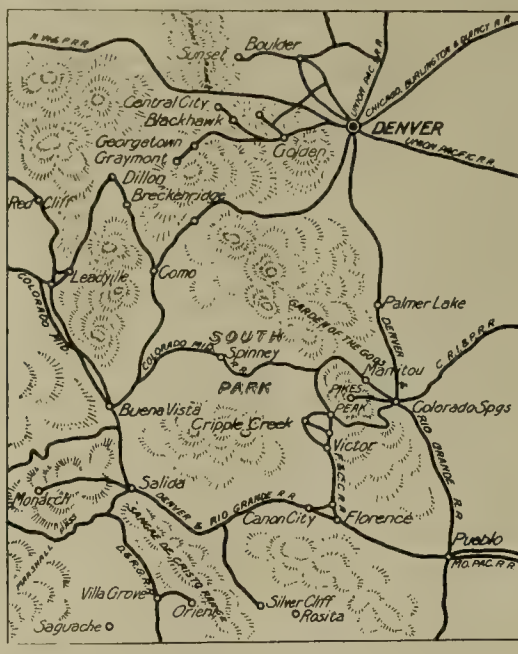
Bureau of Mines Bill Reported.—Cullom Resolutions.

The committee on mines and mining of the House of Representatives did not take long to reach a conclusion on the bureau of mines question. All of the bills introduced into the House with the exception of one that came later, were discussed. A bill was framed and reported favorably. It was immediately placed upon the calendar, and will come up for hearing directly after the holidays. It is practically the Douglas bill that passed the House last year, with the amendments suggested by the Senate. It provides that there shall be a Commissioner of Mines at a salary of $6000 per year, and, "That it shall be the province and duty of said bureau and its commissioner, under the direction of the Secretary of the Interior Department to foster, promote, and develop the mining industries of the United States; to make diligent investigation of the methods of mining, the safety of miners, the possible improvement of conditions under which mining operations are carried on, the treatment of ores and other mineral substances, the use of explosives and electricity, the prevention of accidents and other technologic investigations and inquiries pertinent to said industries, and from time to time make such public reports of the work, investigations, and information obtained as the Secretary of said Department may direct, with the recommendations of such bureau." The bill also provides for the transfer of the technologic branch of the United States Geological Survey to the Bureau of Mines. The Senate committee on mines and mining, which is headed by Charles Dick, the senior Ohio Senator, held a meeting for the preliminary consideration of the subject, and decided to hold a series of public hearings after the holidays. The House committee accompanied its bill with a report which stated in part that, "The demand for such a bureau has steadily grown with the growth of the mining industry of the country, and the substantially unanimous testimony and appeal from every quarter recognizes the necessity of some central governmental bureau where the varied needs and interests of this great industry may be studied and promoted. * * * But there is one other consideration which your committee cannot refrain from urging. The great growth of the mining industry of the United States in recent years has been attended with a disproportionate and appalling loss of life, due to accidents and explosions in mines. The horror and sadness of some of these are still fresh in our memories. It is inconceivable that such accidents might not be prevented. The cause, or causes of them are obscure, as was shown at our hearings; but the danger, whether gas or dust, or both commingled, or whatever the cause, must disclose itself to adequate scientific investigation. When we recall that these accidents in 1907 sacrificed the lives of more than 3200 persons, that this appalling loss of life has continued from year to year among the men who in darkness and dangers courageously pursue their vocation, the appeal in this regard becomes well-nigh imperative." Stirred by the catastrophe at Cherry, Shelby M. Cullom, Senator from Illinois, introduced in the Senate a resolution calling upon the Secretary of the Interior to report on the following questions: (1) The number of Federal stations equipped with rescue appliances which are in operation in the mine fields. (2) The number of Federal stations essential to the proper safeguarding of life which should be established in the mine fields, with an estimate of the cost of their construction and operation during the next fiscal year. (3) The opinion of the mine experts of the Department of the Interior as to the causes of the numerous accidents, and their views as to the action the Federal Government should take to prevent or at least minimize them in the future. The resolution passed after a rather spirited debate, Joseph W. Bailey, of Texas, objecting to the resolution on the ground that it made inquiry into matters that belonged solely to the States. He denied the right of the Federal Government to establish and maintain rescue stations in the various States. An echo of the Cherry, Illinois, disaster, is also seen in a strange bill introduced in the House by Alfred B. Garner, of Ashland, Pennsylvania, who asks that the sum of $2,500,000 be appropriated annually "for the purpose of relieving the poverty, destitution, or distress of the parents, widows, or orphans of laboring men in any part of the United States killed while in pursuit of their labor." Mr Garner says numerous national calamities have befallen the laboring men of the United States at various times and places and that the death of the breadwinner leaves the parents, widows, and orphans in destitution and poverty. Whenever such calamities have occurred in foreign countries, Mr. Garner says, it has been the policy of the United States to furnish the persons afflicted large and substantial financial assistance. He thinks it is only just and equitable that when calamities occur in the United States, the same or a fuller measure of financial support should be given the afflicted persons.

DENVER, COLORADO.

The Year in Colorado.—Bad Weather but Good Work.— Progress in Mining and Metallurgy.

The weather in 1909 was at its worst. All precipitation records were broken. The snow stayed long in many camps, hindering prospecting and delaying transportation. This was especially true in the San Juan, where trains were



Mineral Districts of Colorado.

blocked until late in the spring. In the latter part of September a flood wrecked the D. & R. G. tracks in many places so that traffic was suspended for the greater part of October. Uncertainty regarding the tariff legislation was another factor. Low prices and dull markets prevailed in all the sulphide camps. Probably Leadville was most seriously affected, as the greater part of its ore is now low grade, and the margin of profit small. Most of the work was carried on by lessees who could ill afford to lose. The Yak tunnel, which is to be for Leadville what the deep drainage tunnel is for Cripple Creek, was not far enough advanced during the first part of the year to be of any appreciable advantage. The companies which could, took advantage of the dull times to prospect and develop. A great deal of diamond-drilling was done during the year. By the middle of June the Central Colorado Power Co. was in position to furnish electric power from its Shoshone plant to the mines. Many of those to which it is difficult to get fuel have availed themselves of the cheaper power, and this should be an important factor in reducing costs.

Many of the old mills have been remodeled so as to make a lead-zinc separation.

The Clear Creek district has fared better than any of the other sulphide camps. The numerous gold producers have given it a certain stability during the hard times. The Newhouse tunnel was advanced steadily during the year and is now a little over five miles in length. With is numerous laterals it drains an immense territory, and opens many famous producers. Another notable achievement was the tapping of the water in the Seven-Thirty shaft by the raise from the Burleigh tunnel. The connection was made on December 9. This opens a large block of supposedly rich ground. At Georgetown a mill is being built to treat the mixed sulphides by chlorination. If this Malm process is a commercial success it will add greatly to the wealth of the district. The North American Smelter & Mines Co., which has purchased the old Golden smelter, seems to hold the solution of the problem of maintaining a smelter in the district. The company controls a sufficient number of mines to assure a continuous ore supply. The plant at Golden is being remodeled preparatory to starting this month. It has been especially noticeable during the past year both in the San Juan and Clear Creek districts that a great deal of outside capital was being invested. The tungsten industry is in the most prosperous condition in its history. Resumption of work at the great steel plants has created a heavy demand for tungsten ore. Almost all the important mills in the district have had to install new machinery. The district has gradually extended until now it takes in the properties near Rollinsville in Gilpin county. Coördinate with the tungsten industry in importance might be mentioned the dredging at Breckenridge in Summit county. The operators have had an unusually successful season, and will attempt to operate throughout the winter. As yet no great difficulty has been experienced and the dredge men are confident of success.

Cripple Creek has maintained a nearly uniform output during the year. The production up to December 1 was $14,487,362. Allowing the usual amount for December would bring the production for 1909 to nearly 16 millions, a trifle less than in 1908. The mines have been operated almost entirely by lessees. In all, seventeen companies have paid dividends. The cyanide mills near Colorado City are estimated to have handled about 12 million dollars worth of ore from the Cripple Creek district. At the beginning of 1909 the deep drainage tunnel had been advanced 4505 ft. from the portal end. The intermediate shaft had been sunk, and a total of 377 ft. driven from its bottom, making three headings, with a total footage of 4882. The portal heading and that from the intermediate shaft met exactly, last July. The remaining breast has been advanced steadily, and allowing the usual 300 for December the tunnel should measure about 12,100 ft. The $160,000 necessary to complete the work has been subscribed. The tunnel should be completed in about eight months. Leasing has been more in vogue during the past year than ever. What development has been done by the large companies has strengthened the belief that the rich ore-shoots extend to some distance below the present water-level.

No bonanza camps have been opened in Colorado during the past year. Probably the most important find was near Newcastle, where there is a small boom in progress, and a new camp called Goldstone has grown up. One good copper mine, with a rather large acreage, has been reported from nine miles north of Canon City. The interest seems to have swung from metal mining to oil. Drilling outfits have been at work prospecting in the San Juan district, Mesa, Routt, Boulder, Elbert, and El Paso counties. The most encouraging results have been obtained from the work in the western counties. Some advances have been made in metallurgy. A 50-ton Kuenzel oil furnace has been installed and operated at Buena Vista. The furnaces are comparatively cheap to construct, costing about $15,000. What is known as the Portland cyanide process has been perfected in the experimental mill of the Portland company. In this process the tellurium of the Cripple Creek ores is dissolved instead of being removed by roasting. The company has a 400-ton mill nearly completed at its mines near Victor.

TORONTO, CANADA.

Year at Cobalt.—Gowganda, Elk Lake, and Porcupine Lake. — Iron, Coal, and Oil.—Mergers

The year has been characterized by steady progress in Canadian mining industries, and will show a considerable advance in the output in most lines, over that of 1908. Shipments from Cobalt have largely increased, and numerous improvements in plant and equipment have been made. Nevertheless few mines have been added to the shipping list, the majority are still in the prospect stage, and some which once shipped extensively have produced little. The dividends paid, however, show that the camp is getting on a substantial basis. The total payments since the beginning in 1905 will approximate $16,750,000 from 17 companies. More than half, or about $9,000,000, will have been paid during 1909. Cobalt mining stocks have tended downward because the purely speculative element is being largely eliminated. The silver field has been steadily expanding in several directions. The sale of a large number of properties on the Gillies Limit, lying to the south of Cobalt, has been followed by extensive development. Early shipments are expected from the Waldman, Wyandoh, and some others. In South Lorrain the Wettlaufer mine is making shipments. The most extensive work in the outlying districts has been carried on in the Elk Lake and Gowganda areas, where a number of mines have been sacking ore for shipment. These districts have been greatly retarded by the want of transportation facilities. Conditions at Gowganda have been considerably improved lately by the construction of roads, and shipments of ore will be made during the winter. The contemplated improvements in the navigation of the Montreal river, to be undertaken in the spring, will greatly aid the mining industry. During the late fall reports of important gold discoveries at Porcupine lake and several other localities in northern Ontario, near the line of the Temiskaming & Northern Ontario railway, attracted a rush of prospectors. Government officials confirmed the existence of gold in promising quantities on the surface, but the value at depth is still undetermined. Some heavy investments in these properties are reported, companies are being formed, and the usual glowing appeals to the speculative public will be made before long. A large influx into this region is anticipated in the spring. With the experience of Larder Lake still unpleasantly fresh in the mind it will probably be difficult to excite public enthusiasm until development has proved the value of some of the prospects. As to Larder Lake there is little to be said. Some of the companies are still in operation, but the results hardly justify the expectation of their ultimately making good.

There has been a decided impetus given to iron-ore mining by the general revival of industry and the increased demands of the furnaces. The Dominion Bessemer Ore Co. has opened a mine in the Port Arthur district, and began shipping in the fall. Operations will be conducted on a larger scale in the spring. The mica industry which had been for some time languishing, owing to over-production, began to improve toward the end of the year and the mica-trimming works in Ottawa resumed activity. Owing to the large stocks of raw material on hand it is likely to be some time before mining becomes active. Coal mining in Nova Scotia was considerably disturbed by an extensive strike of the miners affiliated with the United Mine Workers of America. The company principally affected was the Dominion Coal Co., employing usually upward of 5000 men in its collieries at Glace bay. A considerable proportion of these, belonging to the Provincial Workmen's Association remained at work, but the strike, which began in July, crippled operations for some months. The company gradually strengthened its force and resumed its normal output. During the strike, now practically over, the company was unable to furnish coal to the Dominion Iron & Steel Co.'s plant, at Sydney, for which about 150,000 tons were imported from the United States. Other coal mining companies largely increased their output. The industry in the western provinces is rapidly growing.

The modern tendency toward the concentration of capital in large enterprises and the absorption of smaller concerns

have been much in evidence in Canadian mining affairs. Several extensive mergers have been put through, including the amalgamation of 11 cement companies in the Canada Cement company with a capital of about $30,000,000, two asbestos mergers, and the consolidation now in process of the Dominion Steel & Iron Co. and the Dominion Coal Co., with a joint capital of about $57,000,000. Extensive oilfields have been discovered in the Province of Alberta, upward of 300 miles north of Edmonton. These promise to attract much attention. Evidence recently given before a committee of the Canadian Senate by Alfred von Hammerstein, who has been exploring this field for eight years, and put down numerous wells scattered over an area of 60 miles, is to the effect that oil and gas occur in large quantities through this region.

MEXICO.

Financial Conditions.—Railway Extensions.—Metallurgical Improvements.—De-Waterers.—Filters.

A review of the financial conditions in Mexico during the past year unfortunately is not altogether cheerful. The influence of the panic in 1907 in the United States is still felt, and the number of new mining enterprises, the amount of development, and the investment of capital, has borne no relationship to the opportunities that exist. The only really promising outlook is seen in the steady increase in railroad mileage, especially in the undeveloped and only partly prospected Pacific Coast regions of Tepic and Sinaloa. This railroad expansion will undoubtedly result in a great number of new mines being taken up and developed. The most important of these railroads is the Southern Pacific of Mexico, extended from Guaymas to Mazatlán, beyond which it probably will be completed to Guadalajara before the end of the year 1910. F. S. Pearson's activities in Chihuahua will eventually give a cross-country line to the Pacific that will open up another important territory. David E. Thompson's purchase and extension of the Pan-American railroad will make the connecting link from the United States to Central America. The line from Acapulco north along the coast to Zihuatanejo, will help prospectors to reach the coast range, which is known to be a good gold belt, mined extensively by the early Spaniards. The projected line from Cuernavaca to the Balsas river, which now seems to be almost a settled fact, will also tap this same region. A new road from Guadalajara to the sea, has been started, and will pass through Ayutla and Autlán, giving Jalisco an independent port of its own at Chamela. The line from Pachuca to Zimapán, with the probability of an extension to Tampico, will also open a valuable territory. But while mining will undoubtedly be stimulated by greater facilities in transportation, there still remains a large number of mines with known deposits of good ore that cannot be worked profitably without the necessary machinery and capital.

With the low price of silver, higher wages, deeper mining, and the scarcity of capital for investment, the Mexican silver mine manager has been forced to improve methods both in mining and metallurgy; and while much has been done, there is opportunity for doing more.

The Mexican mine manager gets to look upon cheap labor as a thing that is so cheap that he can afford to waste it, with the result that in many camps the cost of mining and milling is far more than the costs at similar mines in the United States.

There has been a steady improvement in the organization and equipment of important mines during the past year. Electrically driven centrifugal pumps for both station use and sinking are being generally adopted in place of steam or compressed air. The steady increase in the number of hydro-electric power-plants, and the net-work of power-lines that are now reaching all the important mining camps, are largely responsible for this change. For the same reason electric hoisting is being generally adopted, and electricity is being carried underground for lighting and for driving ventilating machinery. Electric-air rock-drills have been proved to be not only successful but economical in several mines. Electric distribution of power being more economical than compressed air, they can be conveniently placed underground for drifts and headings, but in winze-sinking they are not so convenient to handle. The most popular drill of this type seems to be the Temple-Ingersoll. There have been over 60 sets installed in Mexico during the last 18 months; 4 at Guanajuato, 9 at Pachuca, and 6 at Necaxa, besides individual installations at other mining camps. Acetylene lamps are being experimented with at some mines and a few flare acetylene lamps are being used underground for contractors' work. Electric light is largely used for stations and main gang-ways, but cannot be used in headings, as economically and conveniently as acetylene.

During the year the cyanidation of silver ores has been brought to a high state of perfection. The percentage of extraction has been increased while the costs have been lowered. The most noticeable features have been the tendency to increase the crushing efficiency of the mills as a whole, by careful step-reduction in crushing, but there is room for improvement. Single-discharge 5-stamp mortars are still almost exclusively used throughout the silver camps, with a maximum crushing efficiency of 7 to 8 tons, through a 3-mesh screen per 24 hours. The weight of stamps was 1150 lb. The multiple-discharge mortar calls for an excess of water, but this is not a defect in a modern silver mill, owing to the fact that de-watering following the stamps is almost universal practice.

A noticeable feature has been the increased use of mechanical de-watering devices. Callow screens have been used to separate coarse material and de-water it after medium-coarse crushing from rolls or stamps. The increasing use of Dorr mechanical classifiers is noticeable, over 30 having been put into different mills during 1909. These machines consist of settling tanks with sloping bottoms equipped with rakes which serve a double purpose; the pulp is kept sufficiently agitated for the 200-mesh silver to be held in suspension and carried over with the water to the thickeners and on to the cyanide vats, while the coarse pulp is dragged out, de-watered, and is returned to the tube-mills for re-grinding. They increase the efficiency of the tube-mills by giving them a pulp of the required consistence and containing less slime.

Callow de-watering cones are also largely used as thickeners. In the latest plants air-agitation is generally adopted; 101 vats of the type known as Pachuca tanks having been erected in Mexico. In these plants, where the Pachuca tanks have been installed, decantation is hardly practised.

The extraction of the solutions is almost entirely dependent on Moore or Butters filters. Great improvements in details have been made in the Moore filters in the latest plants erected at Pachuca; these have been largely due to the efforts of White & Newcomb. One of the principal features introduced has been the addition of a vacuum reservoir-tank attached to each basket that 'holds' the vacuum while the connections are being broken and re-made, and the baskets being changed. Another valuable improvement is a new form of lever slip-coupling in place of the old screwed joint, for the vacuum connections. Several minor improvements have been made in the leaves, guides, and suspending mechanism; a knife-edge 'V' to the top of each leaf prevents the accumulation of slime and scum which was one of the principal sources of loss. One of the most interesting developments in vacuum filtering, and ore of purely Mexican origin, is the introduction of a new type of filter by Grote & Carter during the latter part of the year. This machine has an appearance not unlike the Ridgway filter. It consists essentially of a series of radial trays arranged about a central axis. The trays are about 4 in. deep and are equipped with filter-bottoms and vacuum-chambers under the filter. The trays are mounted on hollow trunnions and can be completely rotated. The vacuum-chambers connect, through the inner trunnion with radial pipes to the centre column and valve-system. Suitable stuffing-boxes and glands are provided. A large horizontal revolving spider carries all of the trays. The centre column is provided with suitable chambers, and a simple system of valves by which the period of vacuum-release and air-

pressure is applied to each tray as required. As the trays rotate slowly they pass under a pulp-feed distributer, and receive a charge. A short interval is allowed before applying vacuum, in which the coarser sand settles on the surface of the filter-cloth first and the lighter slime on the top. As the tray moves forward the vacuum is automatically applied, then follow weak solution and wash-water, with their respective vacuums. The tray then reaches a point where it discharges, this being effected by a simple tripping-gear which rotates the tray and turns it upside down at the same instant that the compressed air is applied by the central valve and the cake blown off. The tray then completes its revolution, is locked in position, and is ready for another charge and cycle of operations. This filter depends on gravity for the distribution of the pulp over the surface of the filter-canvas, and hence is adapted for coarse sand or for mixed and improperly classified pulp, but its area appears to be too limited for a slime-filter.

GOLDFIELD, NEVADA.

Combination Fraction.—Consolidated.—Florence.

An examination of the workings of the Combination Fraction by outsiders has been permitted by direction of George Wingfield. The present manager will be replaced on January 1 by Charles D. Wilkinson, formerly of the Daisy mine and at present on the engineering staff of the Consolidated Mines Co. No ore of commercial grade is being hoisted and there is not sufficient ore blocked to warrant starting the mill. The mine is now employing 30 men with five power-drills, and the work is confined to development, chiefly at the 500-ft. level.

The installation of additional equipment in the 100-stamp mill of the Consolidated Mines Co. is rapidly nearing completion and by January 1 the plant will be treating 900 tons per day. Early in January, according to the dip of the vein as indicated at levels above, the 1000-ft. west cross-cut should penetrate the vein at something over 500 ft. from the Clermont shaft. The Clermont orebodies are being developed by means of intermediate levels between the 600 and 900-ft. levels. At the 750-ft. level is the richest showing in the mine. The entire orebody samples $500 per ton for 25 ft. in width, and there are large bodies of good mill-ore near the walls. Drifts to the north from the vicinity of the Hampton stope have exposed large bodies of ore at the junction of the Combination and January veins.

The Florence has installed three additional electric transformers. The main shaft will be enlarged to the 500-ft. level and sunk to a depth of 1000 ft. While this work is in progress the mill will be supplied with ore from the Little-Florence lease workings and carried to the mill by aerial tramway. Stopes 12 ft. wide are being opened north of the main shaft toward the old Reilly workings at level No. 7, where good mill-ore is exposed for a distance of 500 ft. The mill is treating 150 to 160 tons per day of $25 ore, and 18 power-drills are being worked in the mine, of which three are sufficient to break ore for the mill.

The men who have secured the Gold Bar claim and workings of the C. O. D. Consolidated Co. under a five-year lease, will probably not begin active operations before the first week in January, when they will clean out the old workings and erect a higher head-frame from which the ore will be dumped directly into the bins of the 50-ton mill which they will build. Shipments of ore have been made recently from the MacKay lease on the St. Ives claim of the Merger Mines Co., from the Black Butte Consolidated, and from leases on the Daisy and Belmont. The Annex shaft on the Poleverde claim of the Jumbo Extension has passed the 750-ft. level. The Grizzly Bear shaft on the Jumbo is at about the same depth; three shafts on the Atlanta are below the 600-ft. level; the Mining & Ore Reduction Co. has resumed work on the Golconda claim of the Consolidated; the Thomas lease on Columbia mountain continues sinking its incline shaft on a good vein carrying a foot of shipping ore; the Lincoln Goldfield lease on the Combination No. 2 has begun development from the 600-ft. Moore shaft farther south; the Daisy is covered with actively working leases; the Golden Pick is exploring near the north line of the Combination.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

F. L. Hess is at Los Angeles.

Whitman Symmes is in San Francisco.

Samuel Newhouse has gone to Paris.

Fred. H. Kay is examining properties in Mexico.

Charles Butters has returned to San Francisco.

C. B. Lakenan has returned to Ely from the East.

A. E. Drucker is on his way from London to San Francisco.

W. A. Prichard is spending the Christmas holidays in San Francisco.

Bailey Willis has returned to Washington from London and Paris.

Will C. Russell is manager for the Rawley Mining Co. at Bonanza, Colorado.

S. H. Ball has opened an office as consulting mining geologist at 71 Broadway, New York.

Frederick G. Clapp has recently been examining petroleum and natural-gas properties in Indiana.

Walter B. Raymond has returned to New York from an inspection of mines in the Western States.

Frank E. Pearce has been superintendent of the Iron Dike mine at Homestead, Oregon, for ten years.

F. M. Field is making a series of tests at the University of Utah in connection with his work for the Homestake mill at Neal, Idaho.

H. F. Evans has been appointed on the advisory board in the department of mining and metallurgy of the United States National Fair.

J. H. Burgin is superintendent for the Talbot Dyewood & Chemical Co. He was formerly connected with the Fresno Magnetic Co., of Fresno, California.

Clifford Wilfley has succeeded P. R. Whitman as superintendent of the cyanide mill of the Virginia & Mexico Mine & Smelter Corporation at Hostotipaquillo, Mexico.

James E. Chapman, formerly of the American Smelters Securities Co., is to become one of the members of the staff of the Cia. Minera de Real del Monte y Pachuca, Mexico.

H. R. Plate, who for two years has been manager for the Gunn-Thompson Co. properties in Ely, has severed his connection with them and will leave for New York the first of the year.

J. A. Taff has resigned from the United States Geological Survey and has accepted a position as geologist for the Southern Pacific railroad. His office is in the Flood building, San Francisco.

S. E. Bretherton has just returned from Mazatlán, Mexico. He examined mining properties and made a successful smelting campaign for the Rey del Bismuto Co. near Culiacán.

T. W. Atterbury will leave the service of the Copper Queen Consolidated Mining Co., at Douglas, Arizona, at the end of the year. He made the general layout of the smelter over eight years ago, and has been in charge of the engineering office at Douglas since it was established. He will go East before taking another position.

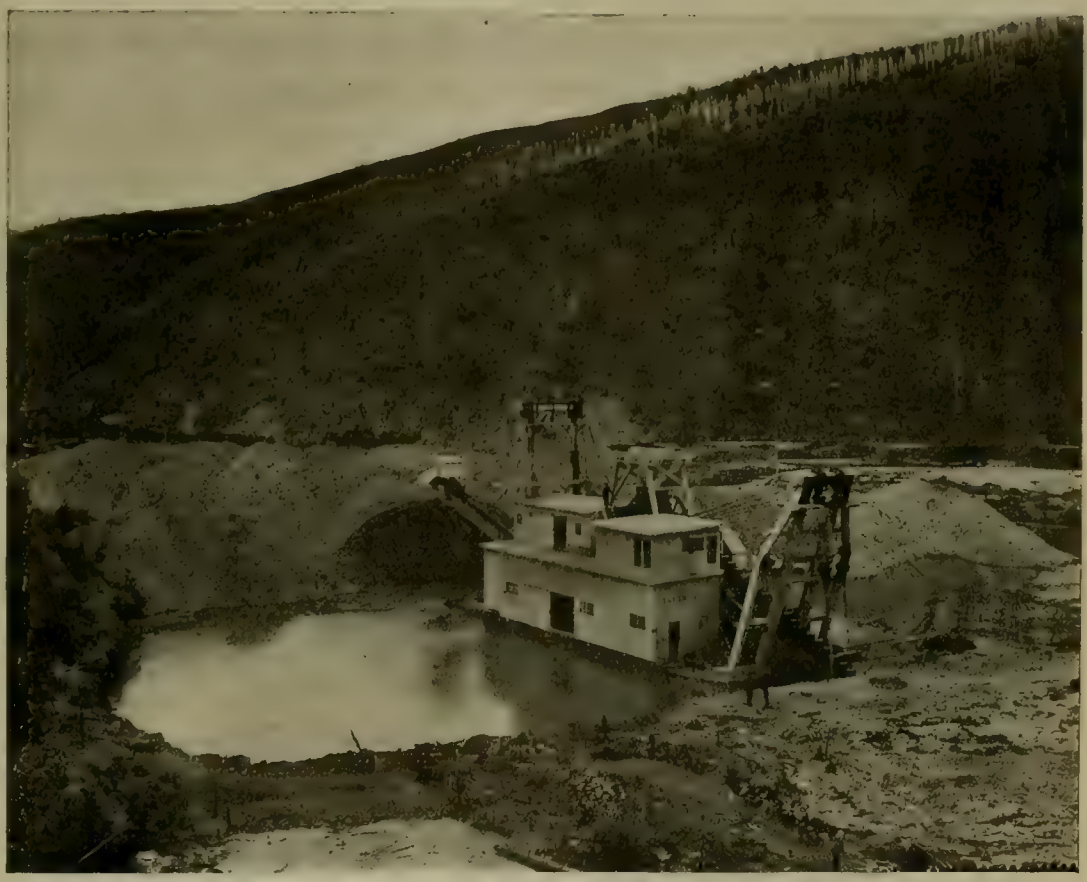
The American Association for the Advancement of Science is meeting at Boston.

The Geological Society of America is meeting at Boston and Cambridge, Massachusetts.

The Montana Society of Engineers will hold its annual meeting at Helena the first week in January.

The Western Association of Technical Chemists and Metallurgists will hold its fifth annual meeting at Boulder, Golden, and Denver, on January 6, 7, and 8. It will include a number of trips to the laboratories of the State University and School of Mines, beet-sugar factories, smelters, and various industrial plants.

GOLD DREDGE MACHINERY



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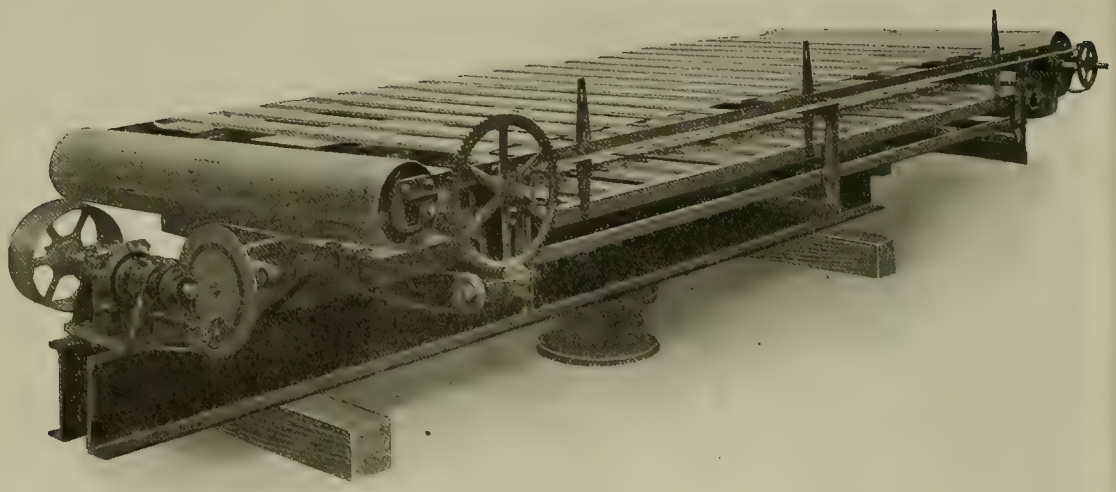

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On the showing that the Craven Slimer made, we were favored with an order for a number of these machines.

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THE CRAVEN SLIMER

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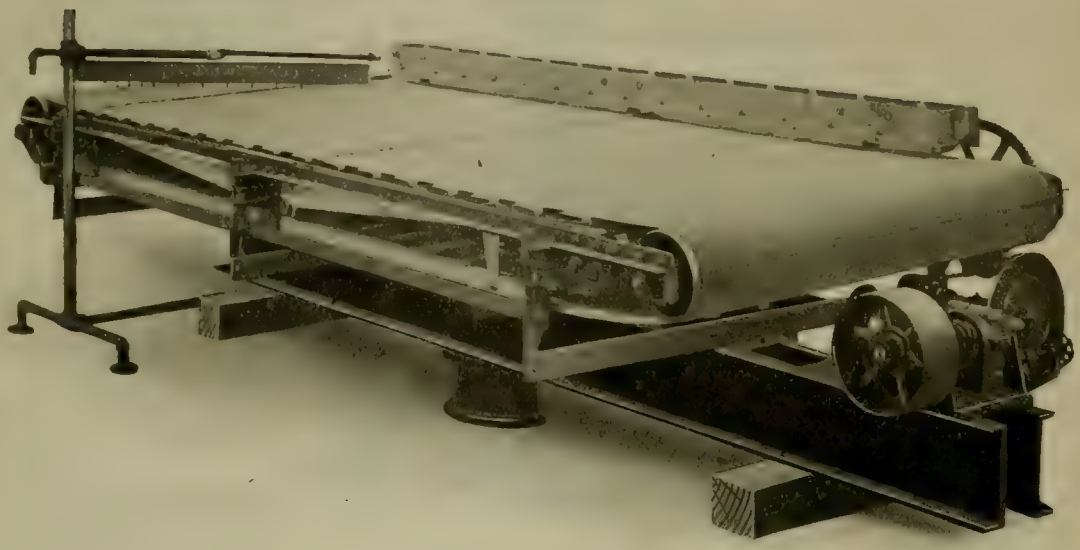
This concentrator has a canvas belt, supported on a flat, smooth, endless moving bed. The belt and table traveling together insures an even surface over which the pulp is fed from one side and discharged from the other side, the values coming out over the end similar to the ordinary vanner.

The entire bed has an end shake.



On comparative trial runs it has been demonstrated that
The Capacity is the largest
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of any slimer on the market

The mechanical construction has been developed to a state of perfection, and is guaranteed.

This machine requires no more attention than the regular type vanner.

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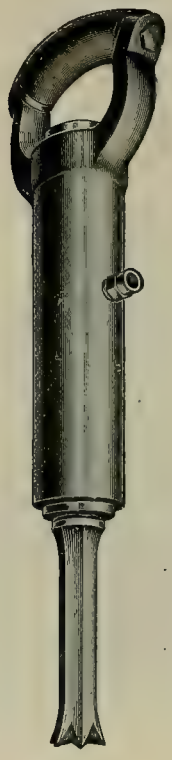

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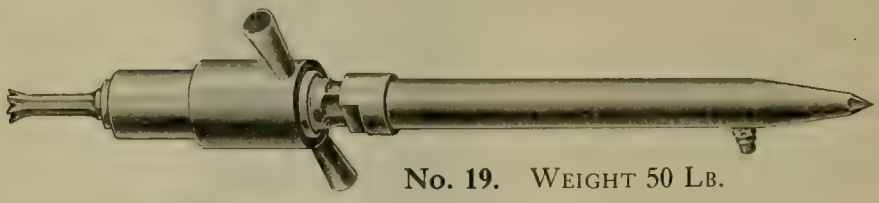

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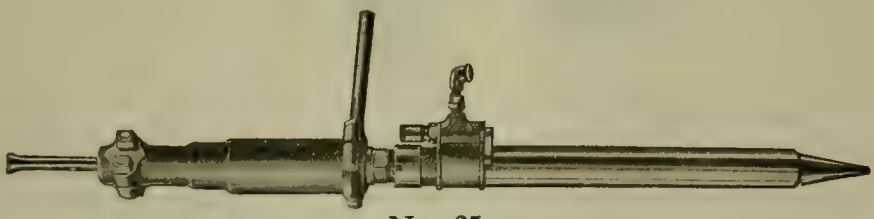

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WONDER STOPING DRILLS

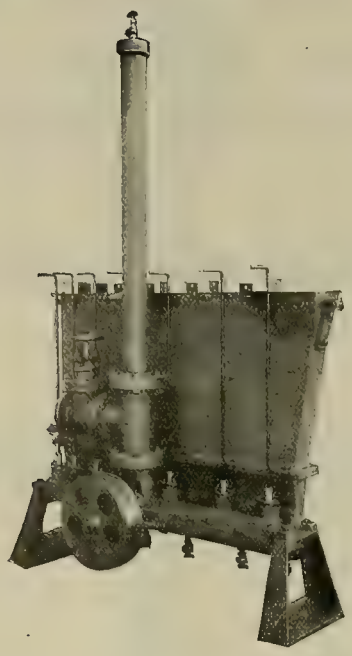
Put a Wonder Drill side by side with any other, compare them point by point, count the number of parts, talk to the men who have run them both and it won't be long until the "also rans" are For Sale or on the scrap pile.

HARDSOCG WONDER DRILL CO.

OTTUMWA, IOWA.

The plans for that concentrating mill you will install this year should by all means incorporate

The Richards Pulsator Classifier



because—

1—It is a Hindered Settling Classifier.

2—It is the only Classifier which discharges the slimes and fines as its first products, before they are so diluted by classifying water that a forest of settling tanks is required for their subsequent treatment. With no over-dilution of slimes and fines, any desired number of classifications may be effected, whereas in other classifiers more than four classes is seldom, if ever attempted.

3—It has an enormous capacity for its size, weight, and cost.

4—It discharges entirely by overflow; no spigots to plug up and give trouble.

5—It has but one moving part (a simple one), and requires but a fraction of one horse-power for its operation.

6—Its products are so perfectly classified that the improvement in both capacity and efficiency of the concentrating machines which treat them is astonishing.

7—If a mill treats, say, 100 tons of ten dollar ore daily, and the recovery is improved by but 2½%, the yearly earnings are increased by $9,000.00.

8—You can never pay a dividend from the values in the creek.

BEFORE YOU FORGET, SEND FOR BULLETIN 1042.

WE DESIGN AND BUILD COMPLETE MILL EQUIPMENTS.

THE DENVER ENGINEERING WORKS COMPANY

DENVER, COLORADO, U. S. A.

SALT LAKE CITY: District Office for - - - Utah, Eastern Nevada, Western Montana, Idaho.
EL PASO: District Office for - - - Eastern Arizona, New Mexico, Sonora and Chihuahua, Mexico.
SAN FRANCISCO: / LOS ANGELES: Sales Agents: Harron, Rickard & McCone for California, Western Nevada, Western Arizona.
MEXICO CITY: Sales Agents: Victor M. Braschi & Co. for Eastern, Central and Southern Mexico.

If coarse concentration be a feature of your milling, you should also have

The Richards Pulsator Jig

because—

1—Its capacity per square inch of screen surface is more than One Hundred times as great as that of Harz jigs.

2—It uses from one-third to one-half the water required in Harz jig practice.

3—Its power requirement is infinitesimal compared to that of Harz jigs. In one mill our jig consuming about ¼ H. P. replaced Harz jigs that required 21 H. P.; a saving of about $2,000 yearly.

4—Our jigs are so small, so light, and so compact that they may be installed on a light floor above the recrushing machines. The middlings go to the recrushing units by gravity—not by elevators. All original and recrushing rolls may be on the same bench. This makes a compact, easily managed mill and saves enormously in floor space and consequently in cost of buildings. Our last 100 ton mill with Harz jigs required 6,200 sq. ft. ground area. A recent 100 ton mill with Richards jigs required 3,100 sq. ft. ground area.

5—The loss of mineral by attrition in the beds of other jigs is always appreciable and frequently serious. It is almost nothing with the Richards jigs.

6—The jigs are made in different sizes and types to suit a wide range of operating conditions.

BULLETIN 1041—THE RICHARDS PULSATOR JIG.

WE DESIGN AND BUILD COMPLETE MILL EQUIPMENTS.

THE DENVER ENGINEERING WORKS COMPANY

DENVER, COLORADO, U. S. A.

SALT LAKE CITY: District Office for - - - Utah, Eastern Nevada, Western Montana, Idaho.
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LOS ANGELES: }
MEXICO CITY: Sales Agents: Victor M. Braschi & Co. for Eastern, Central and Southern Mexico.

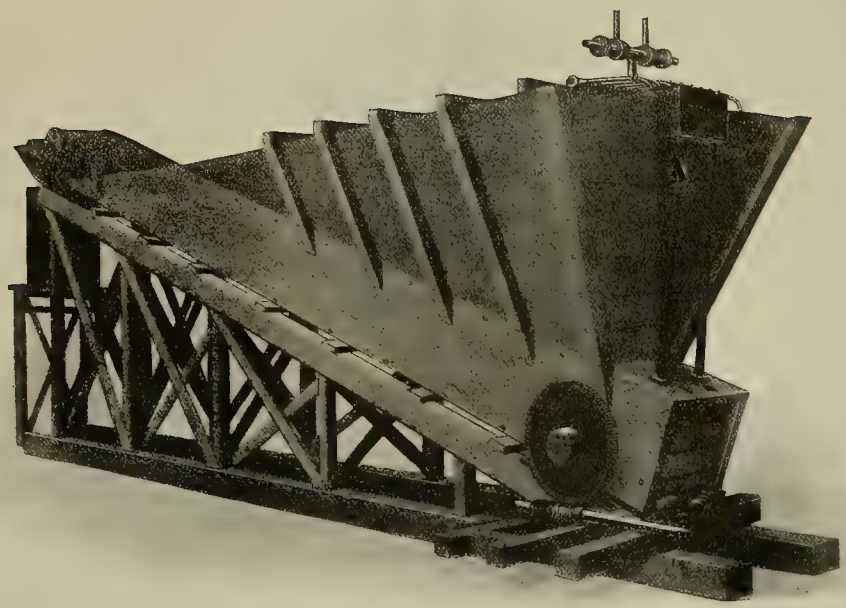
THE

Slimes Treatment Co. Ltd

Incorporated in Canada

The Natural Settlement Method of De-Watering and Recovery of Cyanide Solution from Slime Pulp

THE SLIME SETTLER



A Simple and Continuous Method of Dewatering Slime and recovering Gold-bearing Solution without loss

The Plant illustrated has been in operation at the Queen Mine, at Sheep Creek, British Columbia, for six months, handling 100 Tons Slime per 24 hours, all of which passed 100-mesh and 70% passed 200-mesh, the discharged slime contained 27% moisture. The machine requires little power and works to full efficiency even if pulp is not of uniform fineness, achieving the best results obtainable by Vacuum Filtration without the attendant complexities.

BOX 1094 NELSON, B. C., and 30-31 ST. SWITHIN'S LANE, LONDON, E. C.

THE

Slimes Treatment Co. Ltd

Incorporated in Canada

The operation of the Slime Settler is based upon natural principles by reason of which the many difficulties dependent upon artificial means of separation are eliminated.

Slime in Suspension is held up by the slime below it. The Slime Settler removes the cause of retardation to settlement by removing the slime below.

The further advantages which may be claimed for this process are:—

(1) **Extremely low cost of construction;**

(2) **Absolutely continuous operation;**

(3) **Perfection of washing;**

(4) **Reduction in the percentage of moisture in the discharged solids.**

(5) **Elimination of all filtration costs** proper. The only charge against the process in this respect being for a small amount of power. Special attention is entirely unnecessary.

(6) **Its adaptability to material of any degree of fineness.** It is of no importance whether the pulp contains sand, or slime, or sand and slime. Uniformity of material is non-essential.

The 100-ton Plant in British Columbia has been inspected by several engineers, all of whom have expressed their gratification at the results attained.

As substantiated by these opinions the claims submitted for this process are based upon its novelty and simplicity, and the universal need of such a continuous method.

COPY.

THE CANADIAN METAL COMPANY, LIMITED.

Riondel, B. C. August 10th, 1909.

R. S. Lennie, Esq., Secretary,
Slimes Treatment Co., Ltd.,
Nelson, B. C.

Dear Mr. Lennie:

At your request, I have concluded to write as below concerning my opinion as to the merits of the process and apparatus of Mr. H. G. Nichols, devised primarily for the separation of slimes from cyanide solutions. I have hesitated to express myself formally in this matter for the reason that I am financially interested in your company. To those who know me and who may see this letter that fact may make no difference; but to those to whom I may not be known, please let the statement of my interest be reiterated.

We are concerned essentially with Mr. Nichols' scheme for obviating, or reducing as much as possible the difficulties attendant, in present practice, upon the separation of those very finely divided particles of (gold) ore—conveniently but indefinitely called slime—from the solutions of precious metals in cyanide with which such slime is mixed. The difficulties are quite too well known to those concerned to need recounting here. Suffice it to say that Mr. Nichols' plan seems to have attained its end in his development of a process and apparatus which makes the desired separation quickly, simply, cheaply, effectively.

I am justified in making this statement by my recently having taken occasion to study the operation of the hundred-ton plant erected by Mr. Nichols at the "Queen Mill," Sheep Creek, B. C. As a result I was impressed chiefly by two things.

1st. That slime particles, however fine, will settle quickly from the solution or wash in which they have been suspended, when assisted to do so by the immediate removal, on a belt, of those particles which have previously settled to it, thus decreasing the average density of the medium—of which, be it noted, there is no appreciable internal movement. In other words, the principle of "free settling" has been employed and its simplicity and effectiveness for the purpose are beautifully shown. Thus it is obvious that Mr. Nichols' process is a reversal of common practice—of vacuum filtering because agitation is not maintained, of decantation because essentially the solids are removed instead of the liquid, and of both because it is absolutely continuous.

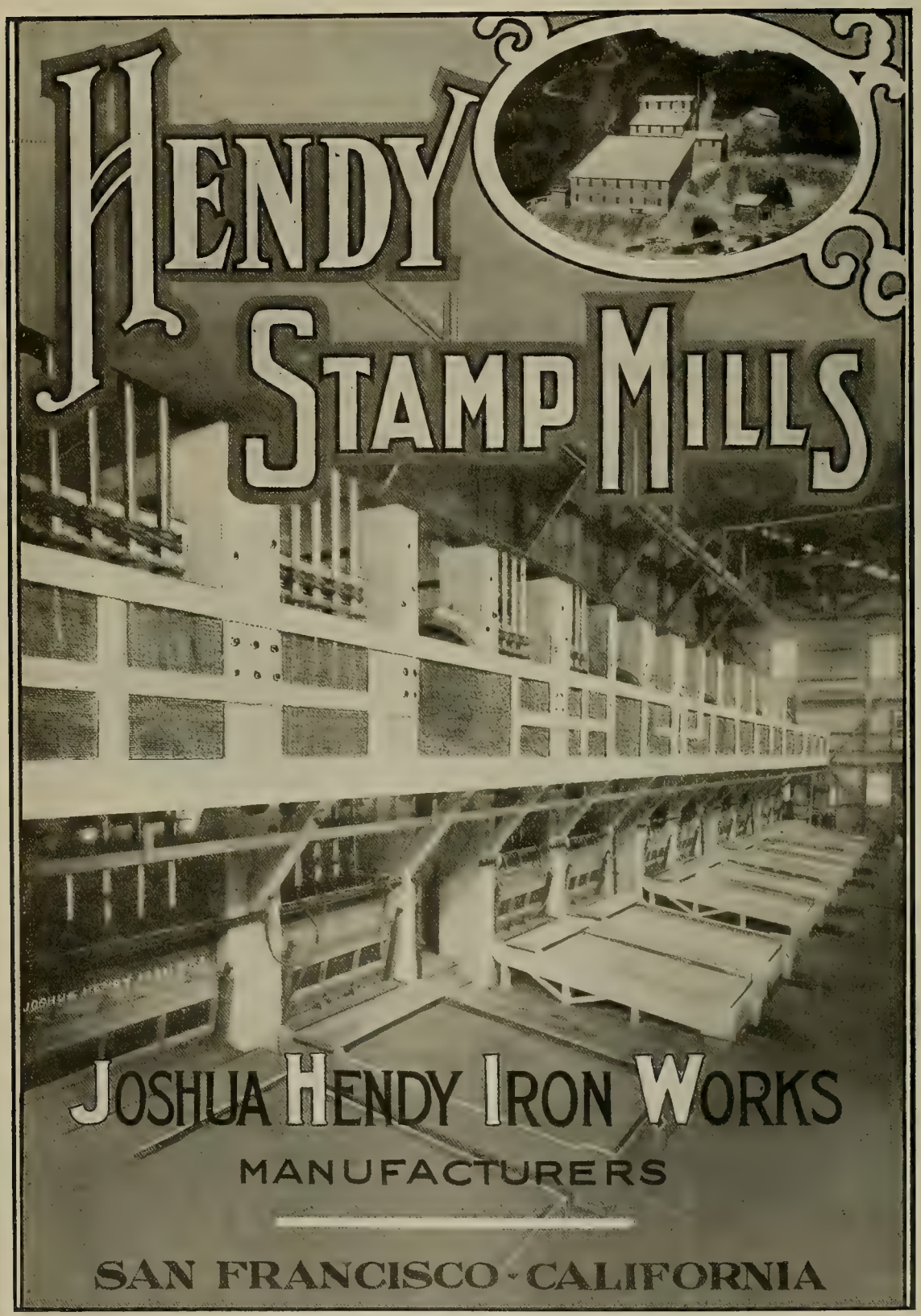
2nd. The compactness and comparative cheapness of the apparatus and the ease of its operation make difficut any comparison with other methods of separation, for we are not concerned with leaching and percolation. Lowness of first cost and of operation is the quality which quickly and directly appeals to those concerned with the installation of any plant or process, and it requires but a glance at the hundred-ton unit erected at the "Queen" to convince one that it possesses that quality. As to the effectiveness and speed of operation, I can say little more than that I was astonished. It was quite incredible before I saw, that a 24-inch flanged belt traveling at six feet per minute up an eighteen degree slope could or would deliver a ribbon of finest slime more than an inch thick containing less than thirty per cent moisture at the top. I did see all this, however, as an operating process and apparatus, and I am convinced not only of the utility of the method, but of its superiority over any yet devised.

Sincerely yours,

(Signed) SAMUEL S. FOWLER, E.M., M.I.M.M., M.M.M.S.A., etc.

For Additional Information and Details Write

BOX 1094 NELSON, B. C., and 30-31 ST. SWITHIN'S LANE, LONDON, E. C.


HENDY
STAMP MILLS
JOSHUA HENDY IRON WORKS
MANUFACTURERS
SAN FRANCISCO · CALIFORNIA

HENDY MILLS ARE STANDARD

THE 4 DISCHARGE INDIVIDUAL MORTAR MILL IS ONE OF THEM.

THESE MILLS HAVE ESTABLISHED A REPUTATION AND WHEN WORKING UNDER FAVORABLE CONDITIONS CAN DO MORE WORK THAN ANY OTHER MILL.

We make no extravagant or exaggerated statements as an inducement to sell this Mill.

It is patented. We own it, and you do not have to pay an exhorbitant price on this account.

A safe, honest piece of machinery, manufactured and put together at our own works, and sold as a standard commodity in conjunction, if desired, with other dependable machinery designed to make money out of your mine if the values are there.

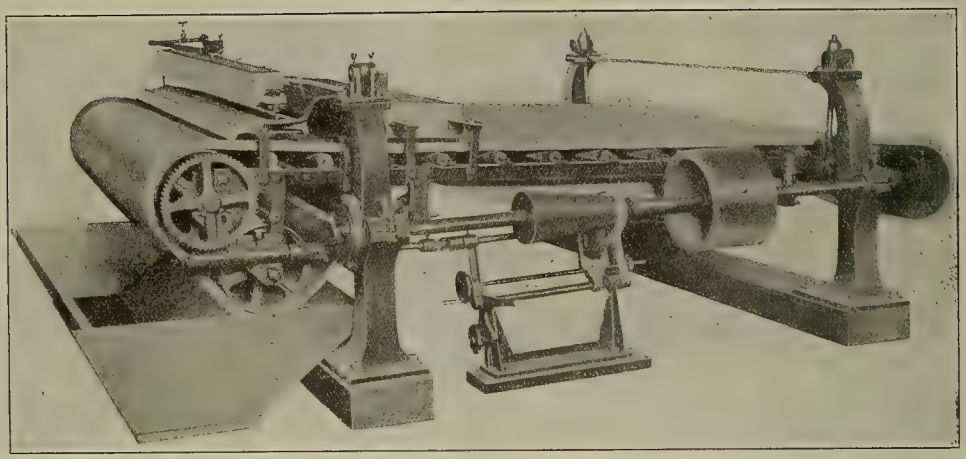
Your success is ours. One good installation sells another. This space does not permit of a lengthy description—our catalogs and salesmen do that. This advertisement serves merely to illustrate the general design, and to attract your attention to the article.

ONLY MANUFACTURED & SOLD BY

JOSHUA HENDY IRON WORKS

SAN FRANCISCO, CAL. U.S.A.

THE RISDON-JOHNSTON CONCENTRATOR



The Millman who is interested in perfect concentration should consider the successful operation of the many concentrators we have built.

The thorough mechanical construction of every part warrants better work and increased capacity.

The RISDON-JOHNSTON METHOD of table suspension prevents the heavy loss caused by the collection of the pulp on the edges of the belt on side-shake concentrators.

The non-parallel suspension construction gives a slightly undulating motion similar to that of a miner's pan, giving a top wash to the sands, while holding the concentrates undisturbed on the belts.

The improved pulp-feeding device produces an even distribution which promotes speedy and sure separation of the sand and concentrates.

Send to us for Catalogue No. 14, if interested.

Risdon Iron Works

298 Steuart Street, San Francisco, Cal.

RISDON DREDGES

RISDON DREDGE ON SOLOMON RIVER, ALASKA.

Property of the Nome-Montana-New Mexico Mining Company.

Detail reports just to hand show that the above 5 cu. ft. bucket installation on the Seward Peninsula, Alaska, operated 143 days the past season, or 17 days longer than any other in the district.

This machine holds the record for running time, yardage and gold extraction.

It also shows the lowest operating costs.

It was erected in 50 days and operated 55 days of that same season.

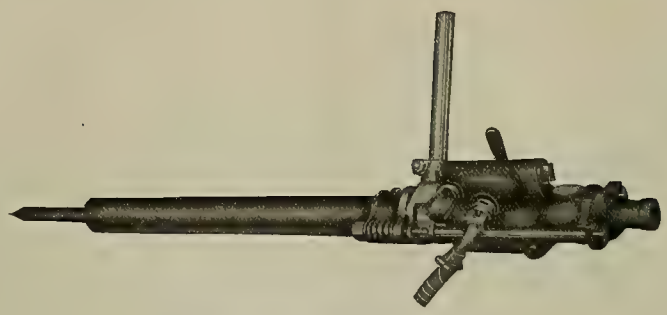
Risdon Iron Works

298 Steuart Street, San Francisco, Cal.

THE LEYNER BULLETIN

January 1 Littleton, Colo., U. S. A. 1910

A POINTED COMPARISON.



No. 5 LEYNER STOPER.

After the Leyner Stoper **had been in continuous service for five months** and the two competitors' machines had been at work **less than two weeks**, the following results were tabulated by one of the largest copper mines in the world:

September, 1909.

	No. of Holes	Feet Drilled	No. Shifts	Ave. Per Shift	No. Steels Broken	Footage Per Cent
No. 5 Leyner.....	159	1141′	39	29.3′	9	100%
Competitor No. 1....	160	1094′	46	23.8′	38	81%
" No. 2....	103	665′	27	24.6′	45	84%

EPITOME.

1. Continuous five months' service.
2. Greater drilling efficiency, compared with new machines.
3. Steel breakage 1 to 4 and 1 to 5 respectively.

Send for our Bulletin No. 1002, which describes this drill and tells **why** it "stays underground," drills more, breaks less steel and costs less for repairs than **any other stoper**—bar none.

MADE BY THE HAMMER DRILL PIONEERS

The J. Geo. Leyner Engineering Works Company

General Offices and Works: LITTLETON, COLO., U. S. A.

BRANCHES OR AGENCIES IN PRINCIPAL MINING CENTERS.

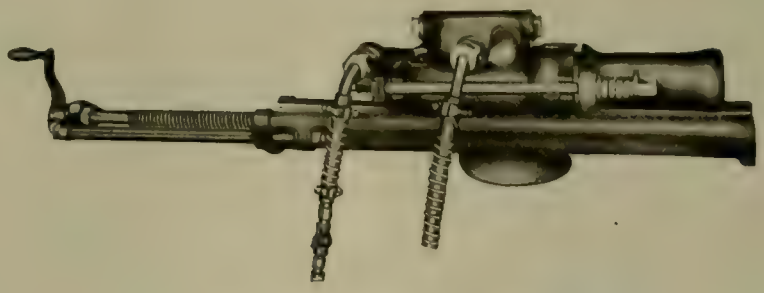
Manufacturers of a complete line of HAMMER DRILLS covering the entire field of rock drilling: Drill Sharpeners, Air Compressors, Oil and Coke Furnaces, Steam and Electric Hoists, Cars, Cages, Skips, Etc.

ASK FOR THE CATALOGUES

THE LEYNER BULLETIN

January 1 Littleton, Colo, U. S. A. 1910

3⅔ to 1 and 3½ to 1



No. 7 WATER LEYNER DRILL.

The Actual Figures Of A Test

"We ran the first week in a 'steel ore' drift, 8'x8', driving the heading 22' 4" in 6 shifts, or an average square up of 3' 8⅔" per shift, against a former best progress by two men on a 3¼" piston drill, running two shifts per 24 hours, of 50' per month or about 1' per shift. **This was a ratio of 3⅔ to 1,** power and labor being equal." (Note: Power and labor were **not** equal, however, for the No. 7 drill, weighing only 115 lbs., **requires but one man** and the air consumption is **less than one half).**

"The second week they moved us into a jasper drift, no ore. Here we drove 16' in 5½ shifts or 2' 10" per shift, against a previous progress that month of 25' in 32 shifts or 9½" per shift **by** two piston drills. This was a little over **3½ to 1, with power reduced 50% and labor 33⅓%.** Repair cost for the two weeks—40 cents."

This large company (one of the largest) is now using No. 7 Leyners.

The prevailing low prices of metals have increased our drill business to a wonderful extent, for they have **compelled close attention to mining costs.**

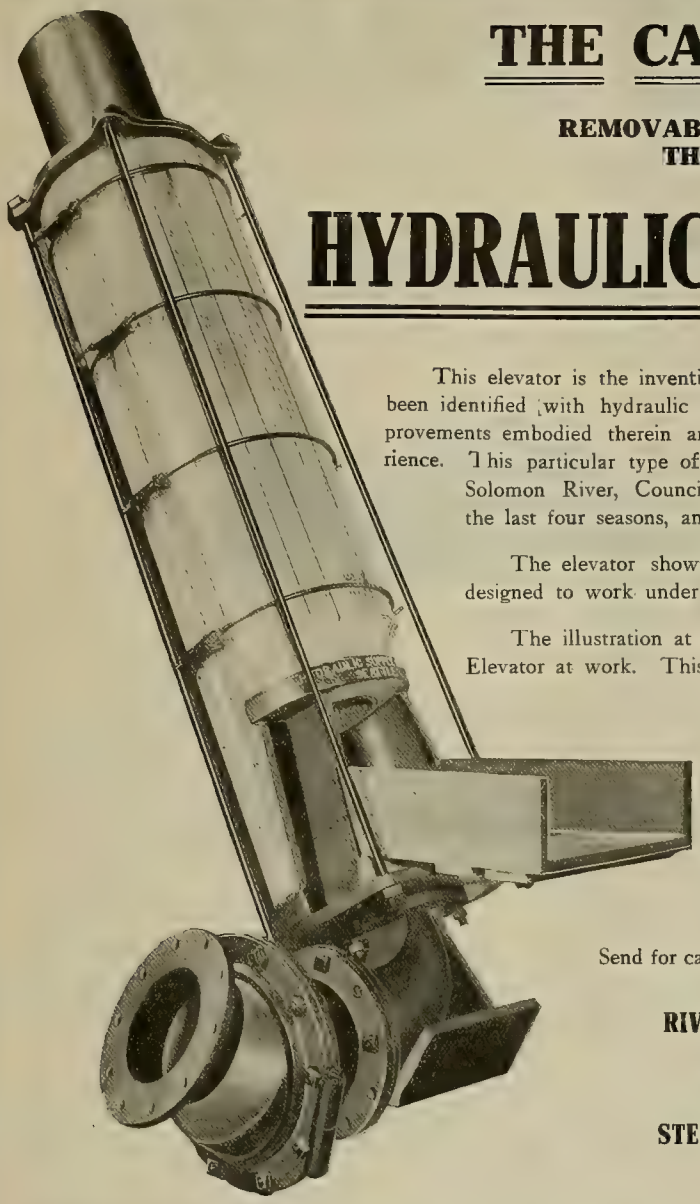
The J. Geo. Leyner Engineering Works Company,

General Offices and Works: LITTLETON, COLO., U. S. A.

BRANCHES OR AGENCIES IN PRINCIPAL MINING CENTERS.

Manufacturers of a complete line of HAMMER DRILLS, covering the entire field of rock drilling; Drill Sharpeners, Air Compressors, Oil and Coke Furnaces, Steam and Electric Hoists, Cars, Cages, Skips, Etc.

ASK FOR THE CATALOGUES



THE CAMPBELL

REMOVABLE CUSHION THROAT

HYDRAULIC ELEVATOR

This elevator is the invention of Mr. R. H. Campbell, who has long been identified with hydraulic mining on the Pacific Coast, and the improvements embodied therein are the result of his large and varied experience. This particular type of elevator has been operated in the Nome, Solomon River, Council, and Teller districts of Alaska during the last four seasons, and has given perfect satisfaction.

The elevator shown here is built of special hard steel and is designed to work under heads of 600 ft. if required.

The illustration at the bottom of this page shows a Campbell Elevator at work. This property is on Glacier creek, 7 miles from Nome, Alaska. The complete equipment was furnished by us.

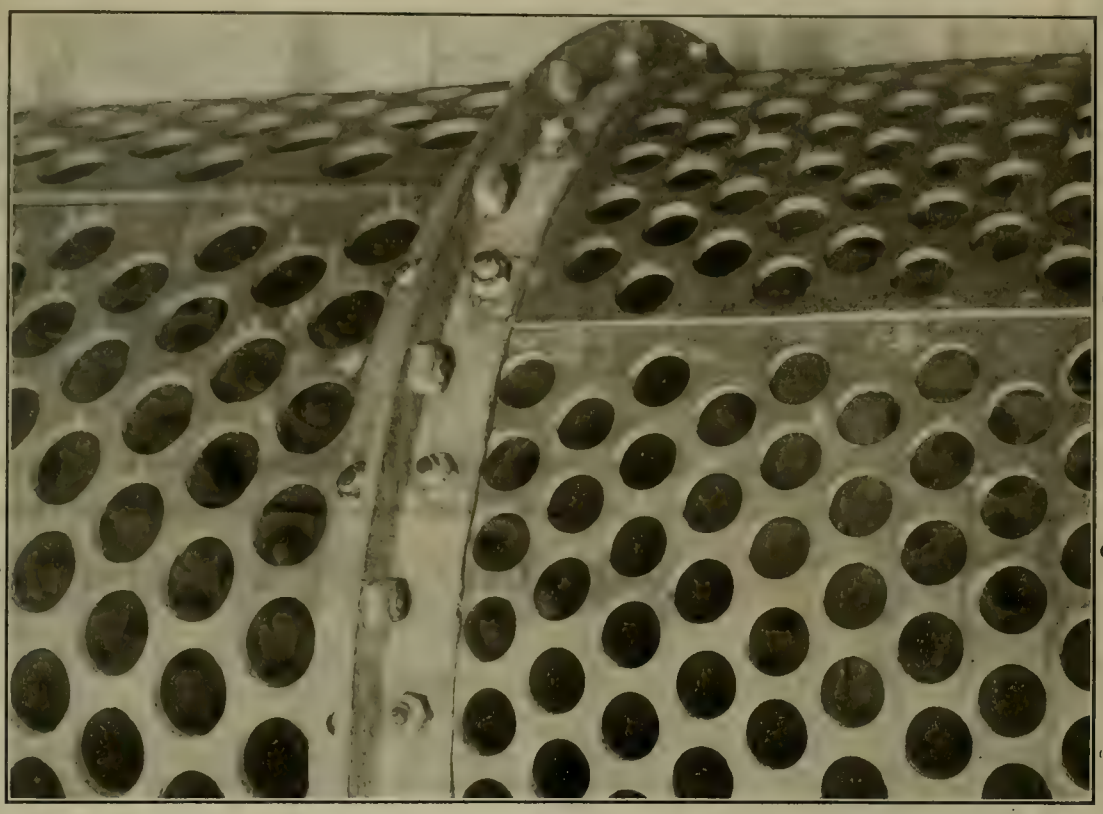
We are specialists in Hydraulic Mining Machinery. We build hydraulic plants to fit the conditions, and absolutely guarantee their efficiency.

Send for catalogue showing our line of

RIVETED IRON AND STEEL PIPE
GRAVEL ELEVATORS
WATER LIFTS
STEEL SLUICES, RIFFLES, GATES AND GIANTS

HYDRAULIC SUPPLY MANUFACTURING CO.
SEATTLE, WASH.

ROLLED MANGANESE STEEL REVOLVING SCREENS



THE CUT SHOWS A REVOLVING SCREEN OF ROLLED MANGANESE STEEL PLATE OF ½-INCH THICKNESS. AFTER HANDLING 10,000 YARDS OF TRAP ROCK THIS SCREEN SHOWED NO VISIBLE OR MEASURABLE WEAR IN THICKNESS, NOR HAD THE PERFORATIONS ALTERED TO ANY GREAT EXTENT. THIS SCREEN REPLACED A CARBON STEEL SCREEN OF ⅜-INCH PLATE WHICH AFTER HANDLING 10,000 TO 14,000 YARDS HAD BEEN REDUCED TO ⅛ INCH AT POINT WHERE CHUTE DELIVERED TO IT. THE HOLES IN THIS SCREEN HAD BEEN ENLARGED FROM $1\frac{3}{16}$ INCHES TO $1\frac{13}{16}$ INCHES AND FROM 2¼ INCHES TO 2⅞ INCHES GREATEST DIAMETER. CUSTOMER STATES THAT IN THE FUTURE ROLLED MANGANESE STEEL SCREENS ONLY WILL BE USED, AND ESTIMATES THEIR LIFE AS FIVE TIMES THAT OF CARBON STEEL SCREENS UNDER SAME OPERATING CONDITIONS. WRITE FOR INFORMATION CONCERNING OTHER ROLLED MANGANESE STEEL PRODUCTS OF THE

MANGANESE STEEL RAIL CO.

MAIN OFFICE: 30 CHURCH ST., NEW YORK

CHICAGO OFFICE: WESTERN UNION BLDG.

D. D. DEM

PACIFIC LUBRICATING STOPCOCKS

RECENTLY IMPROVED AND PERFECTED

This is an ingenious valve for rock drills, air hammers, and coal punchers, whereby a pre-determined amount of oil is fed to the cylinder every time the valve is closed and opened. It delivers the oil to the place where it is of use and does not "plaster the stope." It will double the life of your drill and save five-sixths of your oil bill.

It is the best device of its kind on the market for the following reasons:

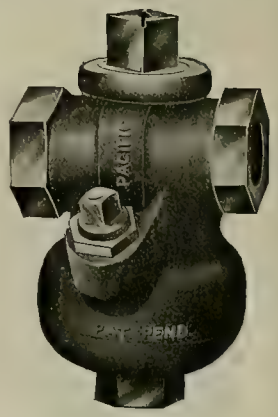
The plug is a true cone, with no pockets in which grit can lodge and grind away the valve seat.

There are no more wearing parts than in an ordinary stopcock.

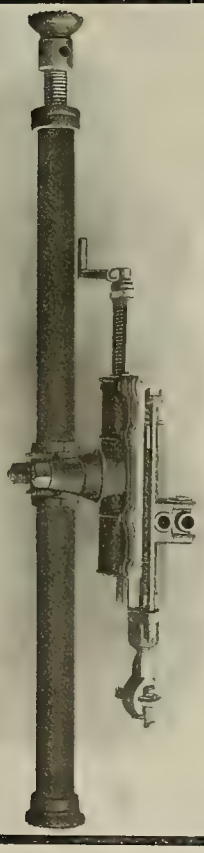
Live air pressure is not necessary to keep the plug tightly seated. The plug will stay in any position, thus giving the operator full control of the air.

The plug is thoroughly lubricated all the time, and as a result the Pacific Stopcock will outlast two of any other lubricating valves and six ordinary stopcocks.

The valve is the strongest, not the weakest part of the air line.



SEND FOR CIRCULAR No. 28.



PACIFIC ROCK DRILLS

A machine particularly designed and built to meet the severe conditions in the metal mines of the Western States. "A special machine which fulfills a special mission especially well."

The shell and cap construction eliminates the "side play" nuisance causing so much trouble in all other makes.

The drill strikes a short light blow at the beginning of the hole, but as depth increases the blow and speed are increased. The full stroke is a hard, rapid, uncushioned, effective blow.

The drill is light and easily handled. The "Baby" weighs only 115 lb. It is quickly set up and particularly convenient in moving around the mine.

We are only too glad to have the Pacific Rock Drill tested on **your work** in competition with any other. If you are interested, write for a proposition. At any rate

Send for Circular No. 30

PACIFIC COAST AGENTS

FOR

Detroit Leather Specialty Co.
Wear Well Leather Packing

George D. Whitcomb Co.
Air Valves and Air Hammer Drills

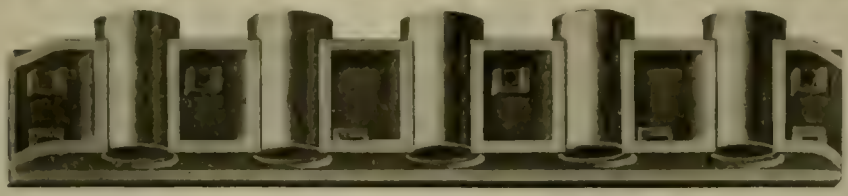
Knight & Co.
Water Wheels and Hydraulic Machinery

CABLE ADDRESS: PACDRILL

503 Market Street

AREST CO.

PACIFIC STAMP STEM GUIDES



Any device which costs less, lasts longer, and gives better service than its predecessor, surely deserves consideration. We make these claims for Pacific Stamp Stem Guides, knowing that they are true. Our assurance is based on a knowledge of their record during the last four years. More than 170 five-stamp batteries in California alone are equipped with these guides.

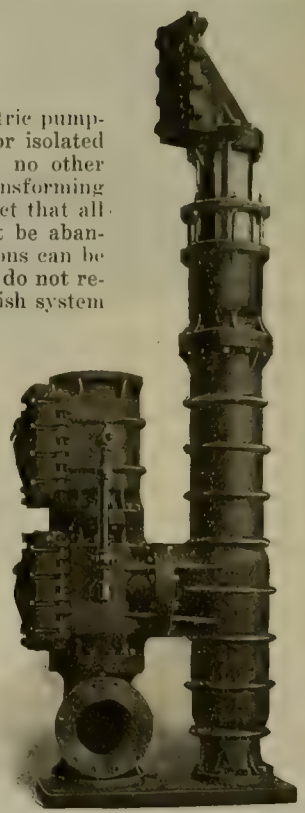
The cut above shows the cast-iron frame with the guide shells proper, in place. The shells are the only parts subjected to wear and can be cheaply replaced. New shells make new guides. Notice that there are no bolts, nuts, set screws, wedges, nor keys which work loose and require tightening. The shells are held in place by the "fit" alone. Any stem can be removed independently of the others.

SEND FOR CIRCULAR No. 27.

CORNISH PUMPS

No one, even the strongest partisans of the so-called "modern electric pumping plants," questions the economy and efficiency of Cornish pumps for isolated plants where the power is developed at the mine. For instance, by no other system can water-power be utilized in unwatering a mine without transforming the energy several times. Among the many other advantages is the fact that all motive power and vital connections are on the surface. If work must be abandoned and the shaft fills up, no damage is done to machinery. Operations can be resumed by simply starting the pump. Cornish pumps are simple and do not require specialists in making repairs or alterations. Then, too, the Cornish system of pumping requires but one pipe line in the shaft.

We make a specialty of Cornish pumping plants and can furnish pumps for station service (illustrated herewith) or for sinking purposes. It is only lately that this latter type has met with favor among American mining men. Let us tell you more about it.



We will be glad to make an estimate on your problem and will guarantee an efficiency for the whole pumping plant that will probably surprise you.

Send for Circular No. 26

MANUFACTURERS OF

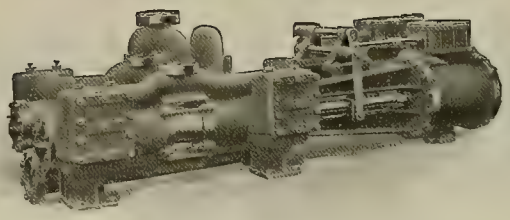
Pacific Rock Drills	Cornish Pumps
Pacific Lubricating Stop Cocks	Complete Stamp Mills
Pacific Stem Guides	Smelting Plants
Complete Concentrating Mills	Air Compressors-- Belted, Corliss Valve, Two Stage.

DEALERS IN

Belting, Shafting and Pulleys, Mine Cars, Cages and Skips, Complete Compressed Air Plants, Steam Engines and Boilers, Gasoline Engines, Electric Motors, Complete Cynanide Plants.

San Francisco, Cal.

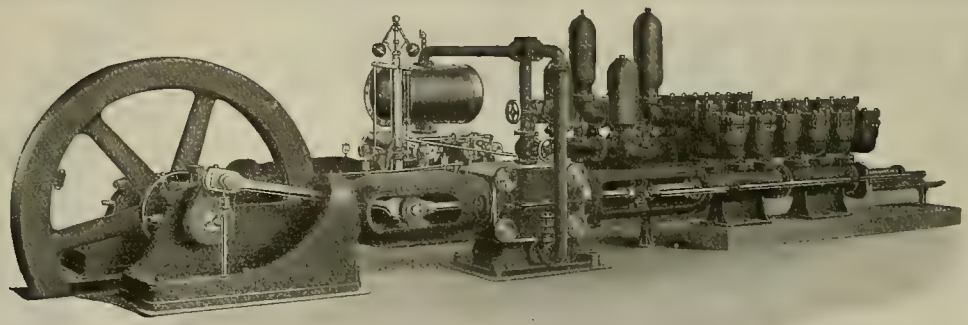
PRESCOTT PUMPS

FROM THE  SMALLEST

Emergency and Development Pump

TO THE LARGEST

High Duty, High Service Station Pump



WE have been intrusted with the building of the largest and highest pressure Mine Pumping Engines in the country.

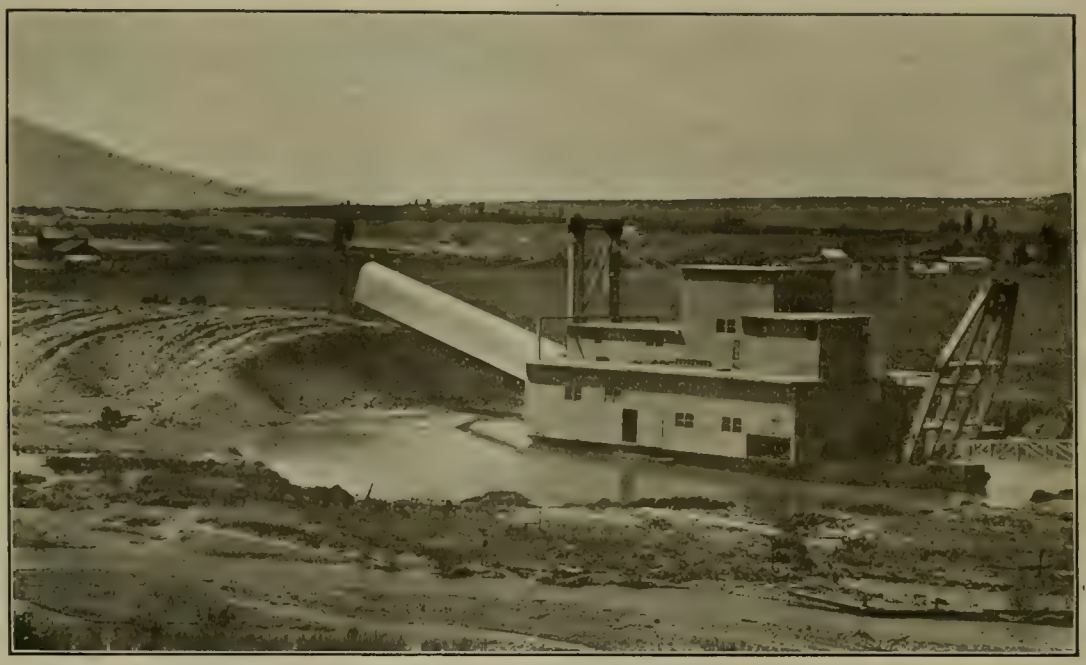
Try the Catalogue Idea—Write for No. 20-G.

FRED. M. PRESCOTT STEAM PUMP CO.

MILWAUKEE, WIS.

DISTRICT OFFICES: EL PASO, TEXAS: ATLANTA, GA: SALT LAKE CITY, UTAH.

MARION
GOLD DREDGES



This dredge is equipped with heating device for cold weather use. The heat passes over the tables and on out over the covered stacker. In preventing the freezing of the gravel as it passes through the boat, over the gold-saving tables, thence on out over the the tailings stacker, the dredging season in cold climates is extended several months and even throughout the entire year.

We will be glad to furnish particulars, and we also invite correspondence relative to installation of dredges and other excavating machinery for placer mining purposes.

THE MARION STEAM SHOVEL CO.

Manufacturers of Steam Shovels, Dredges, and other Excavating Machinery—Steam or Electric; Ballast Unloaders, etc., etc.

MARION, OHIO, U. S. A.

GEORGE W. BARNHART, Western Manager, 718 Monadnock Bdg., San Francisco, Cal.

Professional Directory

(CONTINUED FROM PAGE 26.)

ABADIE, Emile R.,
Mining Engineer.
703 Security Bdg., Los Angeles, Cal.
Cable: Erabad. Code: Bedford McNeill.

ABBOTT, Harry S.,
Mining Engineer.
Nevada City, Cal. Santa Barbara, Cal.

ABBOTT, James W., and Chas. W.,
Mining Engineers.
Pioche, Neveda.

ACKERMANN, Audley H.,
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ADAMS, Henry,
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ADAMS, W. J.,
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ADAMSON, W. G.,
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ADDITON, A. Sydney,
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Cyanide Mill and Plant Construction.
318 Market St., San Francisco,
and Rhyolite, Nev.

ALDRIDGE, Walter H.,
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Trail, B. C. Bankhead, Alta.

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ANDERSON, Robert Hay,
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ARNOLD, Ralph,
Consulting Geologist and Engineer.
Oil Properties a Specialty.
726 H.W. Hellman Bdg., Los Angeles, Cal.
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ATWATER, LINTON & ATWATER
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52 Broadway, New York.
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AUSTIN, L. S.,
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251 West 2nd North Street,
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AUW & ORTIZ CLARCKE,
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Reports on Mines. Ore Shippers Agents.
Apartado 17, Velardena, Durango, Mex.
Code: A. B. C., Fifth Edition.

BABB, Percy Andrus,
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Edificio La Cia. Bancaria, Mexico, D. F.
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BAIN, H. Foster,
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MINING AND SCIENTIFIC PRESS.
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BAIRD, Dudley.
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Care Pacific Foundry Co., San Francisco.
Cable: Smelturgy.

BAIRD, Louis,
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Examinations, Reports, Surveys.
Mill Design and Construction.
Etzatlan, Jalisco, Mexico.

BALL, Sydney H.,
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71 Broadway, New York City.

BARD, Darsie C.,
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BARKER, Wm.,
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BATES, Mowry,
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Chas. M. Becker. Wm. W. Travell.
BECKER & TRAVELL,
Mining Engineers.
Mine Examinations and Managements.
337 Majestic Bdg., Denver, Colo.

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222 Boston Bdg., Denver, Colo.
Formerly State Geologist of Wyoming

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BEMENT, A.,
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BENEDICT, William de L.,
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BERGSTROM, O. H.,
Mining and Copper Smelting.
Knudsen Pyritic Converter Smelting
703 Pike St., Seattle, Wash.

BESLEY, J. Campbell,
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HERMOSILLO, SONORA,
Or Care Banco Occidental, Mazatlan,
Sinaloa, Mexico.
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BLAUVELT, Harrington,
Mining Engineer and Metallurgist.
Prescott, Arizona.
Mines examined and reported upon.

BOSQUI, Francis L.,
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P. O. Box 149, Johannesburg, Transvaal.

BOTSFORD, C. W.,
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Apartado 9, Guanajuato, Mexico.

BRADLEY, D. H., Jr.,
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Specialty: Mining & Milling Machinery.
Examination & Equipment of Mexican
Properties. Parral, Chihuahua, Mexico.

BRADLEY, Fred W.,
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BRANDES, Juan Felix,
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BRAYTON, Corey C.,
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309 Clunie Bdg., San Francisco.

BRETHERTON, S. E.,
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311 Mills Bdg., San Francisco, Cal.
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Tarkwa, Gold Coast Colony.
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Mexican Address: Box 219, Chihuahua.
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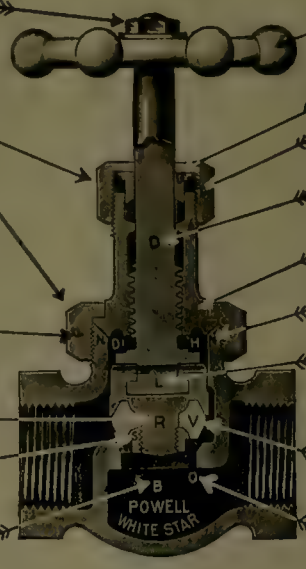
Wheel lock nut
Firm grip hand wheel — painted white
P—Deep stuffing box nut can be repacked under pressure with valve closed or wide open
G—Drive gland follower, in
P—Stuffing box, roomy for packing
a—Hexagon union swivel nut
D—Stem with full acme thread
D¹ and H—Faces on stem and bonnet make steam-tight joint permitting of repacking stem with pressure on and valve wide open
A—Valve bonnet, cone faced
N—Patent beveled ground face
R—Removable disc carrier—protects the upper face of disc while lower one is in use
L—Hole through stem and corresponding groove in carrier R to insert pin for regrinding.
S—Disc lock nut easy to remove
V—Reversible, regrindable white Powellium bronze disc
B—Body shell—note uniform thickness of metal with seat extra thick.
O—Face of beleved seat—note slope, no chance for grit to catch
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WHITE STAR

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FACT FOUR (4)

How It's Done To regrind disc and seat, unscrew nut *a*—pin carrier R to stem through hole L, apply fine sand and rotate back and forth.

FACT FIVE (5)

Beveled Joints The patent beveled ground face connection between bonnet and body neck secured by a hexagon union swivel nut insures an absolutely steam-tight joint under all pressures.

FACT SIX (6)

Stems and Threads The stems are packed with a drive gland in stuffing box, with plenty of room for packing. The long, full Acme threads are all in actual use, and when valve is closed prevent stripping in case of too strenuous use of wheel handle.

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To Repack Stems Stem can be repacked wide open under pressure. The projecting face D¹ on the lower end connects with the corresponding face H on the bonnet, making a steam-tight joint. You don't have to shut off the steam to repack a leaky stuffing box.

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Code: Bedford McNeil.

BROWN, A. H. & DOZIER, C. T.,
Consulting Engineers.
Examination, development, management; ore testing, maps, models, surveys.
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BROWN-TOLMAN ENG. CO.,
Successors to Stone & Brown Inc.,
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Searchlight, Nevada.

BUMSTED, Edward J.,
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Mine examinations and reports.
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El Oro, Estado de Mexico, Mexico.

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Gen. Mgr. Zapopan Gold Mining Co.

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Arthur Howe-Carpenter.
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Mining Reports. Pyrite Smelting.
Cable: Carpenter.

CARPENTER, BRENNON & RYAN
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CHANCE, H. M., Coal.
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932 Equitable Bdg., Denver, Colorado.

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Mines and Mining.
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502 Hyde Block, Spokane, Wash.

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Santa Barbara, Chihuahua, Mexico.

COLE, F. L.,
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Tientsin, China.
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COLLINS, Edgar A.,
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Superintendent Montana Tonopah Mining Co., Tonopah, Nevada.

COLLINS, Edwin James,
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1008-1009 Torrey Bdg., Duluth, Minn.
Mine Examinations and Management.

COLLINS, George E.,
Mining Engineer.
Mine Examinations and Management.
420 Boston Bdg., Denver.
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COX & JUESSEN,
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First National B'k Bdg., San Francisco.

CRAWFORD, Walter Howard,
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Life Member American Institute Mining Engineers.
181 Huntington Ave., Boston, Mass.

CROOK, Charles E.,
Mining and Mechanical Engineer.
Examinations, Reports, Surveys, Mill Design, Construction, and Management.
Hornitos, California.

H. C. Cutler, E.M. C. D. Wilkinson, E.M.
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Mining Engineers.
Reports, Advice, Consultation.
Goldfield, Nevada.
Code: Bedford McNeill.

CURLE, J. H.,
Mine Valuer.
62 London Wall, London.

DAKIN, Fred H., Jr.,
Mining Engineer.
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DAVENPORT, Geo. N.,
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536 Empire Block, Denver.

DAVIS, Wm. H.,
Consulting Metallurgical Engineer.
Examinations and Reports. Mills Designed and Erected. Boulder, Colorado.

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DE KALB, Courtenay,
Mining Engineer and Metallurgist.
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MINING AND SCIENTIFIC PRESS.

DEL MAR, Alex.,
Mining and Consulting Engineer.
(Formerly Consulting Engineer to the U. S. Monetary Commission.)
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DEMAREST, D. C.,
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Plans and Specifications for Mining Machinery.
503 Market St., San Francisco.

DENNIS, Clifford G.,
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Crocker Bdg., San Francisco, Cal.
Cable: Terlinquite. Code: Bedford McN.

DERBY, Chas. C.,
Mining Engineer.
Virginia City, Nevada.
Code: Bedford McNeill.

DEVEREUX, W. B., & SONS,
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Cable: Walbush. Code: Moering & Neal.

DICKERMAN, Alton L.,
Consulting Mining Engineer.
Colorado Springs, Colorado.
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DICKSON, Archibald A. C.,
Mining Engineer.
Rejoulie P. O., India.
Via. Nawadah E. I. Railway.
Cable: Dickson, Nawadah. Usual Codes.

DIGGLES, J. A.,
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With Bewick, Moreing & Co.,
Manager Broken Hill South Blocks, Ltd.
Broken Hill, N. S. Wales.

DIKEMAN, J. M.,
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2511 Dwight Way,
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DORR, John V. N.,
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Specialty: Cyanidation.
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846 Equitable Bdg., Denver. Pluma, S. D.

DOVETON, Godfrey D.,
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Specialist in Milling.
165 Broadway, New York.
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DRUCKER, A. E.,
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With the Oriental Con. Mg. Company,
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H. W. Dubois, Philadelphia, Pa. C. T. Mixer, Salt Lake City, Utah.
DuBOIS & MIXER, Mining Engineers.
302 Harrison Bdg., Philadelphia, Pa.
Cable: Mixerdubos. Code: McNeill.

DUFOURCQ, Edward L.,
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Produce Exchange Bdg., New York.
Cable: Dufourcq. Code: McNeill.

DWIGHT, Arthur S.,
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25 Broad St., New York.
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DYER, H. H.,
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1039 S. Union Ave., Los Angeles, Cal.

EASTON, Stanly A.,
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EDSALL, Burroughs,
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Clay Peters Bdg., Reno, Nevada.

ELDRIDGE, F. O.,
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EMERY, Percy M.,
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Specialty: Dry Washing and Concentrating.
961 E. 16th St. Oakland, Cal.

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Specialty: Cyanidation of Silver Ores.
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Geologic Examinations and Reports.
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EVANS & CRAUFURD,
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42 Broadway, New York.

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202-3 Exchange Bdg., Denver.

FARISH, John B.,
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Cable: Farish.

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FERGUSON, Donald,
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FINLAY, J. R.,
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Specialty: Mill and Power Plant Design and Construction.
75 Fremont St., San Francisco, Cal.

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Cable: Smelturgy.

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FOX, James H.,
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Examinations, Reports and Affidavits.
Advice on Treatment of Ores.
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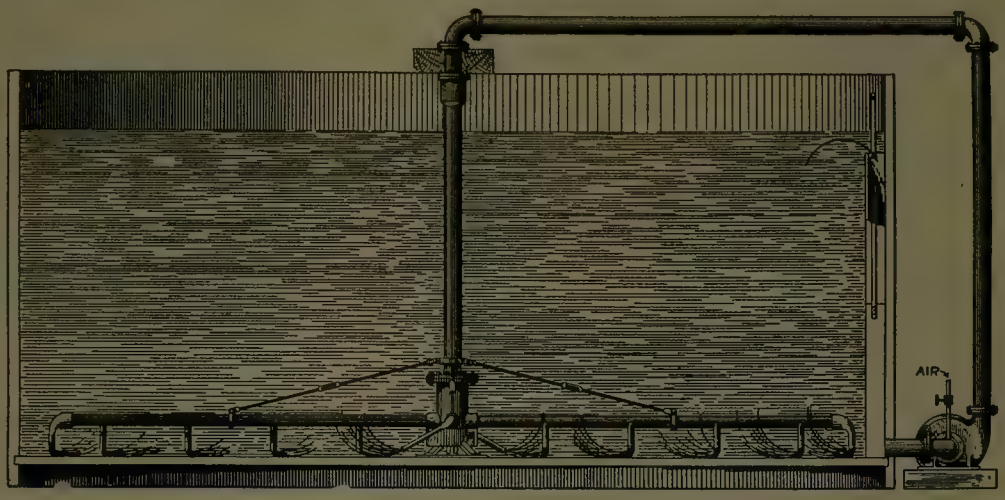

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Mining Engineer.
Consultations, Examinations and Mill Installations.
2280 West 21st St., Los Angeles.

GAMBA, F. Pereira, C.M.E.,
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Pasto, Colombia, South America.
Via Panama y Tumaco.

GARREY, George H.,
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GASSAWAY, A. D.,
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535 I. W. Hellman Bdg.,
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HAMMOND, John Hays,
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71 Broadway, New York.
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HEBERLEIN, C. A.,
Consulting Engineer and Metallurgist.
Calle Arriba No. 68, Zacatecas, Mexico.

HEPBURN, Arthur E.,
Mining Engineers.
317 Winch Bdg., Vancouver, B. C.
Cable: Ruktra. Code: Bedford McNeill.

HERSHEY, Oscar H.,
Mining Geologist.
Kellogg, Idaho.

HERZIG, Charles S.,
Engineer of Mines.
4 & 6 Copthall Ave., E. C., London, Eng.
Cables: Herzig, London. All Codes.

HEYWOOD, William A.,
Consulting Metallurgist.
4 Broad Street Place,
London, E. C., England.

HILL, Alexander,
Mining Engineer.
4 Broad St. Place, London, E. C.
Cable: Truculent. Usual Codes.

HILL, Robt. T.,
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HILLS & WILLIS,
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Cripple Creek. 318 McPhee Bdg., Denver.
Cable: Hillwill. Codes: Usual Codes.

HINDRY, W. E.,
Mining Engineer.
Formerly Manager Esperanza Min. Co., El Oro, Mexico, and Velardena M. & S. Co., Velardena, Mexico.
Examinations, Reports and Management of Mines.
Slavin Bdg., Pasadena, Cal., U. S. A.
P. O. Box 1122.
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HOBSON & CO., Francis J.,
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Cable: Hobson. Code: Bedford McNeill.

HOECK, F. P., **Specialty, Mexican Properties.**
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HOFFMANN, John D.,
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Cable: Tundra.

HOFFMANN, Ross B.,
Mining Engineer.
319 First Nat. Bank Bdg., Oakland, Cal.
Cable: Rosshof.

HOHL, L. J.,
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1834 Delaware St., Berkeley, Cal.

HOLLIS, H. L.,
Consulting Mining Engineer and Metallurgist.
1417 First National Bank Bdg., Chicago.

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Salisbury House, London, E. C.

HOOVER, H. C.,
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HORSFALL, H. A.,
Mining and Mechanical Engineer.
69 Wall St., New York.

HOYLE, Charles,
Mining Engineer.
Apartado 8, El Oro, Mexico.

HUMPHREYS, Llewellyn E.,
Mining and Metallurgical Engineer.
205 Newhouse Bdg., Salt Lake, Utah.
Code: Bedford McNeill.

HUNT, Bertram,
Consulting Chemist and Metallurgist.
Room 709 Mills Bdg., San Francisco.

HUNT & CO., Robert W.,
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Bureau of Inspection, Tests & Consultation.
Chicago–San Francisco–New York–Pittsburg
San Francisco Office, 425 Washington St.
St. Louis–Montreal–London.
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Chemical and Physical Laboratories.

HUNTLEY, Dwight B.,
Mining Engineer and Metallurgist.
31 Bella Vista Ave., Oakland, California.

HUTCHINS, John Power,
Mining Engineer.
52 Broadway, New York.
Cable: Jakuch.

INGALLS, A. O., PH.D., E.M.,
Consulting Mining Engineer.
Mine Examinations & Economic Geology.
Investigation of orebodies and ore treatment. 428 New York Bdg., Seattle.

IRWIN, Frederic,
Mining Engineer.
General Manager, Trade Dollar Consolidated Mining Company,
Dewey, Idaho.

G. B. Jacobs. Julio Posada.
JACOBS & POSADA,
Mining and Metallurgical Engineers.
Mines reported on. Plans and Specifications furnished for Metallurgical Plants.
P. O. Box 229, Chihuahua, Mexico.
Code: Bedford McNeill.

JANES, Byron E.,
Mining Engineer.
Santiago Papasquiaro, Durango, Mexico.
Mine Examinations.
Code: Bedford McNeill.

JANIN & SMITH,
Consulting Mining Engineers.
619 Kohl Bdg., San Francisco.
Cable: Diorite. Code: Bedford McNeill.

JENKS, Arthur W.,
Mining Engineer and Metallurgist.
3909 East Howell St., Seattle, Wash.
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JENNEY, Walter P.,
Consulting Geologist and Mining Engineer.
Cable: Quartz. Box 696, Tonopah, Nev.

JENNINGS, E. P.,
Mining Engineer.
Salt Lake City, Utah.
Cable: Chalcocite, Salt Lake.
Code: Bedford McNeill.

JONES, Charles Colcock,
Consulting Mining Engineer and Metallurgist.
308 Henne Bdg., Los Angeles.

JONES, R. W.,
Mining Engineer.
Cristobal, Canal Zone,
Panama.

KEFFER, Frederic,
Consulting Engineer and Geologist.
With the British Columbia Copper Co., Ltd., Greenwood, B. C.

KEHOE, Henry,
Mining Engineer.
Mine Examinations, Development, Management.
1123 S. Wall St., Spokane, Wash.

KELLER, W. H. SIBLEY, S. D.
Consulting Engineers.
Electrical. Mechanical. Hydraulic.
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KELLEY, Fred G.,
Mining Engineer and Metallurgist.
Examinations, Reports and Metallurgical Construction.
Brooks Arcade Bdg., Salt Lake City.

KENNEDY, E. P.,
Mining Engineer.
Treadwell, Alaska.

KERR, Mark B.,
Consulting Mining Engineer.
Pittsburg Gold Flat Mines Co.
Mills Bdg., San Francisco.
Present address, Nevada City, Cal.

KIRBY, A. G.,
Metallurgist.
Ore testing, mill design & construction.
Specialty—Concentration & cyanidation.
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KIRBY, Edmund B.,
Mining Engineer and Metallurgist.
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KISLINGBURY, George,
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343 Wilcox Bdg., Los Angeles.
Cable: Kislingbury.

KNOX, Newton Booth,
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Care Bewick, Moreing & Co.,
62 London Wall, London, E. C.

LAKENAN, C. B.,
Mining Engineer.
Ely, Nevada.

LAMB, MARK R.,
Milling and Cyaniding Engineer.
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Cable: Marklamb, Milwaukee.
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Gen. Mgr. The Arizona Gold Mines Co., Kingman, Ariz.
Raymond Con. Mines Co., Ohio City, Colo.
408 Ideal Bdg., Denver.

LANAGAN, W. H.,
Mining Engineer.
Nome, Alaska.
Code: Bedford McNeill.

LANCASTER, Joseph,
Mining Engineer.
17 and 18 Exchange National Bank,
Spokane, Washington.

LANDERS, W. H.,
Mining and Consulting Engineer.
Standard Consolidated Mining Company,
Bodie, California.

LANG, H. H.,
Mining Engineer.
Sup't Kendall Gold Mining Co.
Kendall, Montana.

LAWRENCE, Benjamin B.,
Consulting Mining Engineer.
60 Wall St., New York.

LAWTON, E. M.,
Mexican Investments. Lands. Water Powers. Mines. Also U. S. Assay Offices.
Oaxaca, Mexico.
Cable: Lawton. Code: A. B. C., 4th Ed.

LECKIE, J. Edwards,
Mining and Consulting Engineer.
P. O. Box 355. Cobalt, Ontario.

LEFEVRE, Henry F.,
Mining Engineer.
71 Broadway, New York City.
Cable: Quique. Code: Bedford McNeill.

LEGGAT, Alexander,
Mining Engineer.
Examinations and Surveys.
Butte, Montana.
Code: Bedford McNeill.

LEGGETT & HELLMANN,
Consulting Mining Engineers.
15 Broad St., New York City.
519 California St., San Francisco, Cal.
Cable: Legmann.

LEVY, Ernest,
Mining Engineer.
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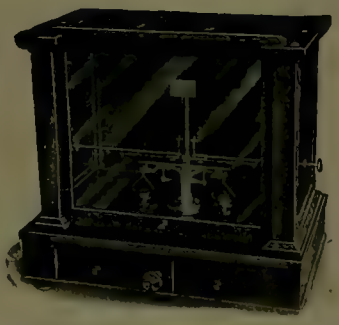

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LLOYD, R. L.
Metallurgist.
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LONG, Frederic H.,
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LORAM, S. H.,
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LORING, Frank C.,
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LORING, W. J.,
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62 London Wall, London.
Cable: Bewick, London. Usual Codes.

LOWELL, Fred L.,
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LYSLE, Walter S.,
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800 H. W. Hellman Bdg., Los Angeles.

MARKS, John H.,
Hydraulic and Mining Engineer.
504 Empire Bdg., Denver, Colo.
Code: Bedford McNeill.

MARSTERS, V. F., F.G.S.,
Consulting Geologist.
Apartado 856, Lima, Peru,
South America.

MAYNARD, George W.,
Consulting Mining and Metallurgical Engineer.
20 Nassau St., New York.

McCAUSLAND, Ross D.,
Mining Engineer.
Apartado 299, Chihuahua, Mexico.

McCORMICK, E.,
Mining Engineer.
Calumet, Michigan.
Examinations, Reports, Management.

McEWEN, Atholl F.,
Mining Engineer.
Box 525, Cobalt, Ontario, Canada.

McKIM, J. W.,
Mining Engineer.
532 Dooly Block, Salt Lake City, Utah.

McLEOD, Howard D.,
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Mining Engineer.
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Mining Engineer.
Mills Bdg., Broad St., New York.
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MERRILL, Frederick J. H.,
Mining Engineer and Geologist.
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MERRILL, Charles W.,
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143 Second St., San Francisco.
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MESSITER, E. H.,
Engineer.
Care Robins Conveying Belt Company,
Passaic, N. J.

R. B. Mildon. B. E. Russell.
MILDON & RUSSELL,
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Nacozari, Sonora, Mexico.

MILLER, Bernard P.,
Mining Engineer.
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MINARD, Frederick H.,
Mining Engineer.
Trinity Bdg., 111 Broadway, New York.
Equitable Bdg., Denver.
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MITCHELL, Deane P.,
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Equitable Building, Melbourne.
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MOORE, Phil H.,
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MYERS, Desaix B.,
Mining Engineer
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Philadelphia Address: 1521 Spruce St.

NAHL, Arthur C.,
Mining Engineer.
Triunfo, Baja California, Mexico.

NEEL, Carr B.,
Mining and Metallurgical Engineer.
525 Newhouse Bdg., Salt Lake City, Utah.

NEILL, James W.,
Metallurgist and Mining Engineer.
159 Pierpont St., Salt Lake City.

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228 Dooly Blick, Salt Lake City, Utah.

NORBOM, John O.,
Mining Engineer.
Berkeley, California.
Cable: Norbom. Code: Bedford McNeill.

NOURSE, C. F.,
Mining Engineer.
Room 416 Crocker Bdg., San Francisco.
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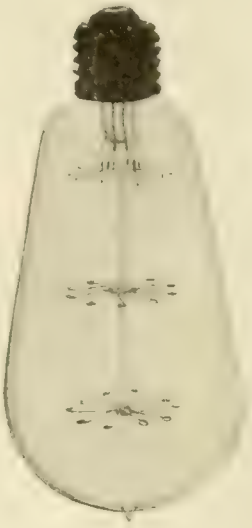

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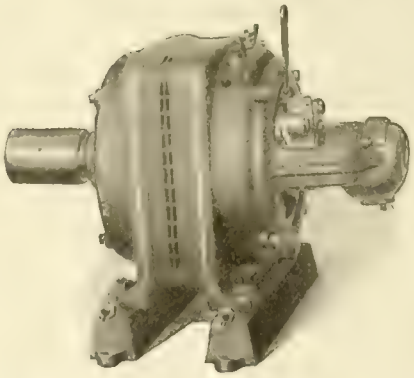

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Professional Directory

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OLDFIELD, Frank W.,
Mining Engineer.
376 Wilcox Bdg., Los Angeles.

ORDONEZ, Ezequiel,
Mining Geologist and Engineer.
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OTTERSON, Geo. W.,
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PACKARD, George A.,
Metallurgist and Mining Engineer.
50 Congress St., Boston, Mass.

PACKER, O. H.,
Mining Engineer.
Room 302 Mills Building,
San Francisco.

PALMER, Cortlandt E.,
Consulting Mining Engineer.
71 Broadway, New York.
Code: Bedford McNeill.

PARKER, Richard A.,
Consulting Mining Engineer.
404 Colorado Bdg., Denver.

PARRISH, K. C.,
Mining Engineer.
Agents, Espriella Hermanos,
Cartegena, Colombia, S. A.
726 Downing St., Denver, Colorado.

PARRISH, S. F.,
Mining Engineer.
Georgetown, Bear Lake County, Idaho.

PATTERSON, H. W.,
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Fairbanks, Alaska,

PAUL, W. H.,
Mining Engineer.
General Manager Dolores Mines Co.
Madera, Chihuahua, Mexico.

PEARSE, KINGSTON & BROWNE,
Consulting Mining Engineers.
Worcester House, Walbrook, London,
and 35 Wall St., New York.
Cable: Undetermined. Usual Codes.

PEMBROKE, Earl R.,
Mining Engineer.
54 West 2d So. St., Salt Lake City, Utah.
Code: Bedford McNeill.

PERKINS, Walter G.,
Metallurgist.
Nevada Consolidated Copper Co.
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PERRY, O. B.,
Mining Engineer.
165 Broadway, New York.

PHILLIPS, Wm. B. & Co.,
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Mining Engineer and Assayer.
Examinations and Reports.
Ketchikan, Alaska.

POMEROY, Wm. A.,
Mining Engineer.
947 Waverly Street.
Palo Alto, California.

PRESCOTT, Basil,
Mining Geologist.
The Charles Butters Companies,
La Union, Salvador, C. A.
Code: Bedford McNeill.

PRICHARD, W. A.,
Consulting Mining Engineer.
Apartado 1060, Mexico City.
Cable: Parallel.

PRITCHETT, C. W.,
Mining Engineer.
2735 Boulevard F., Denver.
Specialty: Examinations in Mexico.

PROBERT, Frank H., (Weed & Probert)
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Consulting Engineer Superior & Boston Copper Company.
819-820 Central Bdg., Los Angeles, Cal.

PROSSER & WALKER,
Consulting Metallurgical Engineers.
42 Broadway,
New York.

PURINGTON, Chester W.,
Mining Engineer.
20 Copthall Avenue, London, E. C.
McPhee Bdg., Denver, Colo.
Cable: Olenek. Usual Codes.

RADFORD, William H., E.M.,
Placer Mining in All Its Branches.
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RAINSFORD, R. S.,
Mining Engineer.
Jackson, Amador County, California.
Manager Argonaut Mining Co.

RAYMOND, Robert M.,
Mining Engineer.
The Exploration Co. of England and Mexico, Ltd. Mutual Life Bdg. No. 523
Mexico City, D. F.

RAYMOND, Rossiter W.,
Mining Engineer and Metallurgist.
29 W. 39th St., New York. P. O. Box 223.

READ, Thomas T.,
Mining and Metallurgical Engineer.
Tientsin, China.
Cable: Lite.

REVETT, Ben Stanley,
Mining Engineer.
Alluvial Mining and Installations.
Breckenridge, Colorado.

RICE, John A.,
Mining Engineer.
19 Mills Bdg., El Paso, Texas.
Code: Bedford McNeill.

RICHARDS, H. De C.,
Hydraulic and Mining Engineer.
Cosmos Club, San Francisco.
Economic Organization & Management.

RICHARDS, Robert H.,
Ore Dressing.
Massachusetts Institute of Technology, Boston.

RICHARDSON, S. H.,
Mining Engineer.
United States Deputy Mineral Surveyor.
Republic, Washington.

RICKARD, Edgar,
Business Manager
The Mining Magazine.
819 Salisbury House. London, E. C.
Cable: Oligoclase. Code: Bedford McNeill.

RICKARD, Forbes,
Mining Engineer.
Equitable Bdg., Denver, Colorado.

RICKARD, Harold,
Mining Engineer.
1805 Ohio St., El Paso, Texas.
Temporary address: Hacienda de Cedros, Mazapil, Zacatecas, Mexico.

RICKARD, T. A.,
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ROBBINS, Hallet R.,
Civil and Mining Engineer.
Mine Examinations and Developments. Power and Hydraulic Engineering.
New York and London References.
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ROBERTS, Albert,
Mining Engineer.
Representative Western Mines Dev. Co.
767 Railway Exchange Bdg., Chicago.

ROGERS, A. P., **Mining Engineer.**
Reports upon Gold Quartz and Dredging Properties.
25 Broad St., New York.
Code: Bedford McNeill.

ROGERS, Allen Hastings,
Consulting Mining Engineer and Metallurgist.
71 Broadway, New York.
Cable Address: Alhasters, New York.

ROGERS, Edwin M.,
Consulting Mining Engineer.
32 Broadway, New York.

ROLAND, Walpole,
Mining and Civil Engineer.
Member Dom. Inst. Ama. Engrs.
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Cable: Roland. Code: Moreing & Neal

ROSS, G. McM.,
Mining and Consulting Engineer.
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ROSS, John Jr.,
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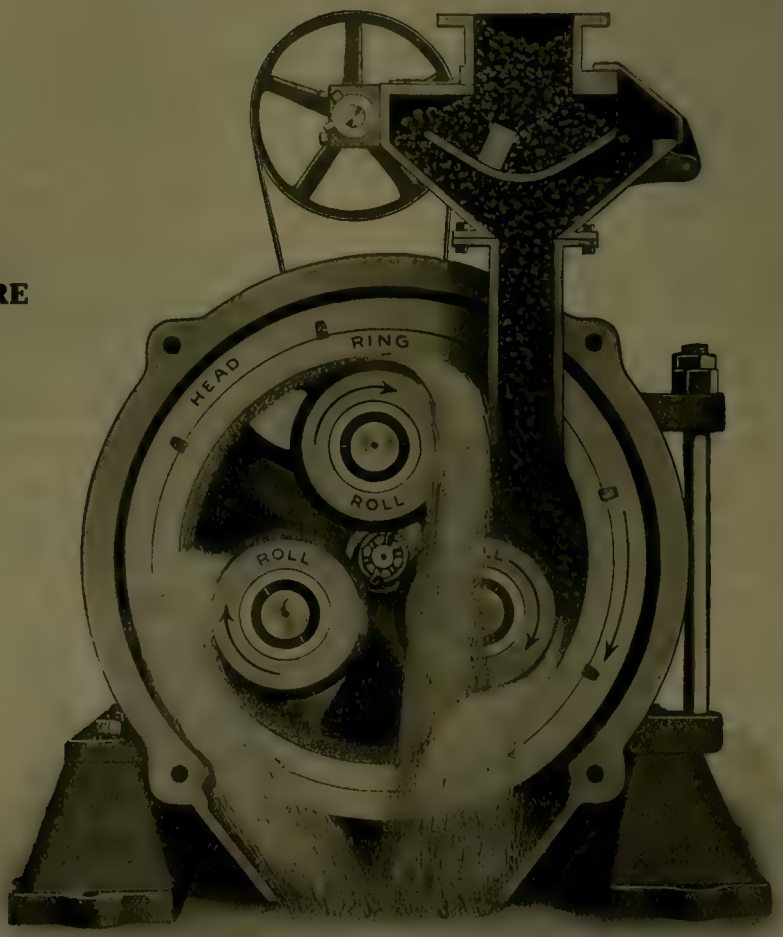

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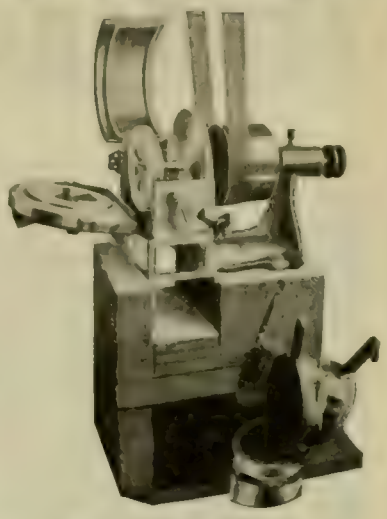

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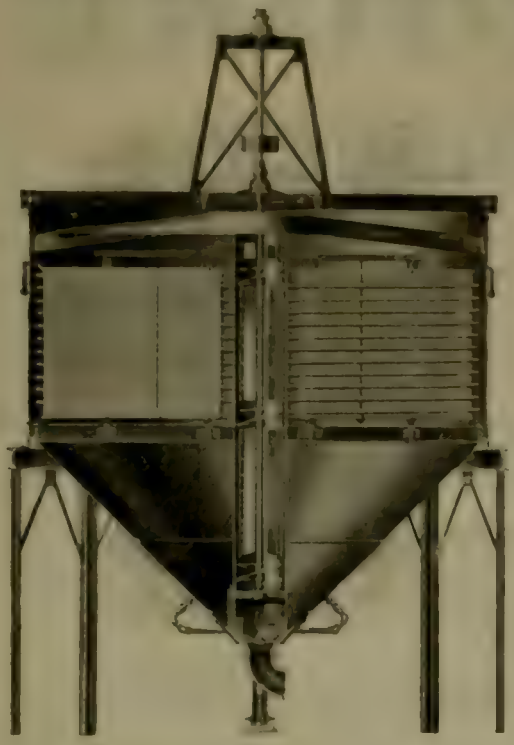

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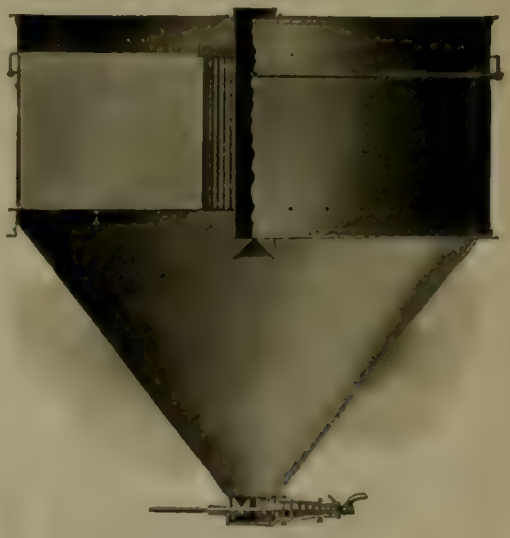

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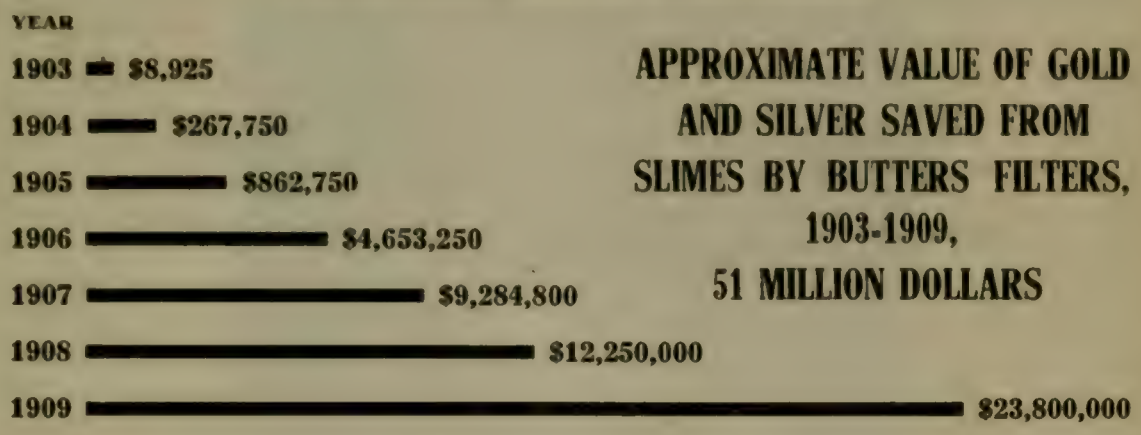

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The **Butters** Filter is handling slime assaying as low as **55 cents per ton,** and has made mines payable that were formerly worthless.

One Manager says:
"We rely entirely on our 'Butters' for profits."

The capacity of Butters Filters in daily use exceeds, by many times, that of all other slime filters in the world put together.

THE BUTTERS PATENT VACUUM FILTER COMPANY, Inc.

333 KEARNY STREET, SAN FRANCISCO, CAL. } Cable: BUTTERS.
30 CHURCH STREET, NEW YORK. }

GANTE No. 1, MEXICO, D. F.

54 NEW BROAD STREET, LONDON, E. C. Cable: ARMISONUS.

AGENTS:

FRASER & CHALMERS,
London and Branch Offices, Paris, Johannesburg, Bulawayo, Sekondi, Singapore, Montreal, Valparaiso, and elsewhere.

FRIED. KRUPP, A. G., GRUSONWERK,
Madgeburg, Germany, and Representatives in London, Montreal, Salisbury (Rhodesia), and elsewhere.

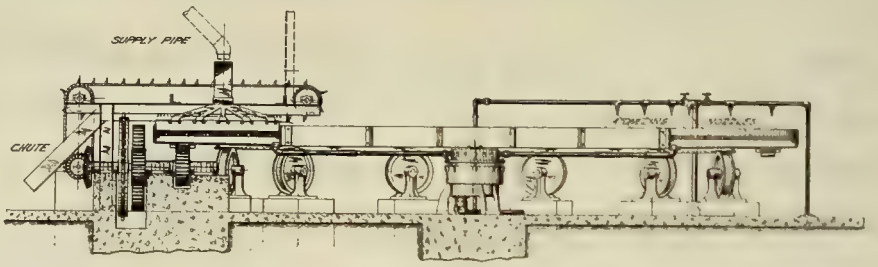
THE SANDYCROFT FOUNDRY CO.,
London and Chester, England.

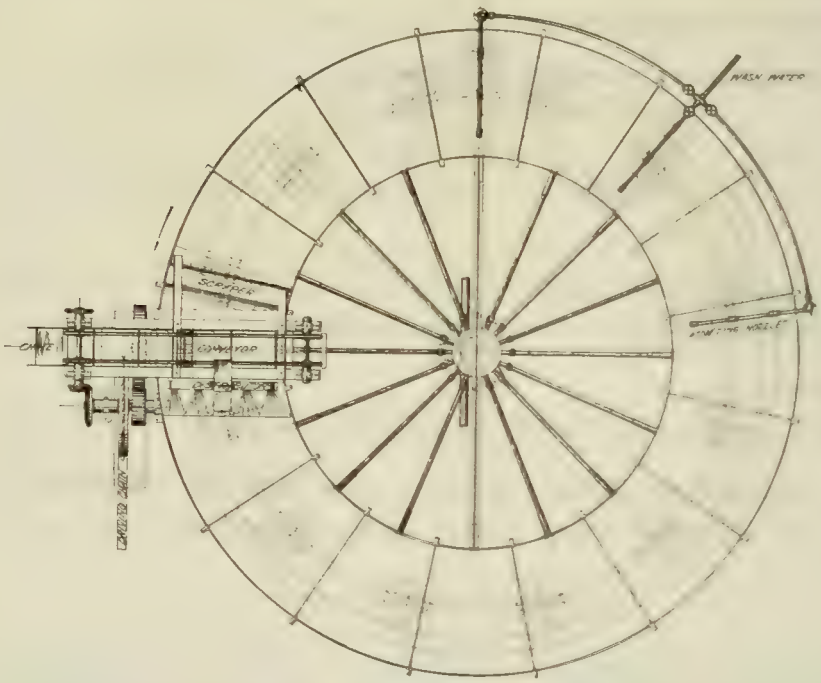
The PARRISH CONTINUOUS FILTER

PATENTED IN 1905

FOR THE TREATMENT OF SLIME AND THE CONTINUOUS COLLECTING OF SAND FOR CYANIDING

The removal of the moisture from sand by vacuum-filtration and the continuous delivery of the dewatered material to the leaching tanks is the latest improvement in cyanidation. It is possible to do this only by employing the Parrish Continuous Filter. Write us for details.





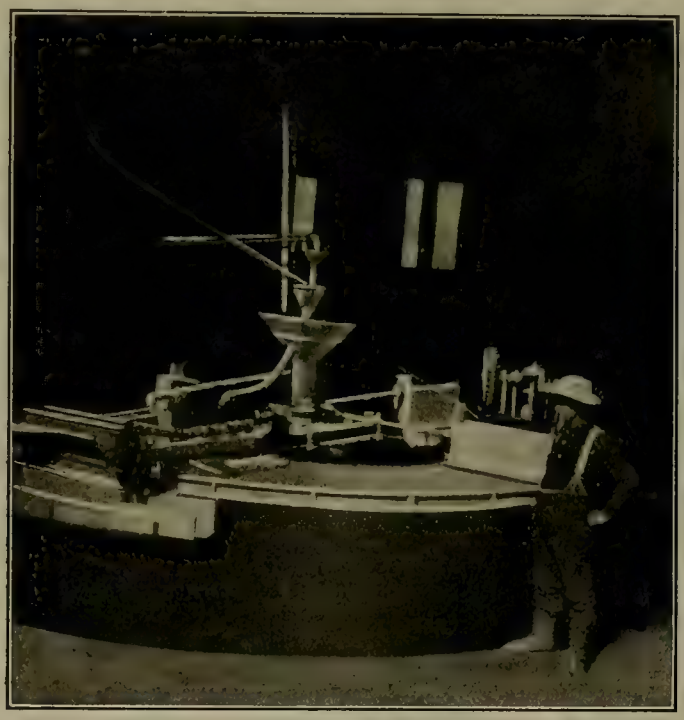
In slime treatment, the machine removes the solution from the sludge and washes and discharges the cake. It automatically separates the strong and weak solution and delivers them to separate storage tanks. The washing of the cakes is accomplished more perfectly and with less water than by any other machine made. The machine is absolutely automatic and requires no attention other than an occasional oiling of the bearings and the replacement of a worn out filter-cloth. The amount expended in one year for labor to operate an intermittent filter amounts to more than the cost of this machine.

MANUFACTURED AND SOLD BY

THE CYANIDE PLANT SUPPLY CO.

61 FREMONT ST.
SAN FRANCISCO, CALIF.
U.S.A.

THE HUNT FILTER



THE HUNT FILTER IN OPERATION

The above picture shows the HUNT FILTER handling product from a 50-ton plant, all pulp passing a 40-mesh screen.

After a Hunt Filter plant has started operating there is no expense for renewals and maintenance. The machine is continuous and positve in action.

HUNT FILTER COMPANY

Office 707 Mills Building **San Francisco, Cal., U. S. A.**

TELEGRAPH: 'HUNTFILTER', SAN FRANCISCO

KEYSTONE

PORTABLE CABLE DRILLS

Nearly Every Engineer or Mining Man is Deeply Interested In Some Phase of Well Drilling.

The following publications are called catalogs because each of them contains a few pages of price list; but they are really TEXT BOOKS, or treatises, on the various branches of the business, having been compiled from the disinterested expressions of reputable engineers in technical journals and elsewhere. A great deal of original material also has been prepared by ourselves. They are printed with good type on fine paper and are elaborately illustrated. Look over the list and see if there isn't something you ought to have in your library. Sent on request.

PUBLICATIONS OF KEYSTONE PLACER DRILL CO.

Catalog No. 1. A 101 page, elaborately illustrated folio on **Water Well Drilling** and machines for the purpose.

Catalog No. 2.—Mineral Prospecting and Placer Gold Testing. Price list of machines and equipments. Folio, 112 pages, profusely illustrated.

Catalog No. 2-B.—A folio pamphlet on our **Percussion Core Drill** and its operation in coal testing.

Catalog No. 3. Keystone Oil Rigs for 1000 to 2500 drilling. Their structure and operation. Price List, etc. Folio, 64 pages. Fully illustrated.

Catalog No. 4.—Keystone Cable Drills for Blast Holes in heavy Railroad Cuts, Canal Excavation, Cement Quarries, etc. Illustrated folio of 36 pages.

NOTE. The 1909 edition of Catalogue No. 4 is just off the press. It contains much new and interesting data.

Prospecting for Copper with Churn Drills at Ely, Nevada, by F. S. Thely. A reprint from the Mining and Scientific Press. An 8-page booklet.

Catalog No. 6.—Downie Deep Well Pumps, single and double acting, steam driven or geared. Designed for lifting large quantities of water from great depths. Illustrated, 64 pages.

Bulletin No. 7.—Gasoline Driller. A 12-page circular, illustrating and describing our new Traction and Non-Traction Gasoline Driven Drills. Gives prices and equipments. Ready Feb. 1, 1910.

Repair List.—A complete list of parts of the machines with prices and telegraphic code.

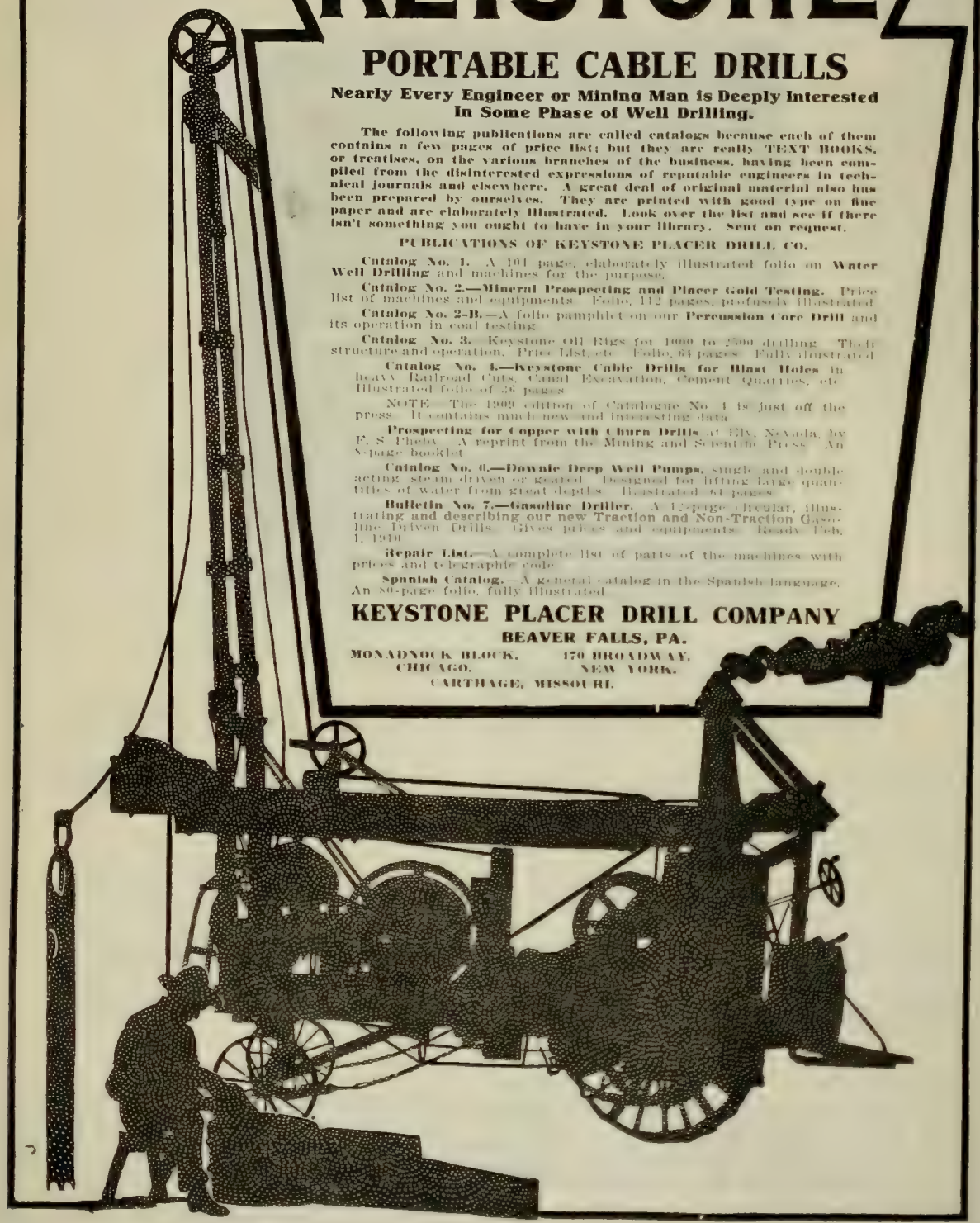
Spanish Catalog.—A general catalog in the Spanish language. An 80-page folio, fully illustrated.

KEYSTONE PLACER DRILL COMPANY

BEAVER FALLS, PA.

MONADNOCK BLOCK, CHICAGO. 170 BROADWAY, NEW YORK.

CARTHAGE, MISSOURI.



GOLD DREDGES

COMPLETELY EQUIPPED

"Three Friends,"

5 cubic foot **Steam Dredge** operating on the **Solomon River**, near **Nome, Alaska**, and digging 6 to 9 feet of **Limestone Bedrock**. Handling **125,000 Cubic Yards** of gravel **Per Month.**

Erected by Us in 1905 and **Completed** ready for operation **in 57 Days.**

Of this dredge Mr. T. A. Rickard wrote in 1908: "This is the one perfectly sane, sound, and successful dredging operation on the Seward Peninsula."

FOLSOM No. 6

8½ cubic foot electrically driven close-connected bucket dredge, equipped with new type **Double Bank Gold-Saving Tables** and **Hydraulic Monitors. Successfully** handling the hardest ground known to the dredging industry, 75 ft. deep, and treating **165,000 Cubic Yards** of gravel **Per Month.**

We are always glad to consult with you on any project requiring **DREDGES, ROCK-CRUSHING PLANTS** or **BELT-CONVEYORS.** Our Engineers are specialists in these lines.

WRITE TO US.

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CODES { Western Union. / Bedford McNeill.

AGENTS ROBINS CONVEYING BELT COMPANY

ORE, STONE, COAL AND DREDGE CONVEYORS

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FOR OPERATION WITH

STEAM, COMPRESSED AIR OR ELECTRICITY

MOUNTED UPON

TRACTION OR CAR WHEELS

THEW SHOVEL FOR UNDERGROUND MINES.

The THEW full circle swing shovel offers special advantages for many classes of mining operations. Although most widely popular for light work, being practicable for limited outputs where standard types of excavators cannot be economically used, it is also built of weight, strength and power suited to the severest conditions.

The THEW full circle swing shovel is built in five sizes ranging in weight from 13 to 50 tons. Modifications of standard designs permit the shovel to be adapted to special conditions.

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The THEW SHOVEL for underground mining.
The THEW SHOVEL for constricted quarry operations.
The THEW SHOVEL for open cut excavations.
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The Thew Automatic Shovel Company

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A BIG JOB

is never too big for

HAYWARD BUCKETS

They dig--as no laborers can! They save per operation as no other Bucket can! Sand, ore, muck, coal, refuse, heaviest rock----all are alike to Hayward Buckets.

WITH EVERY HAYWARD BUCKET

we'll give you a *written guarantee*--"to execute the work they are sold for," whatever that work may be.

WRITE FOR CATALOGS 35 and 36

THE HAYWARD COMPANY

50 CHURCH STREET, NEW YORK

For immediate delivery standard construction Orange Peel Buckets from 1 cu. ft. up to and including 2 cu. yds. capacity. Also Clam Shell Buckets, Class E, 1½ cu. yds. up to and including 3 cu. yds. capacity.

REVERE RUBBER CO.

BOSTON U.S.A.

MINING SPECIALTIES

CONVEYOR BELTING

Hinge Edge Belt Conveyor

The most successful conveyor belt ever constructed for troughing conveyors.

Note the hinge at the point of bending where several plies of duck are replaced with tough flexible rubber.

It troughs naturally, minimizing wear and tear.

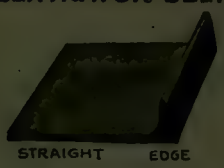
It is rigid where it ought to be, and flexible where it has to be.

It takes a full face contact, eliminating slip and scour.

Furnished with reinforced cover when desired.

Write for descriptive matter containing full information regarding principle and efficiency of this belt.

CONCENTRATOR BELTS



Furnished with various styles of edges.

The construction and compound of our edges are special features and the result of years of study and experiments.

STEAM HOSE

SUCTION HOSE

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NEW YORK - PITTSBURG - CHICAGO - NEW ORLEANS - SAN FRANCISCO - PORTLAND

MINING MACHINERY

ROCK DRILLS.

"Sergeant" (independent valve) and "Little Giant" (tappet valve) Drills are the standard rock drills for mining service the world over.

Their unequalled drilling capacity is due to their superior valve movements, which give the greatest possible power to the blow.

In "stand-up" qualities they are unsurpassed, because special metals of great strength are used and steel parts are toughened by special oil treatment.

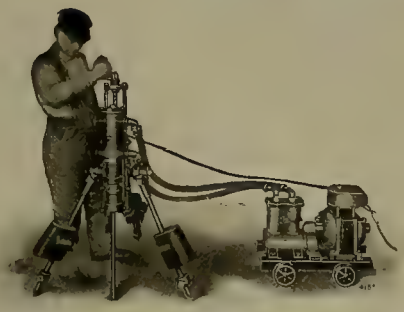
HAMMER DRILLS.

"Crown" and "Imperial" Hammer Drills, in telescope feed and hand types, are built—not to make speed records—but to do the most drilling, year in and year out, with the least cost for power repairs.

They are as light as a machine for rough service can safely be made and are more powerful than other drills of the same weight.

They are up-to-date hammer drills embodying the best points of thirty-nine years of drill building.

"ELECTRIC-AIR" DRILLS

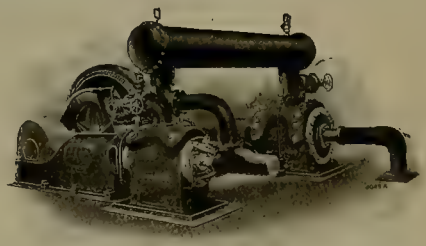


Until the "Electric-Air' Drill was offered to the trade, rock drilling by electric power was not a commercial possibility.

Today more than 600 of these machines are at work all over the world, proving that the "Electric-Air" Drill has successfully solved the "electric drill problem."

Yet it is not an "electric" drill, but an air drill driven by electric power.

AIR COMPRESSORS.



The Ingersoll-Rand line of compressors includes every type of proved merit—steam and power driven, straight line and duplex, adapted for all pressures up to 3000 lbs.

Superiorities characteristic of the largest experience mark each type—improved valve movements, unusually heavy construction, splendid mechanical design, oil treatment of steel parts, the application of special metals.

"Calyx" Core Drills Coal Punchers
"Radialaxe" Shearing Machines

INGERSOLL-RAND CO.

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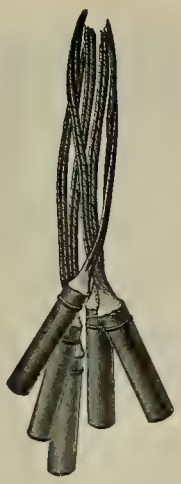

FIRE YOUR BLASTS WITH

Lion Brand

Trade Mark

ELECTRIC DETONATORS

The Safest and most reliable method of firing blasts

They all go at the same time

utilizing the full force of the explosive, each shot assisting the others.

They go when you want them to

and not before. No premature explosions; no hanging fire. No wasting. Avoids accidents from premature explosions in shaft sinking; from persons "walking into" a blast they did not know was lighted, or which hung fire. You can choose a favorable moment for firing and then fire quickly.

Shots may be placed where you like

and separated as widely as you like; disposing of some of the old time difficult problems in placing shots, by enabling blaster to divide blast into as as many parts as he wishes, and fire all together.

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The Aetna Powder Co.

143 Dearborn St., Chicago

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THE "DICKBELT"

DICK'S ORIGINAL PATENT BALATA BELT

CONVEYOR BELTS DRIVING BELTS

An 8-inch, 5 ply endless belt, made by us, drove a centrifugal pump night and day from June 5, 1892, to June 3, 1904. It traveled during that time at the rate of 4000 to 5000 lineal feet per minute, or a total distance equal to 155 times around the world.

Every belt sent out is guaranteed to give complete satisfaction. Otherwise it can be returned to the manufacturers.

WE WILL GLADLY SEND DESCRIPTIVE BOOKLET AND PRICES.

R. & J. DICK, LTD.

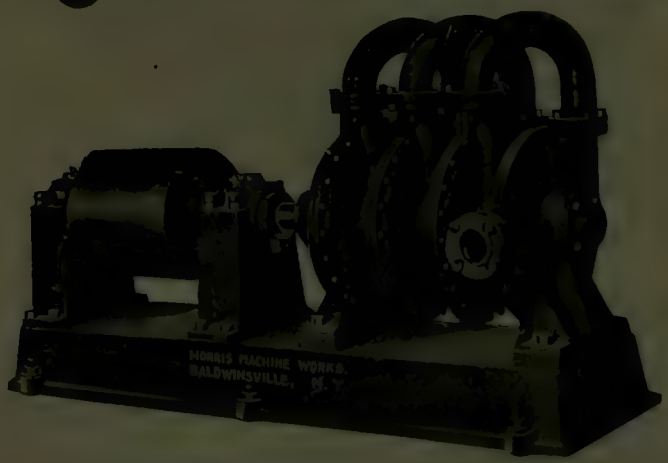
50 CHURCH ST. NEW YORK.

MORRIS
CENTRIFUGAL PUMPS
FOR MINING DUTY

GIVE — GREATEST SATISFACTION
MOST RELIABLE SERVICE
WONDERFUL EFFICIENCY

POSSESS — LARGE CAPACITY
GREAT DURABILITY
EXTREME SIMPLICITY

REQUIRE — MINIMUM POWER
LEAST ATTENDANCE
PRACTICALLY NO REPAIRS



In these days of cut-throat competition, when quality is so often sacrificed to price, Morris centrifugal pumps, although a little higher priced than some others, have been steadily gaining favor among the buyers of pumps for mining duty.

A solution pump in a cyanide plant, or a station-pump handling the water from the lower levels, must be reliable. MORRIS PUMPS ARE RELIABLE. Don't take our word for this, but find one in use (there are 30,000 of them) and see what men say who really know. Forty years of knowing how, backed by an absolute guarantee, is the principal reason that so many Morris pumps are used around mines and mills.

Give us a chance to show what we can do.

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New York City Office: 39-41 Cortland St.

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Henion & Hubbell,
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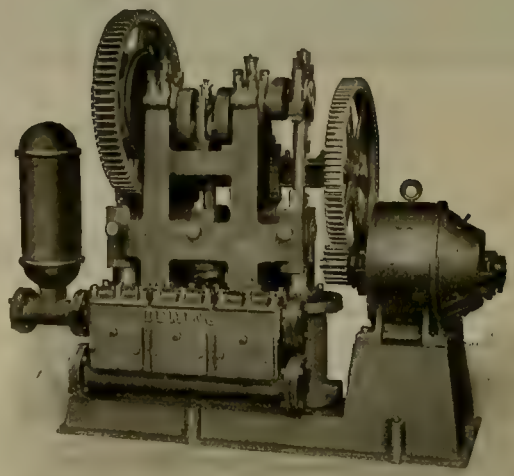
Isn't This a Little Out of the Ordinary?

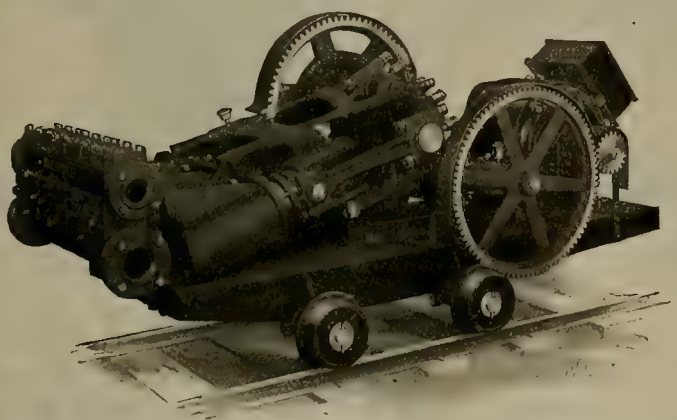
An 18x18 Deming Triplex Power Pump has been running **day and night** out on the Pacific Coast for nearly a year with a shutdown of but **20 minutes a week** for oiling, and showing an efficiency of **87½%**.

It furnishes between **four and five million** gallons per day for irrigating purposes and from present indications is good for long years of effective service with the same record. So perfectly does it run that hardly any sound can be heard outside the power house. The pump is 19 ft. high.



DEMING General Service Electric Driven, Single-Acting Triplex Pump. Economical and efficient.

All Deming Pumps are made for this kind of service, and guaranteed to give satisfaction. If you are in the market for an economical pump for a mine, mill, farm, factory or any place, write us. Give us a few conditions under which the pump would have to work and our engineering department will send full information by return mail.



Deming PORTABLE Electric Driven Triplex Mine Pump. Can be moved from one sump to another at a few moments' notice.

The Deming Company, Salem, Ohio.

Hand and Power Pumps for all Uses

Central Western Agents:—
Henion & Hubbell, Chicago.

Western Agents:—
Hendrie & Bolthoff Mfg. & Supply Co., Denver.
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OTHER AGENCIES IN ALL PRINCIPAL CITIES.

The Decision of The Judges

2 Grand Prizes and 5 Gold Medals

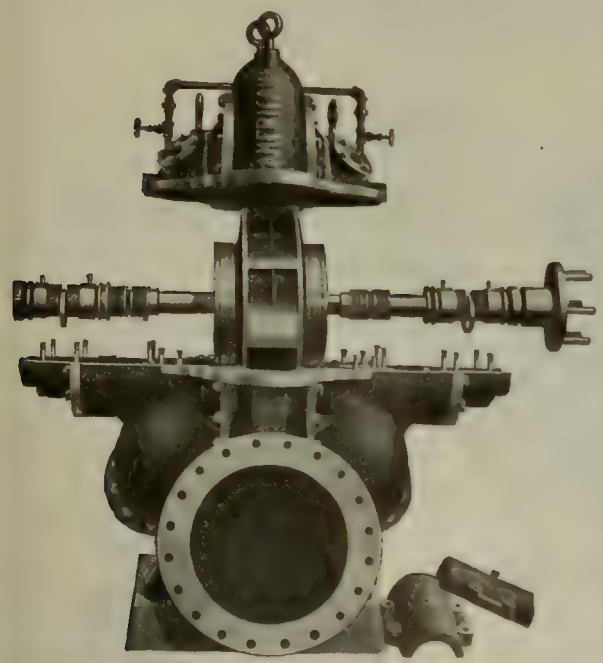
All of the Grand Prizes and all of the Gold Medals given by the Alaska-Yukon-Pacific Exposition at Seattle last summer to Pumps were awarded to American Pumping Machinery.

The reason is, "American" pumps are constructed with the best possible flow-lines and the judges were compelled to recognize their superiority.

Chief among the "American" family of pumps is the Plain Volute Centrifugal.

A large percentage of mine owners and mining engineers are not aware that the latest improved types of volute centrifugals are more economical than any other pumps in mining operations.

The "American" centrifugal will attain as high efficiencies as the best type of compound reciprocating pump. The plunger type of pump will cost one-third more to install, several times as much for attendance and will require many times as many repairs. Add to this, time lost in re-packing valves, and the centrifugal will prove far more economical in every instance.



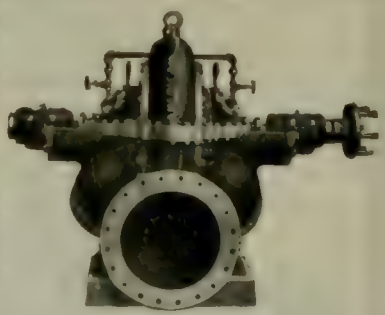
Another misconception of the centrifugal pump is the heads under which this style of pump will operate.

There seems to be a prevailing idea among users of pumping machinery that the volute centrifugal is a "low head" pump and that the single stage will attain good efficiencies only on heads up to 50 or 60 feet.

Such were the conditions ten years ago, but many persons are not aware that there has been greater progress during the last decade in the design of centrifugals than in any other kind of pump, and that manufacturers are conservative at the present time when they recommend single stage centrifugals for double these heads.

We guarantee large size single stage "American" centrifugals to attain mechanical efficiencies of 60 to 80 per cent. on total heads up to 125 feet, but we have these pumps in constant operation near Chicago delivering water at 70 lbs. pressure, or equivalent to a 190-foot head.

We guarantee "American" two stage centrifugals to maintain high efficiencies on total heads up to only 250 feet, but we have these pumps operating constantly for over three years in mines of South Dakota on heads of 300 feet, and these are not our latest and most improved designs.



"American" centrifugals are built in both horizontal and vertical styles, in any size, in any number of stages and equipped with any power.

If you require mine pumps of any kind, give us the opportunity to prove to you that the pumps the judges at Seattle pronounced superior will prove superior for you.

Efficiency tests by one of the most eminent hydraulic engineers in American for the asking. Complete catalog No. 104 free.

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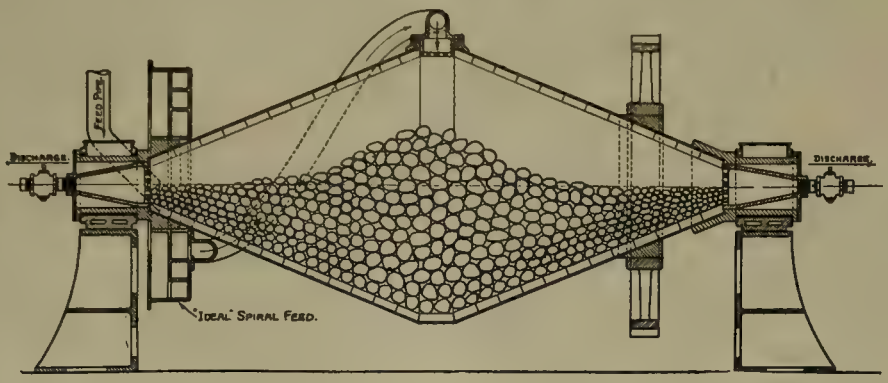
DOUBLE CONICAL MILLS

Double Discharge



Double Capacity

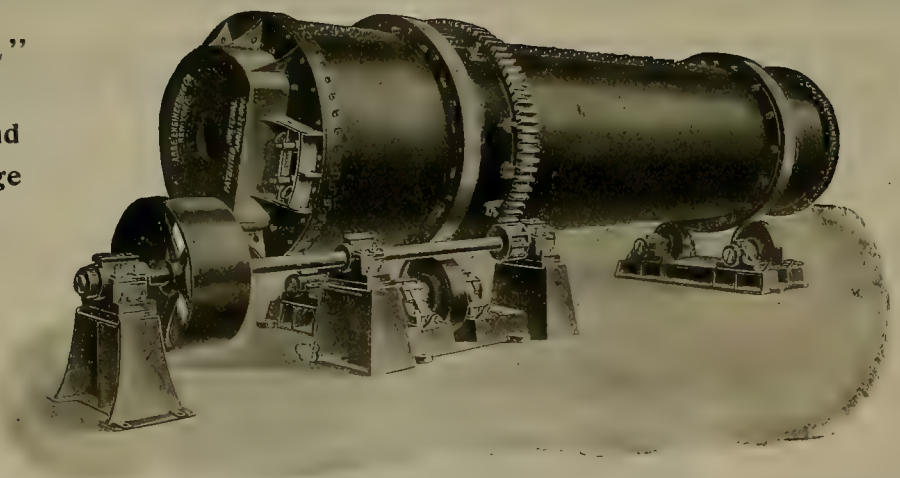
PATENTED.

Feeds in the CENTER and Discharges at BOTH ENDS.

Scientifically designed and practically constructed to produce the most economic results in reducing ores for concentrating and cyaniding.

TUBE MILLS--TIRE STYLE

"IDEAL" Spiral Feed and Discharge



For fine grinding these mills have made records for economy and efficiency that are unsurpassed.

We sectionalize for muleback transportation.

THE ABBÉ ENGINEERING CO.

BROADWAY AND ANN ST., NEW YORK.

PACIFIC COAST AGENTS:
FREDK. C. ROBERTS & CO., MECHANICAL & METALLURGICAL ENGINEERS
221 SHELDON BUILDING, SAN FRANCISCO

A GOLD MEDAL TO THE JACKSON DRILL

The Jury of Awards of the Alaska-Yukon-Pacific Exposition, after witnessing thorough tests of the Jackson Hand Power Drill in the hardest granite, awarded the Drill a GOLD MEDAL, thus confirming our claims as to efficiency and ease of operation compared with hammer work.

If you are doing hammer drilling you are simply wasting time and money.

The Jackson strikes 250 blows per minute. Every blow is even and regular. The drill steel is rotated automatically, hence every blow counts.

READ WHAT THE USERS SAY:

COPY.

Lostine, Ore., Aug. 27, 1909.

Dear Sir: Yours of the 17th inst. at hand.

I will say the drill is a fine piece of machinery, and does fine work in Quartzite and Quartz-Porphyry.

That is all that we have tried it in as yet; but it will do its work in any kind of rock.

(Signed) S. W. LILLY.

COPY.

Corvallis P. O., Mont., Aug. 20, 1909.

To the Jackson Drill Mfg. Co., Seattle, Wash.

Gentlemen: Your favor of 12th August. In reply I will say that the "Jackson" Hand Power Rock Drill I bought of you last fall is all that could be expected. I could not get along without it.

The Drill will pay for itself in two months.

We are working in the hardest kind of rock, which cannot be drilled by hammer work. The "Jackson" Drill also does not wear out drill steel, which is a great saving.

Two men with the drill can do the work of four men, and drill with greater ease.

I could not do without the "Jackson" since using it.

The machine is all right and no mistake.

(Signed) S. SAGE.

R. R. No. 2, Box 2, Bingham Canyon, Utah, March 22, 1909.

Have used the "Jackson Drill" in making a tunnel over 400 feet long, and therein encountered from soft sandstone to the hardest kind of quartz, and it gives me great pleasure to say that the drill has done a great deal to bring the tunnel ahead, as well as saving labor. It would indeed be a trying matter to now have to return to the former way of hammer and bit drilling. I do not see that much improvement could be made on either the drill or equipment.

(Signed) J. E. CARLSON.

You have probably heard of the Jackson Drill—why not know all about it. It has saved thousands of dollars in hundreds of mines. It will save money and time for you. Remember the drill is guaranteed against breakage for ten years.

Write for CATALOG B 19, WHICH CONTAINS 10 YEAR RECORDS.

THE MINING SUPPLY CO.,

14 West Conn. St., SEATTLE, WASH. 64 BROAD ST., NEW YORK.

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Regular sailings from Antwerp for San Francisco, calling at La Pallice, Marseilles, Genoa, Port Said, Singapore, Hongkong, Shanghai, Chinwangtao, Moji, Kobe, Yokohama.

San Francisco to Antwerp, calling at Mazatlan, Guaymas, Santa Rosalia (if sufficient freight offers, at Manzanillo) Montevideo, Buenos Ayres, Liverpool, Avonmouth, Swansea, Dunkirk, and Havre.

Freight accepted to and from all above ports of call.

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MATRIXES

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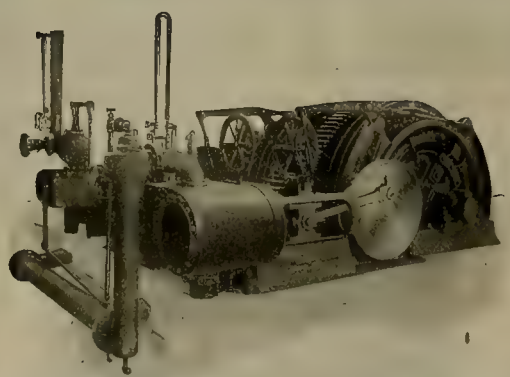

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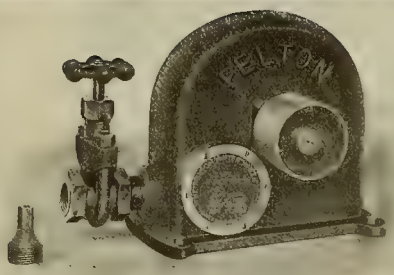

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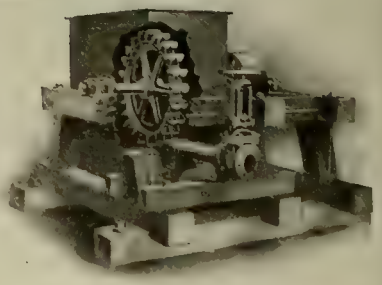

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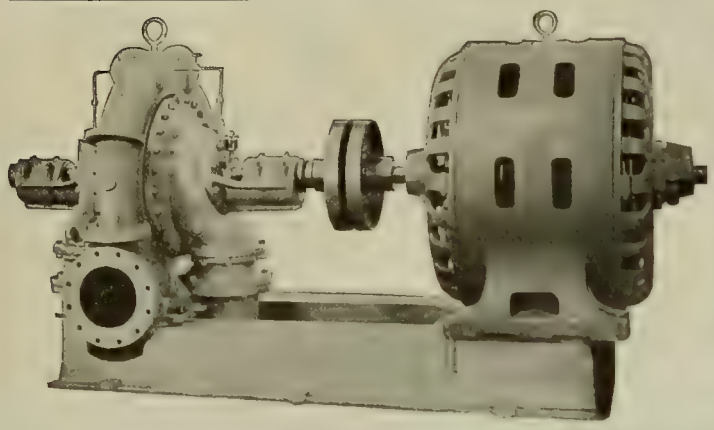

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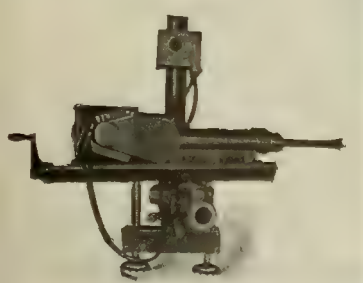

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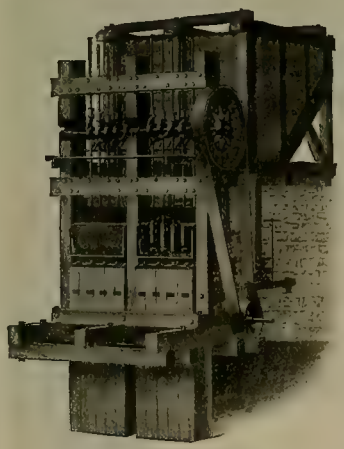

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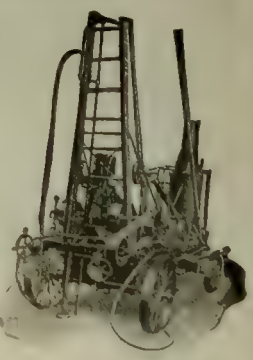

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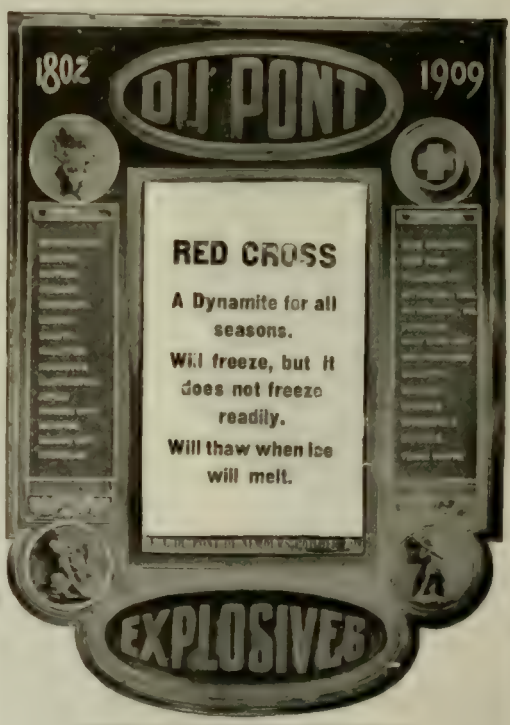

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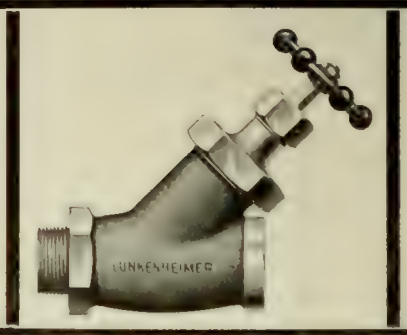

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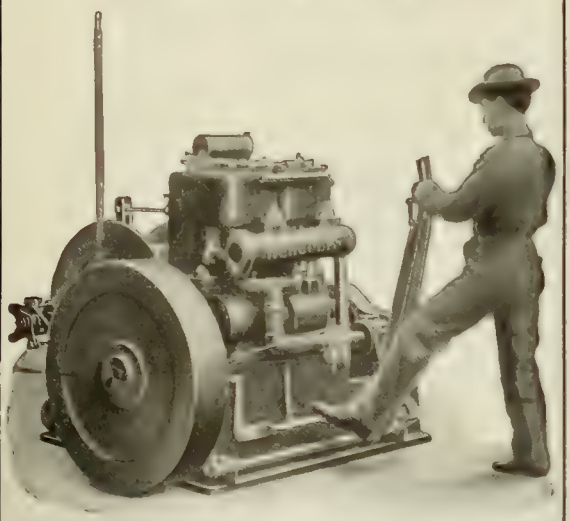

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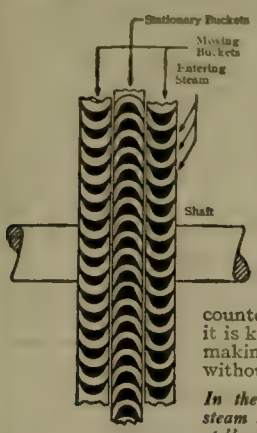

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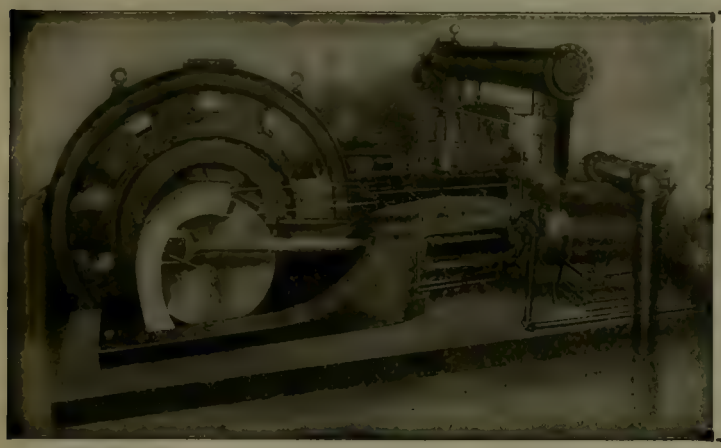

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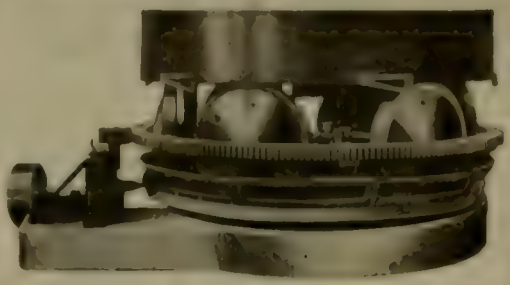

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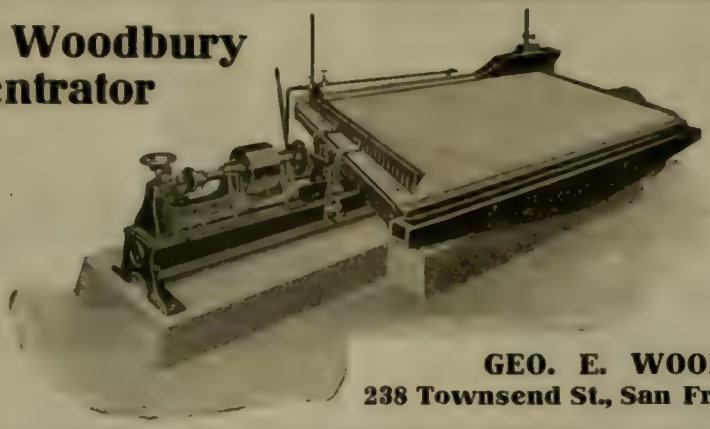

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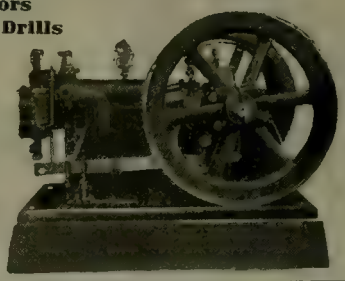

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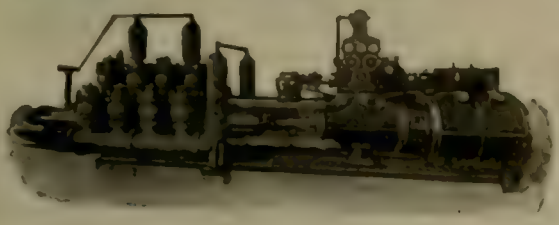

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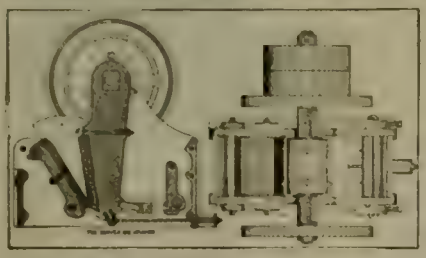

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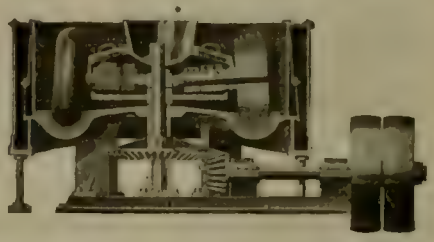

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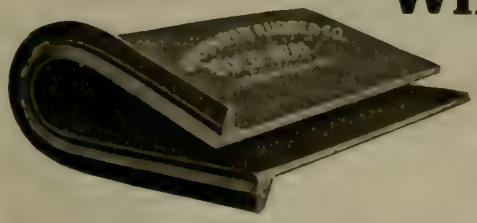

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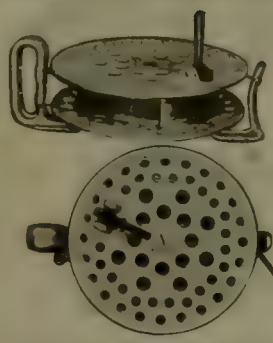

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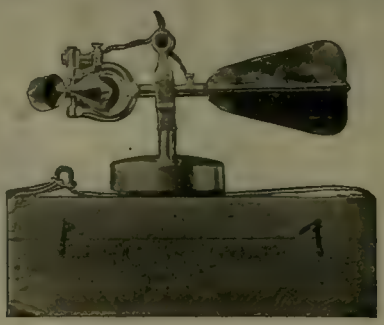

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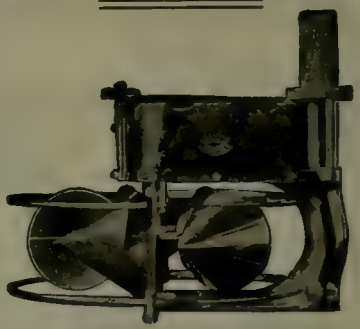

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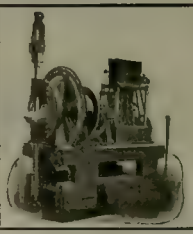

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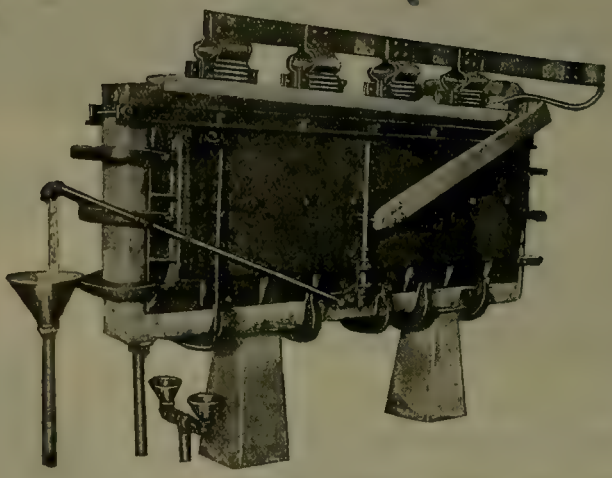

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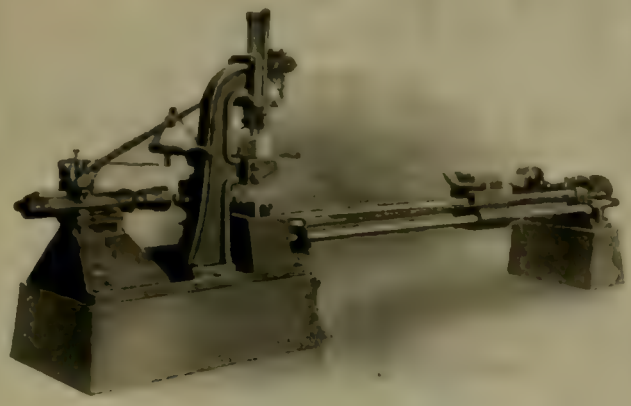

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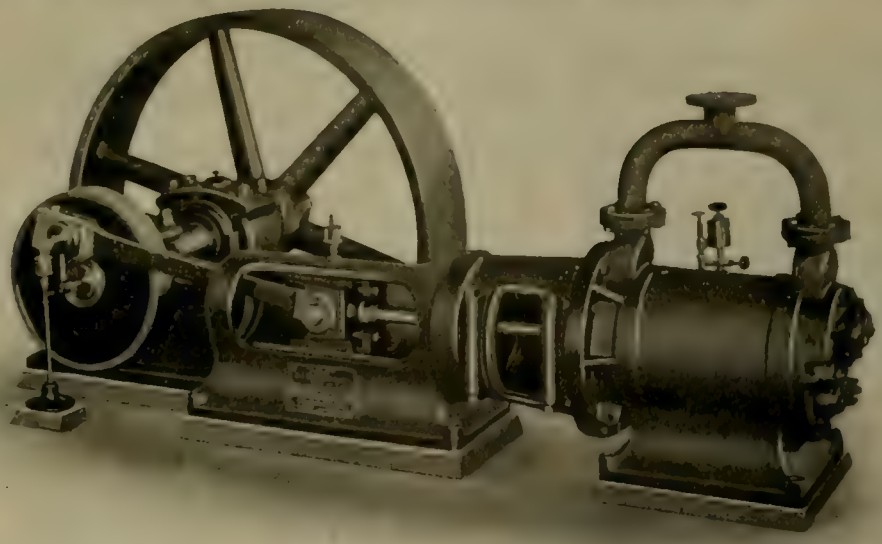

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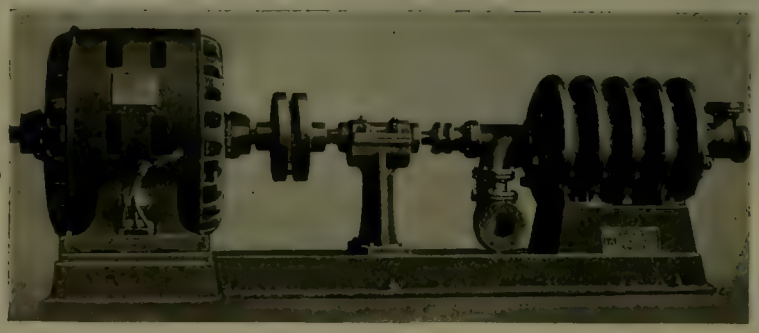

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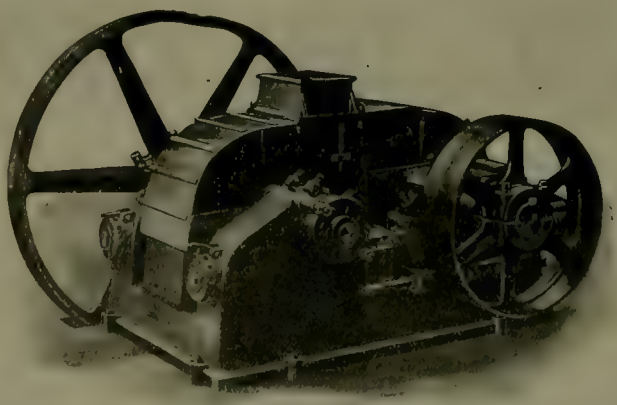

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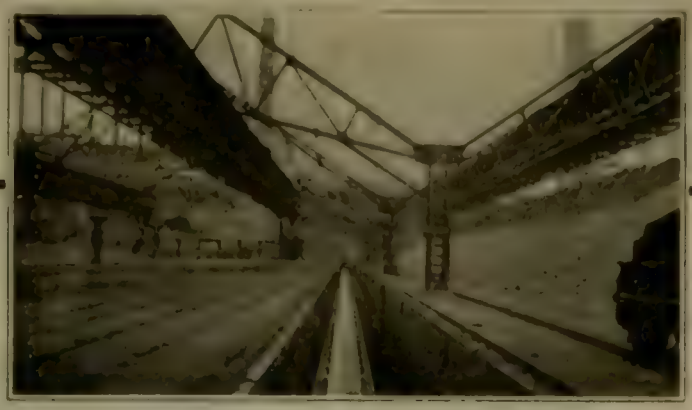

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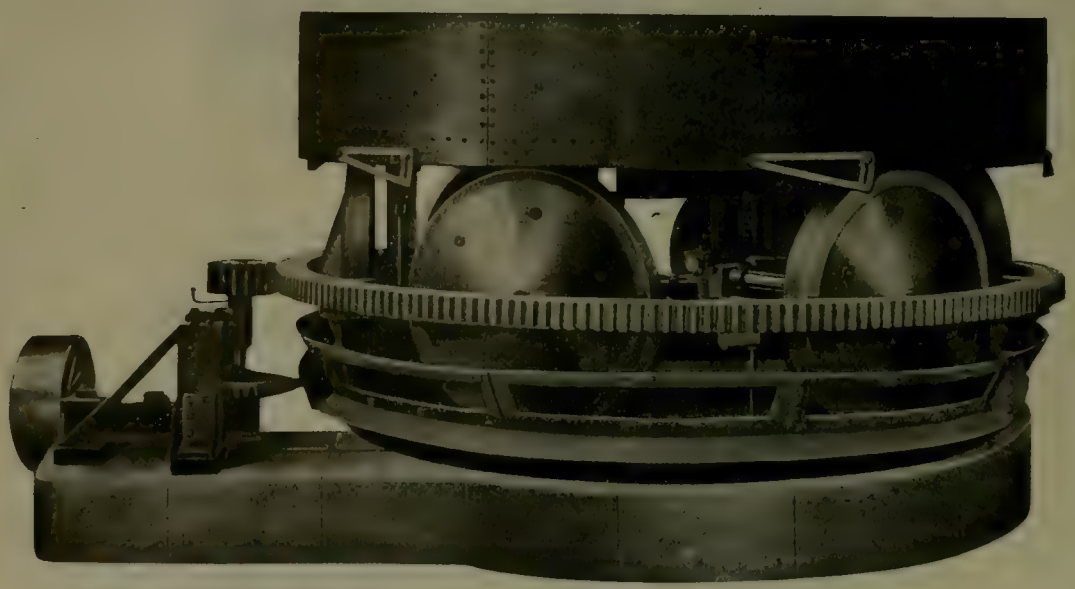

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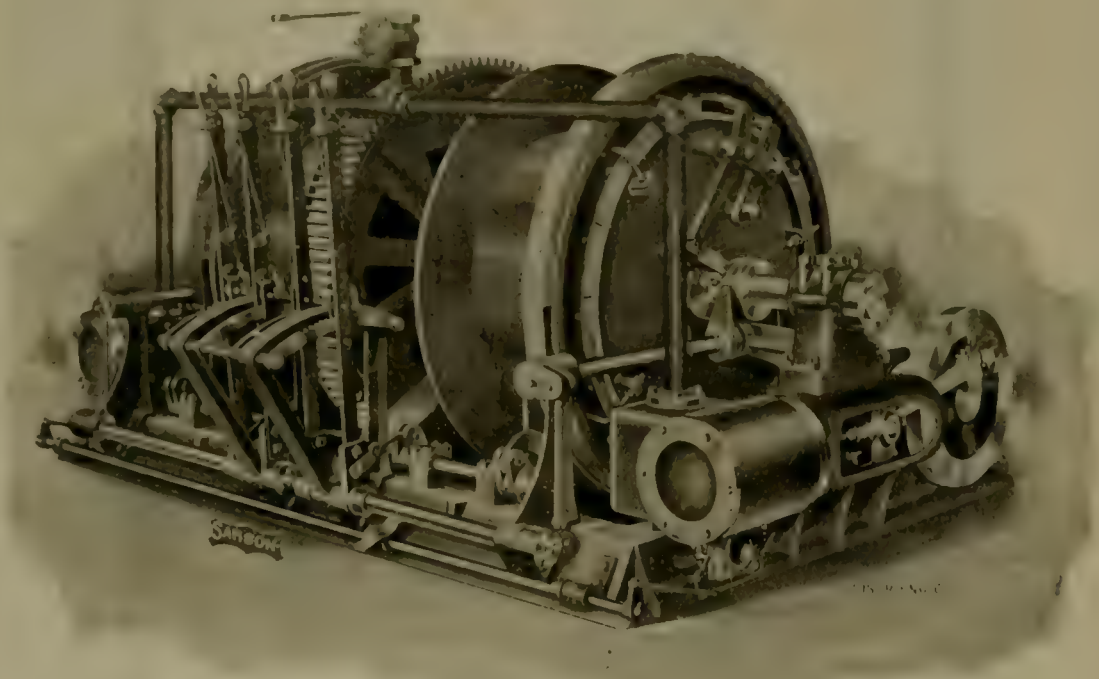

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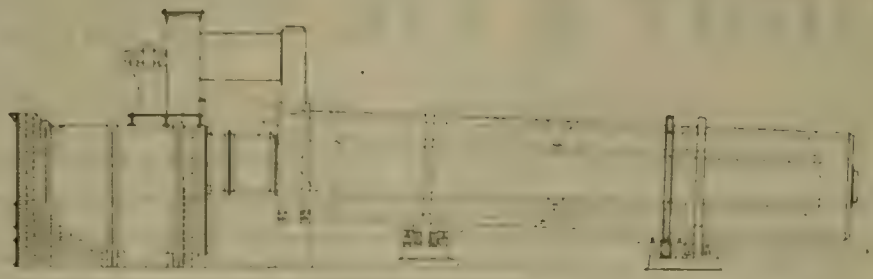

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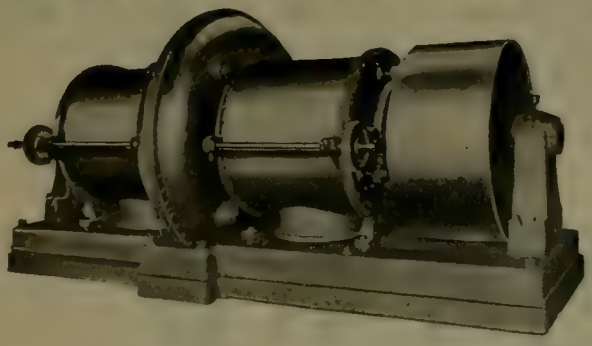

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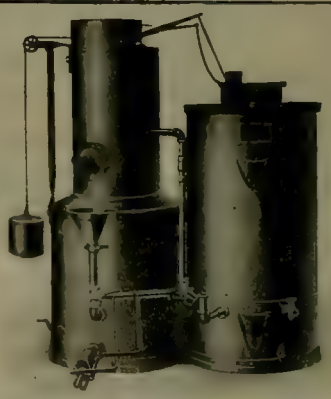

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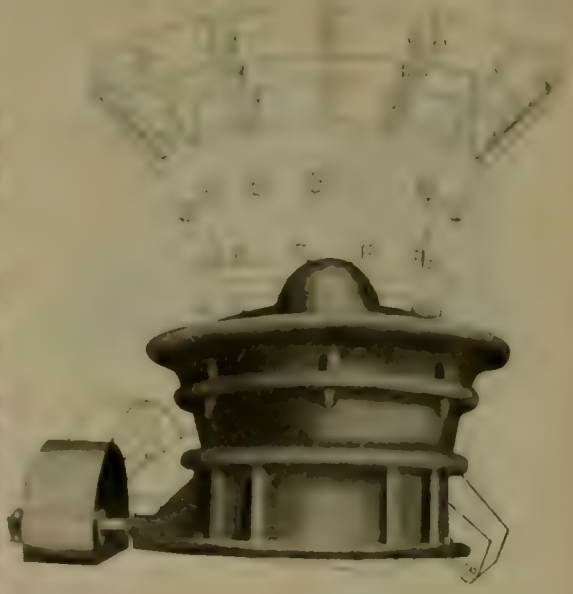

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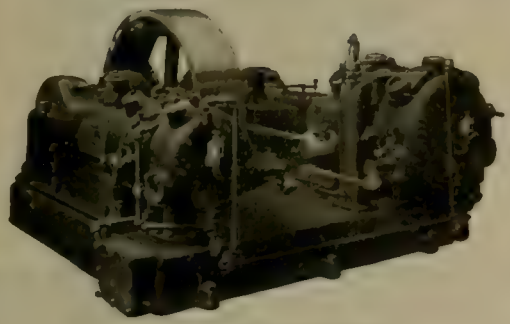

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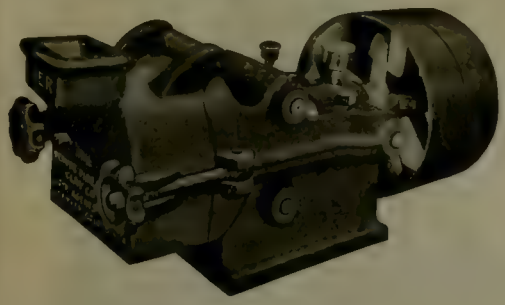

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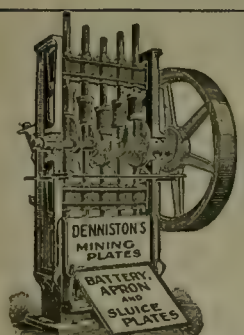

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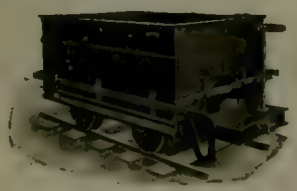

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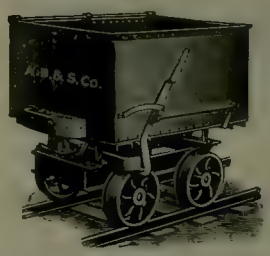

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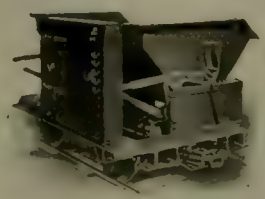

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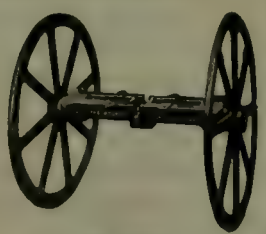

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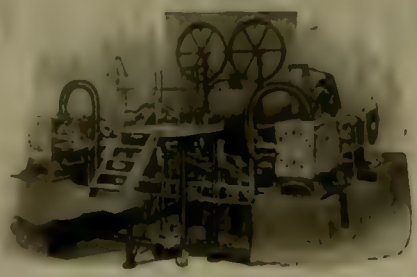

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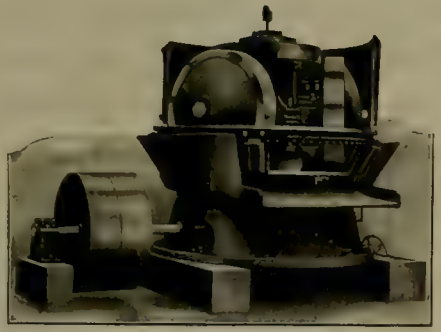

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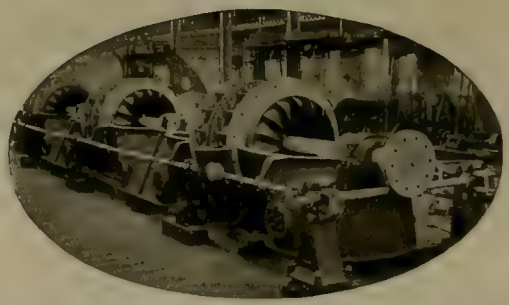

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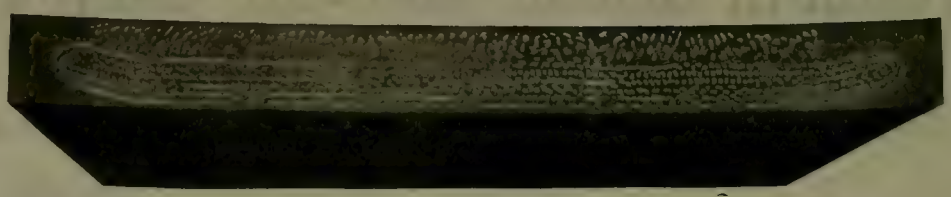

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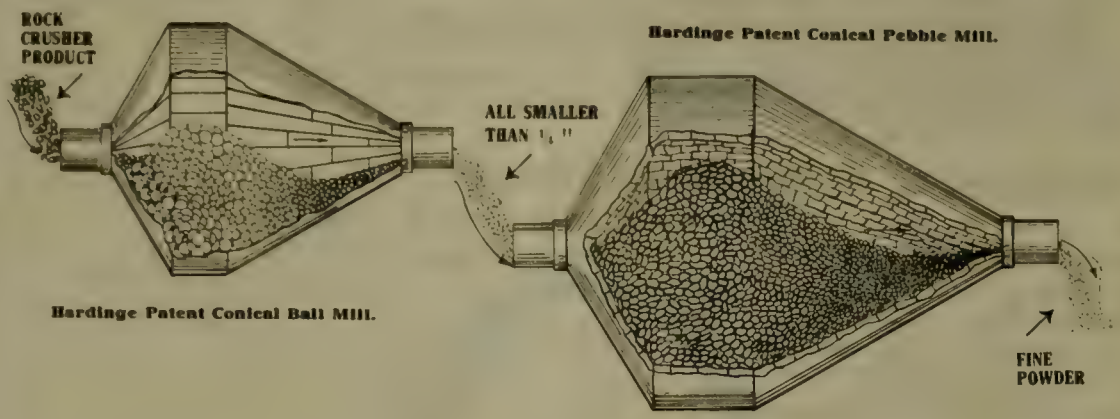

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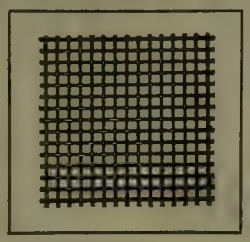

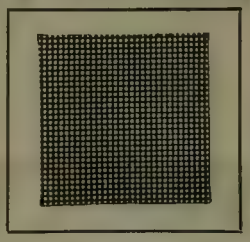

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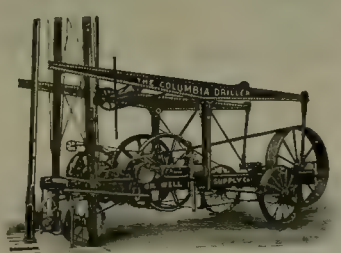

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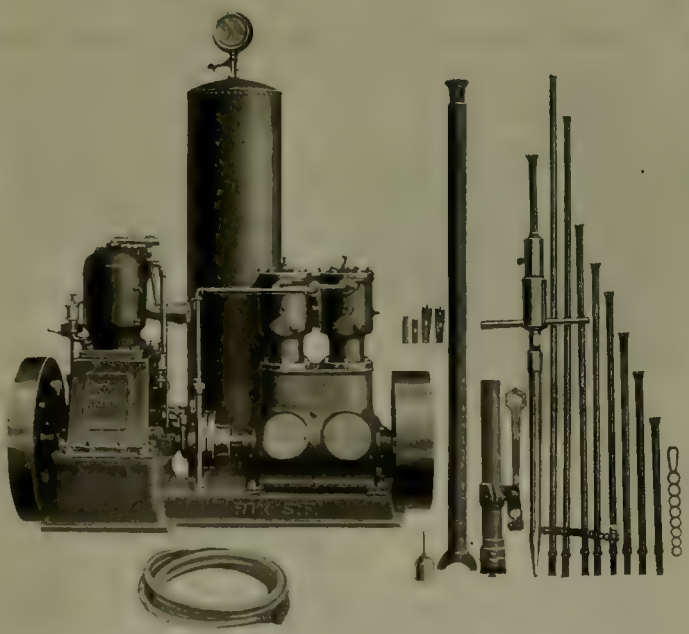

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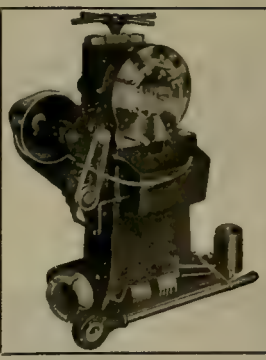

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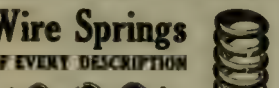

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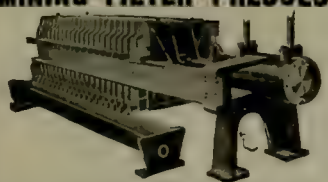

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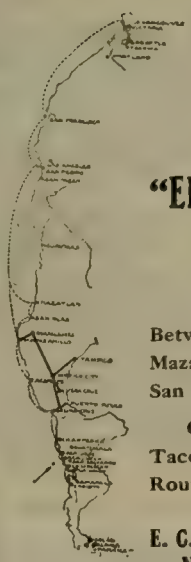

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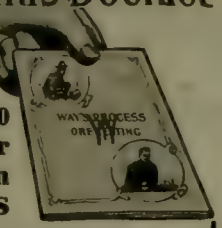

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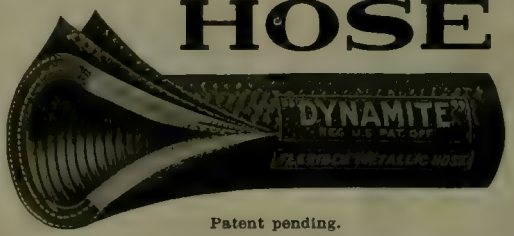

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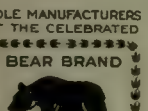

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WANTED—Position as engineer (surveyor) with mining company, by man of 30, graduate mining engineer, good draftsman, experienced in wet and fire assaying, retorting amalgam, melting bullion, etc. Box 513, this office.

CHEMIST AND ASSAYER desires position, ten years' experience; five years in Mexico, excellent references; Southwest preferred. Address Box 505, this office.

MINING ENGINEER, with technical training and 12 years' practical experience, is open for engagement as superintendent in Mexico, Sonora preferred; practical experience in mining, milling, assaying, cyaniding, mine surveying, and especially superintendence; has had extensive experience as superintendent in opening and developing large mines at long distances from railroad, with difficult transportation; speaks Spanish and has had 7 years' experience handling Mexican labor; excellent references. Address Sonorense, care this office.

MINE SUPERINTENDENT, with experience in gold, silver, and copper mining, seeks position in Mexico; speaks Spanish and understands handling Mexican labor, seven years in Mexico; capable of taking charge of property. Address Box 509, this office.

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POSITION as assayer and chemist; am a provincial assayer for British Columbia; 8 years practical experience in gold, silver, and copper; want position Mexico, South America, or any healthy country. Address Box 400, this office.

ELECTRICAL AND MECHANICAL ENGINEER, technical graduate of three years' experience would like a position with a mining or manufacturing company; best references. Address Box 502, this office.

EXPERIENCED mine superintendent with 12 years' practical experience desires position; familiar with every detail in or around metal mines; competent to design and install proper equipment for the existing conditions; employed, but can leave on short notice; will go anywhere; references. Address Box 503, this office.

WANTED—Position to take charge of power plant using producer gas, or gasoline engines; Mexico or Western States preferred; at present employed, but desire change. Address Box 504, this office.

SITUATIONS WANTED—Continued.

A SUPERINTENDENT of 20 years' experience, a specialist in gold-silver mining and metallurgy, is open for engagement. Address Box 409, this office.

WANTED—Charge of mine or mine and mill; have surveying instruments; age 28; employed. Box 408, this office.

YOUNG MAN with mining education, some experience; have charge of municipal work; want mining job; chance for experience chief consideration. Address Box 407, this office.

EXPERIENCED MINE FOREMAN, with good business judgment and a nose for ore, and the very highest recommendations, desires position; fifteen years underground; I. C. S. graduate; can survey, may, or assay, experience gained in Canada, Washington, California, Colorado, Nevada, and Central America; Spanish spoken. Address Box 393, this office.

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WANTED—For mine in Mexico, accountant with thorough knowledge of Mexican mining and stamp laws, storekeeping, timekeeping, and general mine accounts including costs system; salary $200 Mexican currency per month. Answer, with references, Box 507, this office.

WANTED—Master mechanic to take complete charge of mechanical and electrical equipment of mine in state of development in Mexico; must have working knowledge of Spanish; salary $175 U. S. currency per month. Answer, giving reference, Box 508, this office.

WANTED—To know of good location for assay office, to be established by experienced chemist and metallurgist. Address G. J. Hough, general delivery, Denver, Colo.

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GEORGE TOURNY, Secretary.

INFORMATION WANTED.

Whereabouts of J. H. Hennessy.

The undersigned is very anxious to obtain the address of J. H. Hennessy. Information of great importance to communicate to him. Please write or wire

J. V. STEWART,
Care Benj. F. Biedsoe, San Bernardino, Cal.

NOTICES OF RECENT PATENTS.

Among the patents recently obtained through Dewey, Strong & Co.'s Scientific Agency, the following are worthy of special mention:

CONTAINING CAN.—No. 941,781; November 30, 1909. William H. Hoyt, San Francisco, Cal. Assigned his right, title, and interest in said improvement to J. A. Folger & Co., San Francisco, Cal. In this invention a compound sealing film is combined with the main portion of the rigid top of the can, and the two are simultaneously united with the body of the can so that this thin double seal extends across beneath the open space in the top, and is normally protected by the cover fitting into the opening; and when the cover is removed, the thin seal still protects the contents until such time as it is desired to have access thereto, when it may be cut out.

WATER HEATER.—No. 941,882; November 30, 1909. Bryant B. Kinkade, Berkeley, Cal. It is the object of this invention to provide a means whereby a single heater of this class may be employed to supply heated water to several independent points of distribution, in combination with means for properly registering the amount of water drawn and gas consumed by the independent party servie, or at point of distribution, so that the correct charges may be made against each individual consumer.

BOTTLE STOPPER.—No. 941,788; November 30, 1909. Dewis Landau, San Francisco, Cal. The object of this invention is to provide a simple, practical stopper of novel construction which will permit a bottle to be filled and charged from any suitable source of supply and under any pressure, and which stopper will have suitable automatic venting means which will prevent the bottle being charged beyond a predetermined maximum pressure. This device will not only prevent the bottle bursting from internal pressure, but it will enable the bottle readily to be re-filled and charged without sending to the factory.

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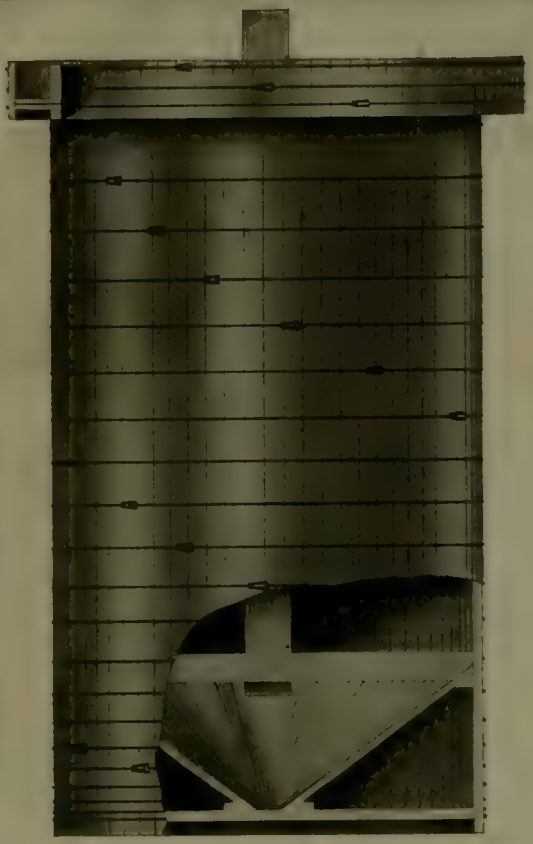

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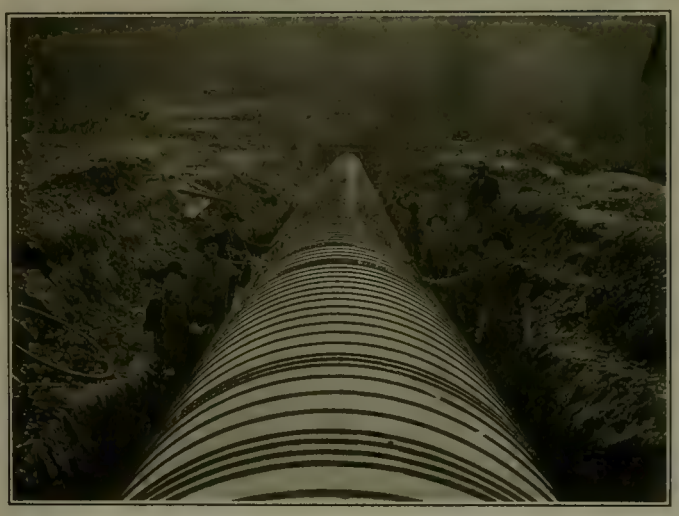

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EDITORIAL.

FOLLOWING the centre of mining activity in New York, the MINING AND SCIENTIFIC PRESS has removed its Eastern offices to 42 Broadway, where it will be represented by Mr. F. S. Wayne, as in the past.

RECOGNITION should be given to the Geological Society at Stanford University as the body before whom the paper on 'Progress and Problems in Ore Dressing', by Mr. Courtenay De Kalb, printed in our last issue, was originally presented. The address was given only in abstract.

JOURNALISM, like other industries, tends toward specialization. Our esteemed contemporary, *Wood and Iron*, has for a long period been practically the exponent of the Western lumber interests. It has now ventured to claim that field by a frank change of name to *The Pioneer Western Lumberman*. The management remains unchanged, and publication will be made semi-monthly, as in the past.

ONCE MORE the North Star mine has given proof of undiminished vitality. A full account of the year's work will soon be published in these columns. It is gratifying to make an advance statement of earnings for 1909 exceeding $1,250,000, out of which dividends of 23 per cent on the capital stock have been paid. The company is mining to a depth of more than 5000 feet on the incline, and the ore shows an average assay value of about $12 per ton.

OWING to a large accumulation of articles dealing with the status of the mineral industry in 1909, it has been deemed advisable to omit the usual departments of Discussion and Concentrates from this issue. The discontinuance is only temporary. We value the open letters sent us as a reflex of current opinion on the leading problems which concern the mining world, and our desire is to encourage the custom among our readers of using our columns as an open forum.

CIVIL SERVICE protection has been extended to the Census Bureau, and this action has awakened fear in many quarters lest a high degree of training would be requisite to pass the 'test'. The Bureau has taken steps to give wide publicity to a contradiction of this impression. Anyone with an ordinary common school education, familiar with the three 'Rs', which have been the basal equipment of successful Americans for some generations back, may face the examination with smiling confidence. Applications must be on file with the supervisors in each district by January 25, and on February 5 the examinations will take place. Letters addressed

simply to the Supervisor of the Census, and bearing merely the number of the Congressional District and the name of the State, will be sent by your local post-master without more definite direction.

IN OUR issue of last week the dredge of the Nome Mining Company on Bourbon creek was referred to as of Bucyrus type. This is true only in the sense that it was an attempt to design along similar lines. The Bucyrus company, as it happens, had nothing to do with its building and is in no sense responsible for its defects, which seem to have been due to faulty construction and poor material rather than to the design. It need only be added that the discovery of this error is our own, and that the Bucyrus company has entered no complaint, which renders it all the more pleasant to make this correction.

DATA regarding ore deposits are becoming relatively abundant. Not long ago no such wealth of material was ready at the hand of the investigator. Mere facts, however, mean little. Correlation, analysis, and synthesis are as important as are the facts themselves. In this issue we publish the first of a series of articles in which Mr. T. A. Rickard brings together a great mass of material regarding the ore deposits of Colorado. The material is valuable, but even more so is the way it is brought together and the deductions Mr. Rickard makes. Perhaps there are errors, probably there will be some differences of opinion, but the articles are sure to be stimulating and helpful. They are based on personal observation, wide reading, and extensive correspondence, and are the fruition of many months of patient study. We only wish that similar studies of other areas might be made. One or two workers might well be spared to broader studies from the detailed investigation of districts and camps which have been so characteristic of American work on ore deposits.

California Eight-Hour Law.

Eight-hour legislation as a police measure has been upheld by the Supreme Court of California. This result we predicted in editorial comment shortly after the passage of the bill. The full text of the decision appears elsewhere in this issue. The mining interests of the State are certainly under obligation to Mr. Fred J. Martin, manager of the Utica mine in Calaveras county, for submitting to the inconvenience and sacrifice of time necessary to test the constitutionality of the statute. The matter was conducted in a decorous manner, and conclusively determines the law of the State on the three points at issue, which were, first, the constitutionality of the law considered as to discrimination between classes of persons and industries; second, whether the law contemplated eight hours of actual labor, or whether the time consumed going to and from work-places at mining plants should be included in the eight-hour period; and third, whether stamp-mills are embraced with the meaning of the term 'reduction works'. The decision denies that the law constitutes class legislation; declares that the statute requires eight hours of actual labor; and construes 'reduction-works' to include stamp-mills for the reduction of gold and other ores.

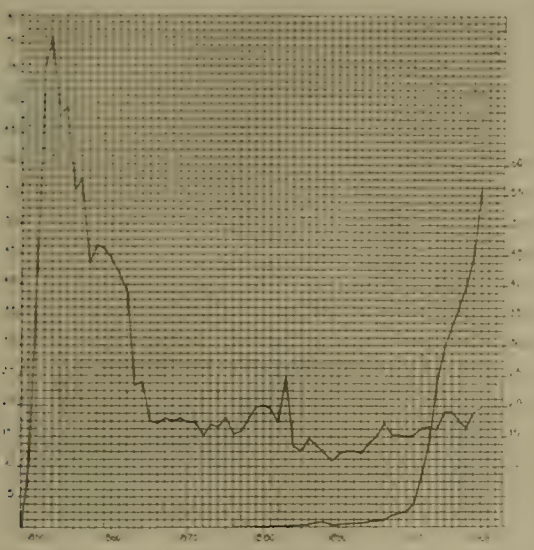
It must be observed that the authority cited by the court concerning class legislation is a previous decision by the Supreme Court of the State. This was a sufficient answer from a technical standpoint to a question that related to the interpretation of the constitution. Legislation is permissible in California regulating a group which is distinct in character, such as a well defined trade, or industries based upon fundamentally different resources or conditions, such as agriculture or mining. The case of City of Pasadena *v.* Stimson, to which reference is made, involved an attempt to discriminate between municipalities on the basis merely of difference in population. This was held invalid. So far as this portion of the decision is concerned it can hardly serve as a precedent of value in other States except where like constitutional provisions exist. In Colorado an act similar to the one enacted by the legislature of California was ruled out on the ground of unconstitutionality.

The California court has distinctly held that it is not enough to show that other occupations are equally unhealthy in order to impugn a statute as unjust class legislation. There is no reason to assume that the legislature may not protect workmen in other occupations likewise, and under the stimulus given by this decision of the Supreme Court a whole crop of special acts for the regulation of trades may be anticipated. It would seem that the end sought could be attained quite as well by a general statute, leaving the healthfulness of conditions as maintained at individual plants subject to inspection and control by officials of a suitably constituted bureau. The Supreme Court would have necessitated new and wiser legislation by less broadly interpreting the constitution. The act as it stands would have benefited by the criticism of the mining men of the State, which it certainly did not receive. All mines are not necessarily unhealthy, and reduction works may be made clean and free from dust or fume by the introduction of proper appliances. It is manifestly unfair to classify an industry as in itself prejudicial to health, when its undesirable features may be eliminated. If this is not class legislation it comes so near the border line as to create a precedent fraught with possibilities of evil. A petition for re-hearing of the case has been filed, asking for review of this portion of the decision. It would be pleasing to see the Supreme Court bridle the legislature by curtailing that unlimited power to affect classes and special industries which the decision just rendered will be construed as conceding.

Petroleum Production.

The petroleum production of the United States now amounts to approximately 175,000,000 barrels per year. In 1908 it was 179,572,479, but in the last year a decrease occurred. It sells for $125,000,000 to $130,000,000 per year, ranking in total value next to coal and pig iron, and equaling, for example, the combined value of the gold and silver output of the country. Nevertheless, the production of oil is a new industry. It is within a year that the semi-centen-

nual of the drilling of the Drake well at Titusville Pennsylvania, was celebrated and the three most productive fields in the United States those of California, Oklahoma, and Illinois, only became important producers in 1900, 1905, and 1907 respectively. For many years the Appalachian region, including at first only Pennsylvania and New York, but later Ohio and West Virginia, were the main sources of supply. The Pennsylvania-New York field reached a production of 30,000,000 barrels in 1882, and a maximum of 33,009,236 in 1891. Since that year they have steadily declined. West Virginia produced 16,195,676 barrels in 1900, but has since declined to less than 10,000,000. Ohio ran up to nearly 24,000,000 in 1896, the Lima field being then important, but it now produces little more than West Virginia. In a general way the Eastern States were thought to contain the most important oilfields up to 1901, when the great Lucas well at Spindle



Gold Production in California, 1849 to 1909, in Millions of Dollars Compared with Petroleum Production, 1876 to 1909, in Millions of Barrels.

Top in Texas, and the rapid increase in California production, attracted renewed attention to the West. Since then the California output has exceeded most sanguine expectations, amounting to over 57,000,000 barrels in 1909. At the same time the Oklahoma field has proved embarrassingly rich, the output in 1909 amounting to 46,535,613, more than could be properly cared for, as shown by Mr. L. L. Hutchison, of the Oklahoma Geological Survey, in this issue. The whole Illinois production has also been developed. Mr. R. S. Blatchley estimates the output of the latter State in 1909 at 29,700,000 barrels. We believe this to be a little low, since, in addition to the pipe-line runs of the Ohio company and the tank-car shipments, allowance should be made for the oil handled by the new Tidewater line. Since this has been estimated as high as 8000 barrels per day for part of the year, it is evident that something may safely be added to Mr. Blatchley's figures. However, the pre-eminence and relative rank of the three great producing States, California, Oklahoma, and Illinois, are likely to stand.

In California the oilfields furnish now the greatest single item in the mineral output. And yet these fields were for many years condemned as probably worthless because of the 'low grade' of the oil and an alleged lack of cover. How groundless were these fears is shown by the curve of production above.

For the sake of comparison the gold production of the State is sketched on the same diagram. It should be remembered that the comparison here is between rates of production and not between absolute values. To make the latter hold it would be necessary to assume that the oil had heretofore sold for $1 per barrel, which is far from true. The gold-production curve, it will be noted, swings suddenly and sharply upward, and with the prompt working out of the rich placers drops down at a rapid but somewhat less pronounced rate. As the industry became firmly established, quartz mining began, and methods of exploration and mining adapted to the territory were developed, the line ceased to drop and became roughly horizontal. The oil-production curve shows the industry still to be in the first stage. Indeed, it is a characteristic production-curve for a young industry, and corresponds to one representing the portland cement industry in the United States beginning with 1895. The early years of the Klondike and of Cripple Creek yield similar production-curves. So far the situation is most hopeful.

Predictions regarding oil production are notoriously uncertain, and only most general statements may be ventured. There is, however, a growing conviction among those who have watched the development of the territory that the areal limits of the oilfields of the State are now mainly ascertained. It is not to be expected that the formations which have proved so productive in the southern counties will show equally rich in the central and northern parts. Doubtless some additional fields will be found and the limits of the present pools are by no means known. Depth, however, imposes difficulties and costs which must ultimately prevail. It is not likely that 'mile-deep' wells will become common, even in such rich territory as California. Water, another limiting factor, may be overcome, at least in part, as has been shown this year in the Summerland field. Yet it is the almost universal rule that in the end the water prevails. Care in drilling, casing, and plugging wells is effective in combating it, but complete success is contingent on vigilance and co-operation which is not to be expected in an industry where so many individuals and companies are all dipping soup from one tureen. Mr. Ralph Arnold has estimated for the Conservation Commission that 8,500,000,000 barrels of petroleum were originally stored in the rocks of the State, and that of this, 5,000,000,000 might be expected to be produced. To date the total yield has amounted to 259,000,000 barrels, so that on the basis of Mr. Arnold's estimates, a considerable amount remains to be drawn. The quantity is, however, fixed. The amount of oil in the rocks is decreasing and not increasing, and its importance to the industries of the Pacific Coast demands that intelligent care be taken in its production and use to keep the waste down to its possible minimum.

FUTURE OF COPPER.

Written for the Mining and Scientific Press
By James Douglas.

It is possible that we in this country feel so sure of our present commanding position in the copper markets of the world that we do not attribute sufficient importance to what the world at large is doing and may do. Looking backward is often salutary, and a retrospect, if we read history aright, may enable us to make correct anticipations. Looking back to the beginning of the last century we find that for the first half Great Britain took the lead as a copper producing country, making about 40% of the world's total. Chile, however, kept creeping up into prominence, and when the century had half expired Chile stood first on the list, and retained that position until the seventh decade, after which the yield of the Rocky Mountain mines in Arizona and Montana gave the United States pre-eminently the first place. The contribution of Chile, with a small addition from Bolivia between 1871-1880, was 483,300 tons, as against 186,400 in the United States, whereas during the eighth decade the west coast of South America had declined to 368,300 tons, and this country had risen to 730,750. Great Britain meanwhile had sunk into insignificance. The production of her mines shrunk during the eighth decade to only 21,300 tons (which had yielded in the third decade 144,000 tons.*

Great Britain can never attain high rank, with production on the scale of today, as her mines, besides having been stripped of their richer ores, are included in a limited area of South Devonshire, Wales, and Cornwall, the copper yield of the Wicklow pyrites being negligible. But Chile, Bolivia, and Peru have resources of incalculable extent. Chile's production attained its zenith in the early seventies, when her mines yielded over 50,000 tons. This came almost exclusively from the districts of Tamaya, Carrizal-Alto, and Chañaral, with small quantities of argentiferous copper from the Copiapó. They mined only the richer ore, extracted from comparatively shallow depths. The cost of mining and smelting with dear coal in reverberatory furnaces of small size was high, and has remained so ever since. But Chile's coal mines, in the southern provinces, have of late undergone rapid development; petroleum discoveries on the west coast have been made, and above all, the contagion of our success in working low-grade porphyries will extend, and when it reaches there, low-grade ore will be developed in abundance sufficient to keep both company mongers and metallurgists busy.

The interior of Bolivia and Peru will not yield their mineral treasures until railroads reach them. The sandstones that have for a century yielded the copper *barrilla* (metallic copper) which has been shipped in small quantities from Arica, after transportation over 200 miles by mule and rail, extend for some 300 miles from Corocoro in Bolivia to San Pedro de Atacama in Chile, will in time duplicate the production of our Lake Superior mines.

What Peru may do can be imagined from the brilliant results of working the copper ores at Cerro de Pasco which underlie the silver ores of that famous region. Next year the furnaces at Tinyahuarco promise to turn out 60,000,000 lb. of copper.

The production of Mexico, like our own, has grown with the progress of railroad building, and has expanded from less than a thousand tons 30 years ago to over 60,000 tons at present. Canada also owes her position to the assistance of railroads. The maritime Provinces have never produced copper in any quantity, and though the Province of Quebec in the sixth decade figured more conspicuously in the number of companies organized than in the quantity of copper produced, she has not maintained her early output. Ontario in the same period appeared as a notable producer of copper from the Bruce mine, on the north shore of Lake Huron, but it was not till the Canadian Pacific cut away from the river and the lakes and opened up the interior that Sudbury was discovered, and subsequently the copper mines of the Boundary District of British Columbia were made accessible. But these discoveries have been made on the mere fringe of a territory which covers half the continent. Twenty-five years ago, before the development of the Sudbury mines, Canada made only about 1,000,000 lb. of copper per annum; last year she made 64,000,000.

Looking to the other hemisphere, we find even more unexplored and undeveloped territory than in the Western World. The Cape Copper Co., from its mines in Namaqualand, in Cape Colony, has maintained a small but steady yield since its organization in 1888; but both it and the copper mines in the adjacent German territory lie close to the coast. The vast interior of the continent is to the miner almost an unknown land. Some small mines have been opened in South Rhodesia, and we are soon to know whether the promises made of great production from the Tanganyika Concessions, and from the Katanga District of the Congo Free State, are to be realized. Within less than a twelve month a branch of the Cape to Cairo railroad will have been completed. From the report of the Tanganyika Concessions, Ltd., recently issued, I make the following extracts: "Messrs. Pauling & Co. have kept well up to their promise to be at the Star mine 18 months after starting work. In seven months they have accomplished 140 miles of running line and 20 miles more of earthworks, and Mr. Pauling says that, given a fairly accommodating wet season, he will be at the Star mine next June, instead of October as expected. With regard to the Union Minere company, in which the Belgians own 55% and we own 45: The work at the Star mine and smelter is being equally rapidly pushed forward, and Mr. Gibb reports that in 12 months we should be ready to produce 2500 tons of copper per month."

The Kansanshi mines also promise speedy returns and the predictions are not as vague as those heretofore made. The same report says: "With regard to the Rhodesia-Katanga Railway Co., at Kansanshi mine, we have been producing copper bars containing 96% of copper direct from the small furnace.

*I take these totals from Brown & Turnbull's very useful 'A Century of Copper'.

There are 1000 tons of these bars now ready and will have about $90,000 to $100,000 worth of them on the railway in April or June next. The first shipment by rail will represent in value more than the entire money spent on the mine since it was discovered including the cost of making the copper. Mr. Thomson, the manager of the Kansanshi is enlarging the present furnace, and the shipments will come regularly and increase steadily from this mine until they are followed a little later by 2500 tons monthly from the Katanga mines."

In Asia are vast areas of unexplored territory, and in Australia old mines are being reopened, where our experience in working low-grade ores will be repeated. Meanwhile it must not be forgotten that we have not opened a large high-grade mine except North Butte since the Iron Mountain, in 1894, and that nearly all our old high-grade mines must now be classed as low-grade. To extract the copper from the new avowedly low-grade deposits, even with improved methods, will cost more than the old standard, and the same will become increasingly true of the working of these same low-grade ores as depth is attained. Percentages will fall off, and all the contingencies which accompany either large surface openings or greater depth must be met; and these contingencies will have to be encountered in the face of a larger foreign production. To successfully overcome these difficulties without losing our standing among the world's producers will require skill, discrimination, business ability, and some moderation in output.

LEAD PRODUCTION IN 1909.

Figures showing the production of refined lead in 1909, compiled by C. E. Siebenthal, of the United States Geological Survey, from reports and estimates made by the desilverizers and the soft-lead smelters, are believed to show approximately the actual output within 1%.

The total production of refined lead, desilverized and soft, from domestic and foreign ores in 1909 was approximately 444,363 short tons, worth at the average New York price $38,215,000, as compared to a production of 396,433 tons in 1908 and 414,189 in 1907. These figures do not include an estimated output of 12,860 tons of antimonial lead, as against 13,629 in 1908 and 9910 in 1907. Of the total production, desilverized lead of domestic origin, exclusive of desilverized soft lead, is estimated at 209,698, as against 167,790 tons in 1908; and desilverized lead of foreign origin comprised 87,379 tons, compared to 97,761 in 1908. The production of soft lead from Mississippi Valley ores is estimated at 147,286 tons, as compared with 130,882 in 1908 and 129,607 in 1907. Missouri apparently retained first place among the lead-producing States.

There was a slight increase in the imports of lead in ore and base bullion, which amounted to 112,467 tons, valued at $4,210,829, as compared to 109,287 in 1908. Of the 1909 imports, 90% came from Mexico. The imports of refined lead increased slightly, being 3588 tons, with a value of $230,956, against 2759 in 1908. The exports of foreign lead (lead of foreign origin smelted or refined in the United States) show an increase of 16%, being 88,794 tons valued at $3,221,836 compared to 76,367 in 1908. The exports of lead manufactures decreased slightly having a value of about $540,000 as compared to $599,040 in 1908. The price of lead started in January with an average of 4.2c. per lb., falling in March to the minimum for the year, 3.95c., then rising slowly to the close of the year. The average New York price for the year was 4.3c. per pound.

PRODUCTION OF COPPER IN 1909.

Statistics and estimates received by the United States Geological Survey from all plants known to produce blister copper from domestic ores and from all Lake mines indicate that the copper output from mines in the United States in 1909 surpassed all previous records.

The figures, which have been collected by B. S. Butler, of the Survey, represent the actual production of each company for 11 months and include an estimate of its December output. The November figures for a few companies were not available and these companies furnished estimates for the last two months of the year. On this basis the output of blister and Lake copper was 1,117,800,000 lb., as against 942,570,721 in 1908, an increase of over 18%. This not only exceeds the increase of any previous year but it is considerably greater than the total yearly increase since 1904.

It is impossible now to give figures that represent accurately the distribution of the output among the States, but Montana shows a large increase, again taking first rank, a place lost to Arizona in 1907. The production in Montana will nearly equal or will possibly exceed the State's previous record output, 314,750,000 lb., made in 1905. Arizona holds second place, with a slight increase over the 289,523,000 lb. produced in 1908. Michigan also exceeded the 1908 production, 222,289,000 lb. Large gains were made by Utah and Nevada, and California also increased its output considerably.

Figures published by the Copper Producers' Association indicate that the production of marketable copper from all sources, domestic and foreign, for the first 11 months of 1909 will exceed 1,400,000,000, as against 1,161,176,085 lb. in 1908. Statistics showing domestic deliveries for the first 11 months of the year indicate a consumption of copper in the United States considerably greater than the previous record consumption—682,000,000 lb. in 1906.

The exports of copper will surpass by several million pounds the exports for 1908—661,876,127 lb. According to the Bureau of Statistics, imports of pigs, bars, ingots, plates, and old copper for the first 11 months amounted to 213,100,281 lb., and the copper content of ore matte and regulus imported amounted to 74,708,482 lb. If the imports for December were equal to the average monthly import for the first 11 months the amount of copper entering the United States for the year was about 311,800,000 lb., as against 218,705,487 lb. in 1908.

Stocks of refined copper in the United States show a considerable increase over those of January 1, 1909, but the accumulation occurred for the most part during the first half of the year. European stocks, how-

ever, have increased rather uniformly throughout the year and at the close were probably nearly double those of January 1, 1909. The price of copper has remained close to 13c. throughout the year, the average monthly New York quotation for electrolytic copper being a little under 13 cents.

SPELTER PRODUCTION IN 1909.

A statement just issued by the United States Geological Survey shows that the zinc industry in 1909 had a year of unexampled expansion. Not only was the largest output of spelter ever made in the United States almost completely absorbed by the market, but the imports of spelter were much larger than ever before. A record-breaking production of zinc ores in the Joplin and Upper Mississippi Valley regions and from the Franklin Furnace mines of New Jersey is indicated. The following figures have been compiled by C. E. Siebenthal from reports furnished by all operating zinc smelters, based on their output for the first 11 months of the year and their estimated production in December, and are confidently believed to be within 1% of the actual output. Figures showing the imports and exports were obtained from the records of the Bureau of Statistics, likewise with estimates for December.

The production of primary spelter from domestic ore in 1909 is estimated at 241,842 short tons, and from foreign ore at 26,373, a total of 268,215, worth $28,967,226, as compared to 210,424 tons in 1908 and 249,860 in 1907. The production of spelter from both domestic and foreign ores, apportioned according to the States in which smelted, was approximately as follows: Illinois, 76,486 tons in 1909, as compared to 50,244 in 1908; Kansas, 104,007 in 1909 and 99,298 in 1908; Missouri, 8479 in 1909 and 10,201 in 1908; Oklahoma, 28,821 in 1909 and 14,864 in 1908; Eastern, Western, and Southern States, 50,422 in 1909 and 35,817 tons in 1908. The total production of spelter is equivalent to the output of 56,112 retorts operating continuously through the year, or 60% of the total smelting capacity.

The imports of zinc ore exceeded all records, being approximately 116,173 short tons, valued at $1,381,836. Of this amount 91%, or 105,600 tons, was from Mexico, more than double the quantity imported in 1908, which was 53,757 tons, and even more than the quantity imported in 1907, which was 103,117 tons. The exports of zinc ore show a decrease, being 12,456 short tons, worth $412,300, compared to 26,108 tons in 1908. The imports of spelter show a remarkable increase, being approximately 10,961 short tons, worth $947,196, compared to 881 tons in 1908. The exports of spelter fell off slightly, being 2487 tons, as against 2648 tons in 1908. The exports of zinc dross were 7306 tons, valued at $494,158, compared to 8405 tons in 1908.

The apparent consumption of spelter in 1909 may be calculated as follows: The sum of the stock on hand at the smelters at the beginning of the year, 19,622 tons, plus the imports, 10,961, and the production, 268,215, gives the total available supply, 298,798 tons. From this there is to be subtracted the exports, 2487 tons, and the stock on hand at the smelters at the close of the year (to be exact, on hand December 15), 10,546, a total of 13,033, leaving a balance of 285,765 tons as the apparent consumption. This calculation takes no account of the stocks of spelter held by dealers for speculative purposes. On comparing the consumption in 1909 with the 215,401 tons in 1908, the 228,524 in 1907, and the 220,781 in 1906, it seems probable that considerable stocks are held by dealers. Spelter opened at St. Louis in January at 5c. per lb., but dropped to 4.52c. late in February. A gradual rise carried prices up to 6.27c. near the close of the year. The average St. Louis price of prime western spelter for the year was 5.4c. per pound.

FERROUS IRON IN MINERALS.

*Decomposition of a mineral with the aid of HF and heat is readily accomplished, but the HF interferes decidedly with the permanganate titration. To expel it requires much time, with great danger of oxidation of the FeO. The author has found that the interference may be obviated by addition of calcium phosphate just before titration. The calcium phosphate solution is prepared by suspending 5 gm. $CaCO_3$ in 50 c.c. of water, and adding 10 c.c. (85%) of orthophosphoric acid slowly with stirring. This amount was found to suffice in the treatment of 0.5 gm. of magnetite. Take 0.5 gm. of the magnetite or other mineral weighed out in a 50-c.c. platinum crucible, moistened with water, coils of fine platinum wire introduced to prevent bumping, and then add a cold mixture of 10 c.c. HF and 15 c.c. H_2SO_4 (1 : 3). The close-fitting cover is then put on, and the crucible placed in a hole in an asbestos board, which is of such size that the crucible rests in it when about half way down, fitting closely. Over this is put a 6-in. paraffined funnel, the stem of which is connected with a CO_2 apparatus. The rim of the funnel should fit closely against the asbestos board. Pass in a strong stream of CO_2, and then in a few minutes apply the heat of a burner to the crucible, regulating it so as to quickly bring the content to boiling, and after that to keep it boiling gently. Apparently the point at which the treatment can be safely stopped must be judged by experience; ordinary rocks require about 5 minutes. Magnetite and other minerals may require a little longer. Remove the burner, and when the steam has condensed lift the crucible (still covered) by the aid of a loop of stout platinum wire (previously adjusted) and plunge it at once in 400 to 500 c.c. of cold water in a beaker. When ready to titrate upset the crucible in the beaker, stir, then add the calcium phosphate solution, and proceed to titrate. The first permanent color is to be taken as the end-point, though it may fade in a short time. A blank determination should be run, and the corresponding correction made.

Stockholders in mining companies are not co-owners with the corporation or the other stockholders within the meaning of law referring to forfeiture of interest for failure to do or to contribute to the doing of assessment work.

*Abstract by Elwyn Waller from *Jour.* Am. Chem. Soc. XXX.

GEOLOGICAL DISTRIBUTION OF THE PRECIOUS METALS IN COLORADO.—I.

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD

In a previous article I presented some general conclusions regarding the geological distribution of the precious metals, stating that in Colorado, for example, the occurrence of gold and silver ores was dependent upon structural and thermal conditions, identified with the eruptive activity that was manifested at the end of the Cretaceous and the beginning of the Tertiary period. The irruptive[2] rocks associated with the precious-metal deposits of Colorado are of post-Cretaceous and pre-Pliocene age, and this is true notwithstanding the fact that the Tertiary volcanics and their associated ore deposits traverse rocks belonging to all the sub-divisions of geological time. Profitable mining for gold and silver has been performed in formations belonging to every division of geological time from the Tertiary to the Archaen, and in every kind of rock from the simplest sedimentary to the most complex crystalline. The only condition uniformly prevalent is the vulcanism that supervened at the close of the Cretaceous, as now manifested in the form of dikes, sills, and cores of igneous rock of varying composition.

The accompanying table tells the story. This summary of the evidence collected by me in the course of professional work in Colorado, gives the names of 650 mines, all of which are assigned to their proper geological horizon. Eighty mining districts and sub-districts are specified and, taken as a whole, the table affords emphatic evidence of the wonderful distribution of the precious metals in that portion of the Rocky Mountain region. A suitable description of the various districts, with reference to the mines mentioned, was prepared by me five years ago and it was made ready for publication a couple of weeks before the earthquake-fire that devastated San Francisco. Among the many papers not possible of replacement that were destroyed on April 18, 1906, was the one intended to add to the usefulness of this list of Colorado mines. It went up in smoke, but the list itself, most fortunately, was at my home at Berkeley and so escaped the destruction that befell everything at the office in San Francisco. The fact that the tabulated statement was prepared five years ago will explain the omission of mines that may have won prominence since then, but this is of no moment, for there is no intention of presenting a directory of good mines in Colorado; the list is for the mining geologist and not for the promoter or even the speculator; it is merely a systematic effort to bring out a dominant fact in the study of ore deposits in Colorado.

It will be necessary to give an outline of the geological conditions suggested by the petrography and stratigraphy—the kind and age—of the rocks mentioned in connection with the different districts, and as any such description will lack the life of the one that was burnt it is presented with an apology.

The youngest rocks in which gold or silver have been found in Colorado are, naturally, the Tertiary eruptives immediately associated with the origin of precious-metal deposits all over the State. The first eighteen occurrences are all in the volcanic complex due to the successive periods of volcanic activity that are responsible for the distinguishing features of the Cripple Creek, Silver Cliff, and San Juan mining districts. Hahn's Peak (19) belongs to the same period but is a northern area, separate from the districts mentioned and unlike them in many respects.

The youngest rock in which precious-metal mining has been done is the diorite of the San Juan. At Ophir, Mt. Wilson (1), and in the La Plata mountains (2), this rock appears as a quartz-bearing augite-diorite, passing on the one hand to a granitic phase and on the other to a gabbro. This rock is usually porphyritic. Irregular veins of ore are found traversing the big stocks or cores of this rock, and when they extend out of the diorite into the surrounding sedimentary formation, such as Mancos shale (Cretaceous), the orebodies are less profitable (24). The diorite is probably Miocene. In the La Plata mountains the precious metals occur in the form of tellurides, chiefly petzite and hessite. Displacements are frequent; they are more in the nature of a shifting along the lines followed by the ore than regional faults. In many cases the quartz veins are economically less important than the impregnation of the diorite itself.

At Silver Cliff and Rosita (3) the evidence of geologically recent vulcanism is marked. The Bassick orebody is a chimney occupying the neck of a vent, and the ore itself consists of rounded fragments of andesite representing a phase of volcanic eruption. Fumarolic action is evident.[4] The Bull-Domingo is a similar chimney of ore, but in this case the vent is in ancient granite, while at the Bassick it is in igneous rocks only less recent than the outlet itself. Other mines in the same district, such as the Silver Cliff itself, yielded rich silver ore from a rhyolite flow covering tuff and breccia. This ore was quarried in large quantities, and some shipments were also made subsequently from a depth of 2100 ft. in the Geyser mine, which follows a fissure penetrating both the tuff and the underlying granite. The Pocohontas and Humboldt veins follow fault-planes in the igneous rocks that outcrop in this district, remarkable for long-continued volcanic action on a small scale. Fossil leaves fix the age of the rhyolite as early Eocene.

Next we come to the great area of volcanic ejectamenta out of which the mountains of the San Juan region have been sculptured. This forms the southwestern part of Colorado and is a rough country famous for rich mines. The mountains reach an altitude of 14,000 ft. above sea-level and their topmost 5000 ft. consists of eruptive rocks, mainly breccia and lava. The earliest extrusion was an andesite breccia, which was deposited to a thickness of 1500 ft. and covered the territory included within the

[1] MINING AND SCIENTIFIC PRESS, October 20, 1906.
[2] Eruptive rocks are those that have broken out from vents and covered the surface. Irruptive rocks invade and break into the formation without necessarily reaching the surface.

[3] T. A. Rickard. 'Lodes in the Tertiary Eruptives of Colorado.' MINING AND SCIENTIFIC PRESS, August 10, 1907.
[4] S. F. Emmons. 'The Mines of Custer County, Colorado.' U. S. G. S. Seventeenth Ann. Rept., pt. 2, pp 411-472. 1896.

TABLE ILLUSTRATING THE GEOLOGICAL DISTRIBUTION OF THE PRECIOUS METALS IN COLORADO.—By T. A. RICKARD.

PERIOD.	ROCK.		LOCALITY.	REPRESENTATIVE MINES.
Tertiary	Diorite or monzonite	1	Ophir and Mt. Wilson	Carribeau, Montezuma, Butterfly, Terrible, Silver Pick, Silver Bell, Butler.
"	Diorite porphyry	2	La Plata Mountains	Columbus, Little Kate, Small Hopes, Jenny Lind, Mountain Lily, Tip Top, Durango Girl.
"	Andesite agglomerate and rhyolite	3	Silver Cliff and Rosita	Bassick, Humboldt, Pocahontas, Virginia, Hector, Geyser.
"	Andesite breccia and rhyolite	4	Summitville	Golconda, Little Annie, Aztec, Bobtail, Little Ida, Morse, Major, Treloar.
"	Rhyolite	5	Creede	Amethyst, New York, Last Chance, Bachelor, Commodore, Happy Thought, Park Regent.
"	Andesite and andesite breccia	6	Red Mountain	Guston, Yankee Girl, Congress, National Battle, Gennessee-Vanderbilt, Barstow.
"	Andesite and latite	7	Engineer Mtn	San Juan Chief, Frank Hough, Polar Star, Banner, Palmetto, Manhattan, Old Lout.
"	Andesite breccia	8	Ophir	Suffolk, Alta, Bessie, Gold King, Summit, Palmyra.
"	Andesite breccia	9	Mt. Sneffels, Ouray	Camp Bird, Yellow Rose, Virginius, Terrible, Humboldt, Trust Ruby, Atlas.
"	Andesite breccia	10	Telluride	Smuggler-Union, Tomboy, Argentine, Cimarron, Valley View, Japan, Columbia.
"	Andesite breccia and rhyolite	11	Silverton	Silver Lake, North Star, Iowa, Titusville, Sunnyside, Mastodon, Ridgway, Aspen.
"	Andesite breccia	12	Cement Creek, Silverton	Grand Mogul, Gold King, Nathalie, Henrietta.
"	Andesite breccia	13	Lake City, Hinsdale	Golden Fleece, Ute & Ulay, Hidden Treasure, Lily, Hondee.
"	Nepheline basalt and breccia	14	Raven Hill, Cripple Creek	Elkton, Moose, Tornado, Raven, Bertha, Ingham, Ida May.
"	Nepheline syenite and breccia	15	West Cripple Creek	Vindicator, Lillie, Independence Consolidated, Longfellow, Christmas.
"	Trachytic phonolite and breccia	16	Bull Hill, Cripple Creek	Victor, Isabella, Pharmacist, Orpha May, Golden Cycle, Zenobia, Lucky Gus.
"	Andesite breccia and phonolite	17	Battle Mtn., Cripple Creek	Independence, Portland, Last Dollar, Modoc, Rigi.
"	Andesite and breccia	18	East Cripple Creek	Anaconda, Moon-Anchor, Gold King, Anchoria Leland, Mary McKinney.
"	Trachyte	19	Hahn's Peak	Tom Thumb, Southern Cross, Royal Flush, Imperial, Minnie D.
"	Conglomerate	20	Bear Creek, Telluride	Contention, Champion.
"	Conglomerate	21	Silver Mtn., Ophir	Osceola, Golden Crown, Red Jacket, Winnemucca, Attica.
Cretaceous	Sandstone, shale, and conglomerate	22	Irwin, Gunnison	Forest Queen, Ruby King, Mountain Gem, Bullion King, Ruby Chief, Monte Cristo.
"	Sandstone and shale	23	Ruby Range	Augusta, Domingo, Richmond, Elkton, Painter Boy, St. Elmo.
"	Shales	24	Mt. Wilson	San Bernardo, Magpie, Morning Star, Belcher.
"	Shales	25	Farncomb Hill, Breckenridge	Ontario, Key West, Bow, Carpenter, Gold Flake, Grattan, Bondholder.
"	Quartzite	26	Hahn's Peak	Hidden Treasure, Minnie D., Independence, Good Thunder, Dead Shot.
"	Sandstone	27	Gold Hill, Ouray	American Nettie, Octoroon, Wedge, Bachelor, Khedive, Calliope, Iowa Chief.
Jurassic	Sandstone and shale	28	San Miguel	Allegheny, Crescent, Wonder.
"	Limestone and sandstone	29	Sawpit, San Miguel	Corbett, Lizzie G., Belle Champion, Commercial, Nancy Hanks.
"	Limestone and sand-tone	30	Gold Hill & Camp Paquin, Ouray	Bright Diamond, Ironclad, Pony Express, Slide, Newsboy, Black Girl, Portland.
"	Sandstone	31	La Plata Mountains	Century, North Star, Georgia Girl.
Triassic	Sandstone	32	La Plata Mountains	Baker Contact, Cumberland, Snowstorm, Eureka, Eagle Pass, Gold Bug, Mammoth.
"	Sandstone	33	West Gold Hill, Ouray	Speedwell, Grand View, Gray Eagle, Plutus, Sampler.
"	Sandstone and shale	34	Bear Creek, Telluride	Silver Chief, Silver Glade, Canton, Northern Ohio, Badger.
"	Limestone and sandstone	35	Kokomo, Ten Mile	Queen of the West, Mayflower, Clara, Little Rex, Enterprise, Morning Star, Delmonico.
Permian	Sandstone and sandy shale	36	Rico	Pittsburgh, Cobbler, Butler, Phœnix, Grand View, Alma Mater.
Upper Carboniferous	Limestone	37	Robinson, Ten Mile	Robinson, Big Giant, White Quail, Milo, Badger, Snowbank, Selma, Free America.
"	Limestone	38	Pitkin	Maid of Athens, Cleopatra, Fairview, Silent Friend, Courtland.
"	Bituminous limestone	39	Rico	Logan, Princeton, C. H. C., Wellington, Pigeon, Quebec, Wabash, Sambo.
"	Limestone and shale	40	Newman Hill, Rico	Enterprise, Rico-Aspen, Swansea, New Year, Blackhawk, Union Carbonate, Iron.

Lower and middle Carboniferous	Limestone and shale	41	Smuggler Mtn., Aspen	Mollie Gibson, Smuggler, Della S., Park-Regent, Buckwacker, Mineral Farm, Alta-Regent.
Lower Carboniferous	Limestone and dolomite	42	Aspen Mtn., Aspen	Argentum-Juniata, Spar, Emma, Aspen, Durant, Schiller, Bonnybel.
"	Limestone	43	Gothic	Moss Rose, Sylvanite, Virginius, Silver Queen, Iron Duke.
"	Limestone	44	Mt. Lincoln	Dolly Varden, Fanny Barret, Moose, Present Help, Russia, Sunflower.
"	Limestone	45	Battle Mtn., Redcliff	Iron Mask, Belden, Ben Butler, Kingfisher, St. Joe, Eagle Bird, Belcher, Crown Point
"	Dolomitic limestone	46	Leadville	Small Hopes, Crysolite, Little Pittsburg, Robert E. Lee, Morning Star, Wolftone, Matchless, Iron Silver, Ibex.
Devonian	Limestone	47	Ironton, Ouray	Saratoga, Mono, Brooklyn, Baltic, Albany, Maud S, Mineral Farm.
"	Quartzite	48	Leadville	Colorado No. 2, Louisville, Pyrenees, Rubie.
"	Limestone	49	Dolores Valley	Atlantic Cable, Riverside, Smuggler.
Silurian	White limestone	50	Leadville	Maid of Erin, Adams, Wolftone, Mahala, Mikado, Greenback, R. A. M.
"	Dolomite	51	Gold Hill and Tin Cup	Jimmy Mack, Gold Cup, Silver Cup, Carbonate King and Queen, El Capitaine.
Cambrian	Quartzite	52	Battle Mtn., Redcliff	Ground Hog, Polar, Rocky Point, Star of the West, Percy Chester.
"	Quartzite	53	Leadville	Maid of Erin, Adams, R. A. M.
"	Quartzite	54	Alma	Orphan Boy, Paris, Eureka, Sovereign, Gold King.
"	Quartzite	55	Upper Blue River	Phillips, Ling, El Dorado, Vanderbilt, Monte Cristo.
Algonkian	Granite	56	Squaw Mtn., Cripple Creek	Strong, Gold Coin, Granite, Dead Pine, Ajax, Dillon, Coriolanus.
"	Granite	57	Beacon Hill, Cripple Creek	El Paso, Kimberley, Orizaba, Prince Albert, Little May.
"	Hornblende schist	58	Silverton	Highland Mary, Green Mtn., Creteba, Powder House.
"	Schist and quartzite	59	Bear Creek, Needle Mts	Gold Bug, Good Hope, Sylvanite, New York, Brooklyn, Silverton.
"	Mica schist	60	Vulcan, Gunnison	Good Hope, Vulcan, Mammoth-Chimney.
"	Gneiss and actinolite schist	61	Salida	Sedalia, Gypsy Queen, Cotopaxi, Copper King.
"	Hornblende schist and quartzite	62	Crestone	Independent, Cleveland, Bonanza, Cashier, Shah of Persia, Alamosa.
"	Hornblende schist	63	Ohio Creek, Gunnison	Sacramento, Corydon, Soft Snap, Toronto, Montreal.
"	Hornblende schist	64	Costilla	Hamilton, Honest Abe, Evangeline, Hawkins, Little May.
Archean	Granite	65	Mt. Massive	Denero, Virginius, Tiger, Orinoco, Buckeye, Homestake, President.
"	Granite-gneiss	66	Monarch	Vivandiere, Eclipse, Kadish, Independence, Nick Warren.
"	Granite	67	St. Elmo	Mary Murphy, Nellie Bly, Pawnee, Pat Murphy, Blackhawk, Waupaca.
"	Gneiss and granite	68	Southern Gunnison	Old Lot, Mineral Hill, Iron Cap, Ute Trail, Champion.
"	Granite	69	Burroughs Park	Monticello, Cleveland, Cashier, Bon Homme, La Belle.
"	Granite	70	Needleton	Ajax, Apache, Norch, Mastodon, Emerald Lake.
"	Protogine granite	71	South Boulder	Yellow Pine, Logan, Hoosier, Kekionga, Mountain Lion, Keystone.
"	Gneiss and granite	72	Caribou	Caribou, No Name, Poorman, Boulder County.
"	Protogine gneiss	73	Eldora	Enterprise, Village Belle, Revenge.
"	Gneiss and mica schist	74	Ward	Ni Wot, Columbia, Utica, Morning Star, B. & M., Dewdrop, Texas.
"	Protogine gneiss	75	Gold Hill and Sunshine	Slide, Horsefall, Red Cloud, Grand View, Emancipation, Melvina, Ingram.
"	Granite and gneiss	76	North Boulder	Golden Age, Longfellow, Smuggler, John Jay, Bueno, Nugget.
"	Granite	77	Twin Lakes	Gordon, Bengal Tiger, Kearsarge, Terrible, Belle of Granite, Grit, Magenta.
"	Granitoid gneiss	78	Silver Plume	Pelican-Dives, Seven Thirty, Dunderberg, Stevens, Mendota, Pay Rock.
"	Granitoid gneiss	79	Georgetown	Terrible, Brown, Griffith, Centennial, Lamartine, Freeland, Senator.
"	Granitoid gneiss	80	Idaho Springs	Stanley, Mayflower, Mattie, Edgar, Crown Point & Virginia, Champion, Seaton.
"	Granitoid gneiss	81	Gilson Gulch	Franklin, Gem, Silver Age, Sun and Moon, Casino, Freighter's Friend.
"	Granitoid gneiss	82	Nevadaville	California, Flack, Prize, Gunnell, Kansas-Boroughs, Hulsert, Kent County.
"	Granitoid gneiss	83	Russell Gulch	Saratoga, Topeka, Frontenac, Lotos, Pyrenees, Pewabic, Wautaga.
"	Granitoid gneiss	84	Central City	Running Lode, Mammoth, East Notaway, Carr, Perigo, Bertha.
"	Granitoid gneiss	85	Blackhawk	Gregory, Bobtail, Bates-Hunter, Buell, Fisk, Briggs, Cook, Americus.

counties of Conejos, Hinsdale, Gunnison, Ouray, San Juan, San Miguel, and part of Rio Grande.[5] This was in the early Eocene. In late Eocene time, and in the Miocene also, at intervals, there were many big volcanic eruptions, following earth-movements throughout this region. Enormous quantities of lava, tuff, and breccia were emitted, and still later these layers were traversed by dikes.

Near the headwaters of the Rio Grande is Creede (5), the silver district that caused such excitement in 1892. The lodes are in a sheeted rhyolite and the ore is beautifully ribboned by amethystine quartz, reproducing the structural lines of the country. Jasperoid and agatized quartz characterize the veins, which are much wider than the pay-streaks themselves. Crustification is evident everywhere. While silver is the chief valuable metal, much of the ore was rich in lead also. The Amethyst and Last Chance were famous twelve years ago.

Another mining camp with a brilliant past is Red Mountain (6), half-way between Ouray and Silverton, and in the very heart of the San Juan mountains. The Yankee Girl and Guston made the fortunes of many. With silver-lead outcrops, in depth these veins became rich in copper ores carrying gold and silver. The bonanza ore exhibited stromeyerite, a sulphide of silver and copper. Native gold occurred with barite. In the Yankee Girl a wonderful chimney of ore went down to 500 ft. and was then cut off by a flat fault-plane. Ten-ton lots of the bonanza ore carried 7 to 8 oz. gold and 3000 to 4000 oz. silver per ton. In the deeper workings—600 to 1000 ft.—the average pyritic ore contained 20 to 60 oz. silver, 1 to 4 dwt. gold, 5 to 12% copper.[6] The mine-waters near the surface were very acid. Solfataric action is evident in the removal of the basic constituents of the andesite, leaving a granular silicious mass, which, in places, has resisted erosion so as to form ridges, which may be truly termed 'reefs.'

Engineer Mountain (7) is on the divide separating the watershed of the Uncompaghre from the Animas river, and it is also at the meeting point of the boundaries of Ouray, San Juan, and Hinsdale counties. The prevailing country is a dark-gray andesitic rock, containing labradorite, with augite altered to calcite and chlorite. Ransome classes this rock as latite.[7] The Polar Star lode is typical of the locality; the ore occurs in this porphyritic latite, which is bleached to light gray, with kaolinization of the feldspar. Small crystals of pyrite are disseminated, with quartz, kaolin, and diaspore. Metamorphism of the country is restricted to the immediate vicinity of the veins; here, as at Red Mountain, the mineralizing solutions were probably acid.

The mines of Mineral Point are credited to Engineer Mountain, although they are situated on an outlying ridge. At Mineral Point the rock is a typical andesite of the Silverton series; the country is penetrated by dikes of rhyolite and also by the latite. Many prominent outcrops rib the mountain slopes, and the white lines of quartz can be seen at a distance extending across the uneven surface. The San Juan Chief is in a big mass of quartz. The Old Lout, at the head of Poughkeepsie gulch, was in bonanza in 1884 and produced rich silver-bismuth ore. The Frang Hough was productive at about the same time, yielding an ore carrying chalcocite, with silver and gold. The country is a soft tuff impregnated with pyrite.

The Ophir district (8) is in San Miguel county and due south of Telluride. The mines are in various geological formations, the youngest being the andesite breccia of the San Juan series. The occurrence of ore is associated with rock decomposition, even in the deepest workings.[8] In this soft ground it is hard to distinguish between ore and rock. The latter is impregnated with iron pyrite and traversed by stringers of quartz. The Gold King and Suffolk mines are on Silver Mtn., which contains a network of veins yielding free-milling gold-quartz. The Alta, on the slope to Telluride, is a small silver-lead vein carrying tetrahedrite, well defined and unlike the impregnations that characterize Silver Mtn., for there the precious metals occur outside the limits of the vein-walls.

Within the Mt. Sneffels district (9) is Imogene basin and Canyon creek, at the head of which are some of the best mines in Colorado, notably the Camp Bird and Virginius. In the Camp Bird the main ore-shoot is 1200 to 1500 ft. long and from 5 to 20 ft. wide. It occurs in a sheeted zone of the San Juan andesite breccia, the lode being ribboned by crystallization of quartz along open spaces. Threads of free gold, galena, sphalerite, and a dark telluride mark the bonanza ore. In 1878 the mining claims at the head of Imogene basin were the basis of a fiasco called the Allied Mines Company, yet it was out of this same ground that in 1896 the Camp Bird enterprise was built, developing into one of the great gold mines of the world. The Virginius is notable for being the deepest mine in Colorado, as measured from the surface to the deepest workings, reached by the Revenue adit. The vein has been worked through a vertical extent of 3300 ft., although it is usually only a few inches wide, but rich in silver-bearing gray copper (tetrahedrite). This ore lies in a fault-fissure alongside an andesite dike that cuts across the San Juan breccia. When it reaches the overlying rhyolite the vein is difficult to follow.

The principal mines of Telluride (10) are separated from those of the Mt. Sneffels district by a high ridge into which the veins penetrate. By crossing the divide behind the Virginius mine one reaches the head of Marshall basin, in which are the Smuggler-Union and Cimarron mines. Similarly, by ascending to 14,000 ft. and climbing over the ridge overlooking the Camp Bird mine, one reaches the upper workings of the Tomboy, Argentine, Japan, and other mines of Savage basin. It is a great mining district, one of the most picturesque in the world, and richly productive ever since John Fallon located the Sheridan claim in 1875. The vein that runs

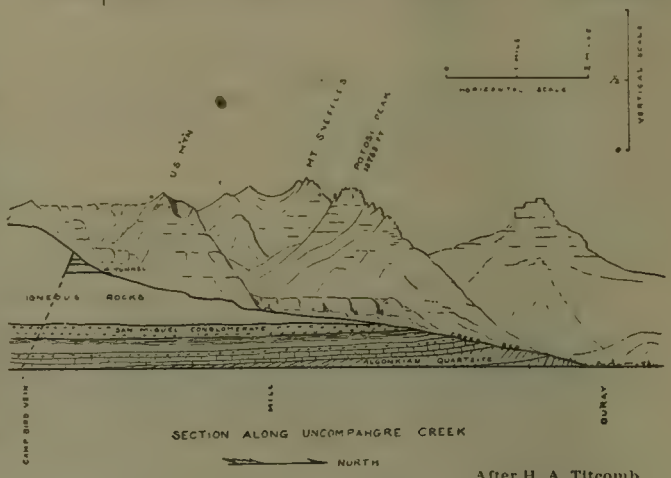
[5] R. C. Hills. *Proc.* Colo. Sci. Soc., Vol. III, p. 407.
[6] T. A. Rickard. 'The Formation of Bonanzas in the Upper Portions of Gold Veins.' *Trans.* A. I. M. E., Vol. XXXI.
[7] F. L. Ransome. 'Economic Geology of the Silverton Quadrangle, Colorado.' U. S. G. S. Bull. 182.
[8] C. W. Purington. 'Mines of the Telluride Quadrangle, Colorado,' U. S. G. S., Eighteenth Ann. Rept., pt. 3, pp. 745-850. 1898.

Silver Cliff, Colorado.

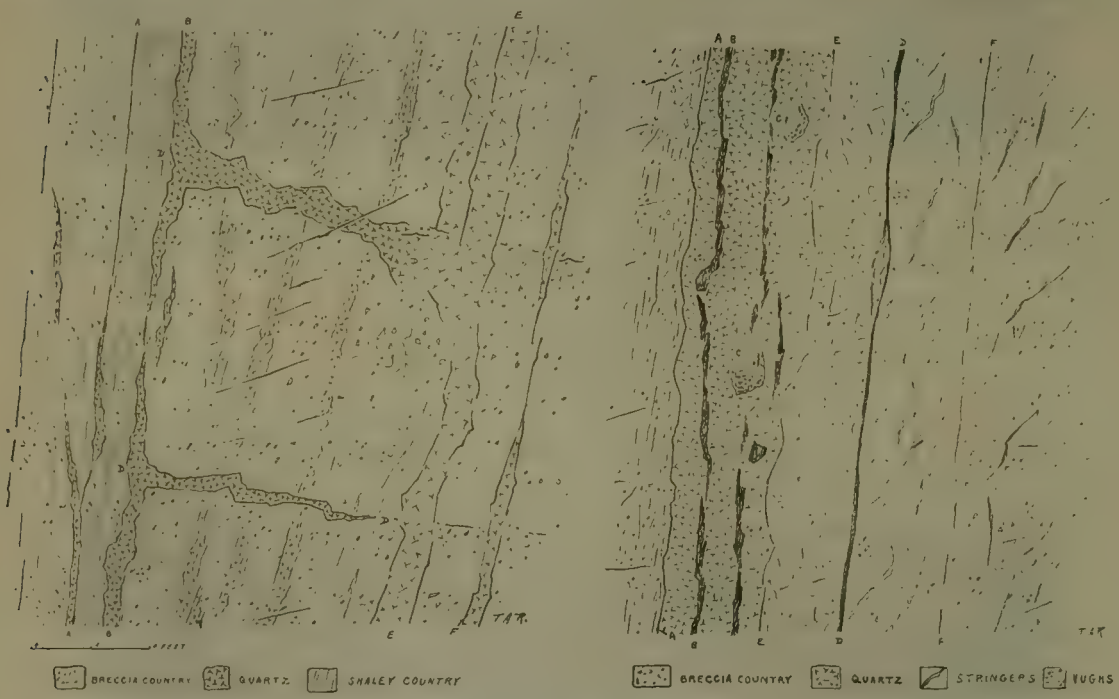
Sangre de Cristo Range and Wet Mountain Valley.

through the Smuggler, Union, Sheridan, Mendota, and Humboldt claims has been stoped continuously for a length of 5000 ft., and it has been traced for fully four miles on its strike. On the crest of the range the vein cuts through rhyolite; 750 ft. lower it traverses a sheet of augite-andesite, which is 550 ft. thick; still deeper the mine workings are within the andesite breccia of the San Juan formation. The best orebodies were found in the augite-andesite; good ore makes in zones, but oxidation reaches downward irregularly and does not coincide with enrichment. The gold and silver are associated with quartz, siderite, calcite, and rhodonite. Most of the lodes in this locality follow sheeted bands of country rather than large fault-fissures, but many of the poorer veins coincide with faults of large throw.[9]

Telluride is on the watershed of the San Miguel, while the Silverton district (11) is over galena as depth is gained in the course of mining, and veins first worked for silver have become important producers of gold, mainly because, with added depth, the silver contents have diminished



After H. A. Titcomb



Two Sections of the Smuggler-Union Vein.

drained by the Animas river; the two districts are separated by one of the high ranges of the San Juan. The prevailing ore-bearing formation is a series of andesite breccias and tuff, varied by flows of rhyolite. Many large lodes rib the mountain sides and exhibit bold outcrops of the fissure-vein type, and characterized by a nearly vertical dip. They extend from the volcanic series into the underlying Algonkian schist. Some of the most important lodes are in Silver Lake basin; they are large and well mineralized, the gold and silver being associated with galena and blende, in quartz. In the Sunnyside lode and others in that vicinity, rhodonite is abundant, and rich pockets of gold ore are found within a large width of low-grade quartz. In several instances blende predominates more rapidly than the gold. Gray copper, tetrahedrite and freibergite, characterize the rich ore throughout the district, especially as regards silver. Many of the veins are remarkably persistent and extend for the length of several claims (of 1500 ft. each). Faulting occurs and is often contributory to local enrichment.

The mines of Cement creek (12) are in andesite breccia also. Hübnerite, the tungstate of manganese, occurs in this locality on the west slope of Bonita peak. The most important mine is the Gold King; the workings follow two typical stringer lodes free from gouge. Apparently they have suffered no post-mineral dislocation, and this fact makes them singularly dry. Walls are lacking, the ore being a network of stringers around which the andesitic country

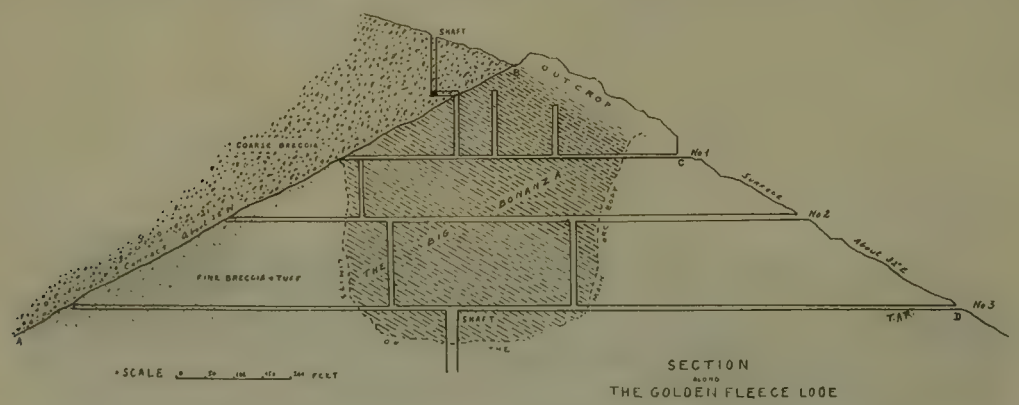
[9] T. A. Rickard. 'Journeys of Observation,' page 50.

Rosita, Colorado.

Quarry in Rhyolite of the Geyser Mine, at Silver Cliff, Colorado.

is much mineralized.[10] The lode often splits, and it is faulted by the Red vein (characterized by rhodonite). These irregularities led to litigation, until adjoining mines were consolidated under one ownership. The ore is mainly white quartz with plenty of pyrite, often banded. Galena occurs in bunches. In Ross basin, at the head of Cement creek, there are many prospects, exposing large croppings of white quartz, slightly mineralized.

The Lake City district (13) has been made famous by the bonanza of the Golden Fleece mine, although the Ute & Ulay property has been an important producer of lead, accompanied by both of the precious metals. The Golden Fleece appears as a comb of hard sintery quartz, rising as much as 50 ft. above the steep hillside on the edge of lake San Cristobal. The orebody was found in a block of ground bounded on one side by a contact between fine grained breccia and an overlying much coarser breccia of the San Juan formation, and on the other by a cross-vein named the Ilma.[11] At about 400 ft. below the highest outcrop the ore became poor, and in the lower workings only patches of rich stuff were found. The gold and silver occurred mainly in the form of two tellurides, petzite and hessite. The Ute & Ulay mines contain two large lodes, which have been the mainstay of Lake City for over twenty years. They are simple quartz veins of argentiferous galena, from four to six feet wide. Iron pyrite and zinc-blende



are present. Geologically, the lodes are essentially lines of impregnation following a sheeted band in the andesite breccia of the San Juan formation, as seen in the Camp Bird and Smuggler-Union mines.[12]

Hahn's Peak (19) is a comparatively isolated district in the northwestern part of the State, and is named from a mountain that is a conspicuous landmark of Routt county. A core of rhyolite, locally named 'white porphyry,' breaks through the Dakota sandstone and conglomerate of the Cretaceous formation, the members of which are arched by the upthrust. It looks like a laccolith. Dikes of rhyolite radiate into the surrounding sedimentary rock.[13] The earliest mining was in the placer deposits due to the débris washed from the mountain slopes. The Tom Thumb and Southern Cross veins occur in zones of brecciation traversing the porphyry; solfataric action is evident. The Minnie D. mine yielded ore along the bedding plane of the shale near the rhyolite. This district is likely to be revived by the completion of the Denver, Northwestern & Pacific railroad.

[10] F. L. Ransome, 'Economic Geology of the Silverton Quadrangle, Colorado.' U. S. G. S., Bull. 182, 1901.
[11] T. A. Rickard, 'Journeys of Observation.' Pp 80 to 87.
[12] Same. Page 123.
[13] Hoyt S. Gale 'The Hahn's Peak Gold Field, Colorado.' Bull. No. 285, U. S. G. S.

QUICKSILVER IN MEXICO.

The latest Mexican Government reports on the status of the quicksilver mining industry in Mexico include the following mines paying taxes on May 31, 1909.

States.	Number of mines.	Hectares.*
Chihuahua	13	252.99
Durango	9	143.00
Guanajuato	7	262.00
Guerrero	24	801.98
Jalisco	14	154.78
Mexico	2	14.00
Michoacán	2	81.00
Morelos	1	10.00
Puebla	1	2.00
Queretaro	2	286.00
San Luis Potosí	44	1240.62
Sonora	2	84.00
Vera Cruz	1	10.00
Zacatecas	8	156.00
Totals	130	3498.37

*One hectare equals 2.47 acres.

There are no statistics on the number of mines actually in operation nor on the home production. The only exportation recorded by the customs during the year past was one lot of 363 kg. sent to the United States and valued at ₱100. The importation for the fiscal year 1907-08 was as follows:

Countries.	Kilograms.	Value.
Germany	89,230	₱210
Spain	12,000,000	21,425
United States	154,488,730	170,278
France	318,750	836
Great Britain	12,281,000	24,386
Italy	10,125,000	16,410
	189,302,710	₱233,572

The number of new quicksilver mines to which title has been issued in Mexico from July 1, 1908, to May 31, 1909, are as follows: Guanajuato, 2; Mexico, 2; San Luis Potosí, 1; Zacatecas, 1; total, 6.

The industry of quicksilver mining has no immediate importance in the Republic and the metal is admitted free of duty.

OIL INDUSTRY IN CALIFORNIA IN 1909

Written for the MINING AND SCIENTIFIC PRESS
By Our Special Correspondent

Development in the oil industry in California for 1909 disclosed no new fields, but successful drilling was carried on either inside previously proved territory or else followed extensions of the proved fields.

Coalinga District. Development in the Coalinga district in 1909 has, among other things, proved that the productive territory is probably limited on the north by the north line of T. 19 S., R. 15 E. The northernmost productive well is the Graham in Sec. 2 of this township. The wells of the Imperial Oil Co., only a short distance north of the Graham well, have proved unproductive and have thus shown the limits of the available territory in this direction. The Mohawk well in Sec. 12, T. 19 S., R. 15 E., has extended the proved territory at least half a mile southeast down the Coalinga anticline. The results obtained in Sec. 6, T. 21 S., R. 15 E. and in Sec. 12 immediately southwest of this, have extended the south end of the field a few hundred yards beyond its known limits in 1908. One of the most phenomenal producers of the Coalinga field and of the State was brought in during the latter part of the summer on the Silver Tip property in Sec. 6. This well produced oil for several hours at the rate of 20,000 bbl. per day. It has since been a consistent producer and is now yielding upward of 1500 bbl. per day of about 20 Baumé gravity oil. The work of the American Petroleum and Nevada Petroleum companies has extended the proved ground on the 'West Side' at least half a mile east of the eastern limit of 1908. The wells of these companies have also shown that the productive sands in 'Zone B' of the West Side field become unproductive toward the east, while 'Zone D', the productive zone in the East Side field, comes in under 'Zone B' in the eastern part of the West Side field and will have to be depended on for the production in the territory east of a practically north-south line through the middle of Sec. 30, T. 20 S., R. 15 E. The consistent performance of the American Petroleum wells, which so far have fallen off relatively little, has been one of the marked features of the development of the year. These wells produce all the way from 400 to over 1000 bbl. per day and cause but little trouble in the way of sanding or water production. Development south of Waltham creek as far as the El Cerito well has not been attended with success. The El Cerito and Peoples Associated wells have been practically abandoned, while two or three others which are drilling in similar territory are not obtaining encouraging results. This work has demonstrated that the region mapped as non-mineral by the Geological Survey is either underlaid by dry sands only or by oil sands too deep to be reached by modern methods of drilling. The wells drilling within the line of probably productive territory, as mapped by the Survey, have not attained a depth where it is believed the productive sands lie, so that no conclusions regarding this territory can as yet be definitely announced. Development in the proved Coalinga field, both on the East Side and the West Side, has been carried forward vigorously during the past year, and the effect is seen in a marked average increase in production from month to month.

Devil's Den District. Considerable development has taken place in the Devil's Den district, owing to the discovery of light gravity oil in the well of the Devil's Den Consolidated Oil Co. during the middle of the summer. Some of the work done, however, has been anything but along the lines of legitimate development, the operators being content to drill shallow 'post holes', in which they make a so called 'discovery' of tar sands, hoping thereby to obtain a patent to the land. With the exception of the discovery mentioned at the beginning of this paragraph, and one or two others of minor importance, no positive results have been obtained.

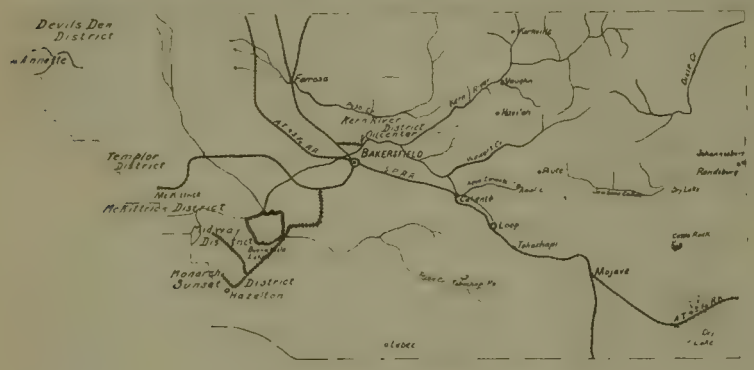
McKittrick District.—Several wells have been sunk during the past year in the McKittrick district, but all, with the exception of one or two, have been within proved territory. One or two wells have been sunk in the region north of the Temblor valley, but so far without success. The only prospect that has yielded quantities of oil that appear to be of commercial importance is the O'Donnell well, situated in Sec. 6 in the low hills north of McKittrick. This well shows indications of becoming a moderate producer of heavy oil. Water still continues to encroach on the productive territory and is more than ever a menace to the life of this field. Strenuous efforts have been made to discover a remedy for the evil, but so far without result.

Midway District.—This district has attracted more attention possibly than any other in the State. At the close of 1908 development had extended as far as the south line of Sec. 31, T. 31 S., R. 23 E., but with the drilling of the Hawaiian, Bear Creek, Majestic, and other wells in the region three or four miles northwest of this section, the extension of the field was assured. As a result of the discoveries made by these wells, the whole Midway flat has been dotted with derricks as far northeast as the Buena Vista hills. In these hills two important gas wells, the Honolulu and Standard, have been brought in, the gas being in such large quantities and under such great pressure as alone seem to assure commercial success. One of the most important discoveries in this field from a commercial standpoint is that of a deep productive sand found underlying the upper oil formation throughout a considerable territory north of the Santa Fe camp. Several wells have been drilled at the south end of the Midway field, and enough evidence has been disclosed by these to warrant the belief that the Midway and Sunset fields are practically continuous.

Sunset District.—Development in the Sunset district has extended the proved territory northward until it practically connects with the Midway district. Development has also proved a part of the flats east of the former field, nearly to the Lady Washington property. One of the sensations of the year in this district was the bringing in of a big water well on the property of the Northern Oil Co. This well started with a flow of about 50,000 bbl. per day and is at the present time yielding large

quantities of warm slightly saline water. The water question is, therefore, one of paramount importance in this field, and operators are looking forward to a solution of the problem with a good deal of anxiety. In this field, the biggest producer of the year brought in was Wellman No. 5, which yielded 3000 bbl. per day for a short time. Within a week, however, the production dropped to 500 or 600 bbl., and at the present time is considerably less. This well simply repeated the history of several at the northern end, which started with large productions but soon dropped to 150 to 300 bbl. No positive results have been obtained by any of the wells being sunk along the hills east of Sunset, although a number of strings of tools are at present operating as far east as three or four miles from Hazelton.

Santa Maria District.—The principal development in the old part of the Santa Maria district, known as the Graciosa or Orcutt field, has been along the lines of drilling within proved territory. Water has become troublesome on the south side of the Graciosa Ridge, and although many efforts have been made to discover the source of the water and remedy the evil, few results have been obtained up to date. Quite a number of new wells have been put down in what is known as the Cat Canyon field, adjacent to the Palmer, the wonderful gusher which has been flowing at the rate of from 10,000 bbl. per day down to 1500, its present output. Although several of these wells have been sunk into the sands which supply the Palmer well, none has so far proved successful. Such a condition is hard to understand, although in the case of the Palmer well the drillers worked with it for several months before being able to bring it in. The prospect wells sunk east and northeast of the Cat Canyon field have so far been unsuccessful, though pioneer work is still going on in the region. The Purisima Hills field has been extended both east and west from previously proved ground, and prospect wells are now being sunk at several points along the axis of the Purisima Hills anticline. Wells in the region of Santa Ynez have so far not proved productive, but exploratory work is still going on.



Kern River Oilfield.

Summerland Field.—No new developments have taken place in the Summerland field. The refinery which was formerly situated at Summerland has been moved to near Arroyo Grande, so that the market facilities have become poor. The production is gradually falling off and the water is becoming noticeably troublesome in wells that previously yielded a large percentage of oil. Some prospect wells have been started in the region east of Summerland, but so far without positive results.

Santa Clara Valley District.—A good deal of activity has been shown in the various fields in the Santa Clara Valley district in southern Ventura county and western Los Angeles county. Several prospect wells put down in the Ojai Valley, Sespe, Piru, and Pico fields have been successful in extending the known productive territory. The oil in this district is as a rule light, and finds a ready market for refining purposes. Owing to the complex geological conditions the developed areas are small and widely separated, and prospecting is, therefore, more hazardous than in some of the districts where the geological conditions are more uniform.

Los Angeles District. — Prospecting carried on in the Los Angeles district has resulted in extending the proved territory southwestward from Sherman as far as the Wolfskill ranch. Here a 400-bbl. well was brought in during the summer, and, in addition, several gas and two or three productive oil wells have been drilled in the same vicinity. Prospecting in the Raphetto hills, between the Los Angeles and Whitties fields has so far resulted negatively, although drilling is still being continued. In the Los Angeles field proper the wells are gradually being abandoned as the production falls off. The Salt Lake field, west of the city, has been pretty well outlined by drilling, and its production has been kept fairly uniform by the bringing in of new wells at quite regular intervals. Within the year the deepest well in the State, the Brashear, was completed in this field. It reached a depth of 5323 ft. and cost, roughly, $40,000.

Kern River District.—Although no longer California's banner oil district, the Kern River field produced more oil than in any previous year. The production of 1909 was a few thousand barrels over 15,000,000. The demonstrated territory has been extended about one-quarter mile to the southwest by wells drilled during the year, and the higher value of oil has made it profitable to open up some of the old wells in the northeastern part of the field which have been idle for several years. The flooding water which has been threatening certain portions of the field seems to be yielding to the use of the air-lift, and several wells have been replaced on the producing list after having been idle for some time on account of water. On December 1 there were 1628 completed wells in the district, of which 1339 were pumping, 17 idle, and 272 abandoned. Thirty-four strings of tools were running on new wells.

Puente Hills District. — An extension of the territory previously proved has taken place in several of the fields of the Puente hills. In addition to this..

the new field in the Coyote hills, hitherto an unknown quantity, and still more or less of an enigma, has developed two or three wells, showing signs of eventually becoming good producers. One of the most important discoveries has been that of the Central Oil Co., which brought in a well producing light oil, north of the main part of the Whittier field. This well has stimulated prospecting in the older formations toward the centre of the Puente hills.

Minor Fields About the State. — Prospecting has been going on at several localities throughout the State in the hope of discovering new fields. Among those in which the results have been more or less encouraging are the Newport Bay field in the southern part of Orange county, the Sargents field in Santa Clara county, and in the Lonoak district in eastern Monterey county. As yet no definite results have been obtained in these new fields, but prospecting

Brashear Well, a Mile Deep in Salt Lake Field.

is still going on, with some chance of discovering commercial quantities of oil.

Prices. — The price of petroleum has remained practically the same as at the beginning of the year, namely about 63c., although many contracts have been signed at the rate of 50c. at the well. The Standard and K. T. & O. companies made an effort to cut the price to 40c., which resulted in a dismal failure owing to the strength of the Independent Producers' organization. The most important combination that took place during the year was the contract entered into between the Independent Producers and the Union Oil Co., whereby the latter agrees to market all of the product of the Independents for ten years. This gives the Union control of a big percentage of the output of the State, and put the Independent Producers on a firm foundation. The contract between the Independents and the Union guarantees stability of the oil market for some time to come.

INDIANA OIL FIELDS IN 1909.

Written for the Mining and Scientific Press
By Raymond S. Blatchley

The Indiana fields are rapidly declining. In the Trenton Rock district a majority of the old wells are being abandoned. About 2400 wells were plugged in 1909, and about 4400 in the last two years. In the last five years 7500 wells have been abandoned. In all about 25,000 wells have been drilled in this field. Of these 7000 were dry and 7500 have been abandoned, leaving 10,500 now producing. Of the wells drilled in 1909, 35% were dry. The Luna Indiana field reached its maximum in 1904.

In 1909 considerable 'wild catting' was done in the southern counties of the State, along the edge of the coal measure basin. But few wells gave indications of oil except in the new field opened at Oakland City, in Pike county. The oil and gas were found here at a depth of about 1100 ft. and are in the so-styled Corniferous limestone of the Devonian. About 25 wells have been put down, bringing in a new production of over 1500 bbl. The following table gives the new development by months in the Indiana fields, according to the *Oil City Derrick*:

	Wells completed.	New production.	Dry holes.	Wells abandoned. 1908.	Wells abandoned. 1909.
January	30	308	9	75	149
February	16	59	7	59	108
March	18	200	2	129	237
April	24	241	4	198	98
May	26	281	7	358	204
June	36	298	9	207	347
July	27	467	8	191	157
August	27	287	6	228	322
September	19	381	6	195	267
October	29	445	13	144	201
November	16	114	5	155	172
December	..	....	..	220	....
Total	268	3,091	76	2,159	2,268

The Appalachian fields cover the States of New York, Pennsylvania, southeastern Ohio, and West Virginia. A great amount of drilling was done during 1909 with the result that 35% of the bores were dry. The main development took place in the high-grade oil territory of West Virginia and southeastern Ohio. The production of the eastern fields will be proportionately higher than the western fields for the year. The following table, compiled from the *Oil City Derrick*, gives the development by months of the Appalachian fields:

	Wells completed.	New production.	Dry holes.
January	600	4,605	158
February	579	4,881	155
March	554	3,976	173
April	690	4,961	171
May	748	5,366	162
June	837	7,273	186
July	813	6,742	211
August	792	7,056	232
September	797	6,278	209
October	624	10,623	175
November	747	6,756	203
Total	7,781	68,517	2,035

MID-CONTINENT OIL AND GAS FIELDS.

Written for the MINING AND SCIENTIFIC PRESS
By L. L. HUTCHISON.

The term 'Mid-Continent Oil Field' seems to have come into official use with the issue of 'Mineral Resources of the United States' for 1905. As there defined, it included the petroleum and gas-producing region of Missouri, Kansas, Oklahoma, and Indian Territory. Indian Territory is now a part of Oklahoma, and the same publication for 1907 defined the Mid-Continent field as southeast Kansas, Oklahoma, and north Texas. It is in this latter sense that the term is here used. The oil fields of the region are divided for convenience into the main field, the Arbuckle-Wichita, and the northern Texas. By the main field is meant that portion of the region which lies in southeastern Kansas and north of the Arbuckle mountains in Oklahoma; that in the vicinity of the Arbuckle and Wichita mountains is designated as the Arbuckle-Wichita district, and the occurrences at Corsicana, Powell, and Petrolia (Henrietta), Texas, belong to the northern Texas region.

The geology of the main field is comparatively simple. The rocks consist of alternating strata of limestone, shale, sandstone, and occasional beds of workable coal of Pennsylvanian or Coal Measures age. So far no paying wells of either oil or gas have been authentically reported from rocks older than Pennsylvanian, thought there are some unproved rumors to the effect that gas has been found in the 'Mississippi lime' which is the Boone formation of Lower Carboniferous age. The normal dip is approximately N. 85 W. in the vicinity of Glenn pool. In the northern part of Oklahoma the dip is more to the north, while farther up in Kansas the dip is nearly northwest. Locally the dip is reversed, thus forming anticlinal and synclinal folds. The anticlinal folds often appear to act as catchment basins for the petroleum and gas, so that some of our best pools are situated along well defined folds. The accumulation, however, in some restricted regions seems to be controlled by folding and irregular deposition of the containing sandstone.

The oil and gas of the Arbuckle-Wichita region is relatively unimportant. Occurrences are known at Granite, Gotebo, Lawton, Wheeler, and Madill. The Gotebo and Lawton fields supply gas for local use, and the Wheeler furnishes the supply for Ardmore. A little oil is also found at Gotebo and Lawton, while Wheeler has an estimated capacity of 600 bbl. per day. The Madill pool is the only one from which oil is being marketed. The petroleum at Granite, Gotebo, Lawton, and Wheeler seems to be found near the base of the Permian Redbeds, which lie unconformably upon older rocks. Oil is found in five different sands at Petrolia, Clay county, Texas, above a depth of 750 ft. It is believed that these sands are above or near the base of the Permian. The 'deep gas,' 1200 ft. and below, is doubtless in the older formations, probably Pennsylvanian in age. The Powell-Corsicana production is from Cretaceous formations. That at Madill is from the base of the Comanche Cretaceous, which is unconformable upon older rocks. The present opinion is that neither the Permian nor Cretaceous of these localities, except in the Powell-Corsicana field, have given rise to oil and gas but that the accumulations are from the older rocks below.

MID-CONTINENT PIPE-LINE RUNS DECEMBER 1, 1908, TO DECEMBER 1, 1909.*

Month.		Runs.	Daily average.	Deliveries.	Daily average.	Tanked.	Daily average.
December	1908	3,796,660	122,472	3,112,078	100,389	684,581	22,083
January	1909	3,630,629	117,097	3,142,078	101,382	487,178	15,715
February	1909	3,204,582	114,449	2,658,899	94,960	545,683	19,488
March	1909	3,504,609	113,084	3,159,414	101,916	345,198	11,167
April	1909	3,323,894	110,796	3,231,918	107,730	91,575	3,065
May	1909	3,532,596	113,954	3,374,896	108,867	157,700	5,086
June	1909	3,633,487	121,116	3,152,482	105,082	481,004	16,033
July	1909	3,561,092	114,680	2,865,530	92,436	689,562	22,243
August	1909	3,735,867	120,511	3,652,297	117,816	83,570	2,695
September	1909	3,716,956	123,898	3,605,133	120,171	111,822	3,727
October	1909	3,631,488	117,154	3,620,685	116,796	12,963	418
November	1909	3,716,353	123,878	3,682,499	122,749	33,854	1,128
Totals		42,985,613		39,258,682		3,725,087	
Average		3,582,301	117,757	3,271,557	107,524	310,424	10,237

*Data for north Texas and Kansas incomplete.

The Mid-Continent field first became a noticeable factor in the production of petroleum in 1906, when it produced 18.05% of the yield of the United States, and ranked third among the great fields. In 1907 and 1908 it held first place by yielding 28.20% and 26.91%, respectively, of the production. Just what the final statistics for the year 1909 will show is hard to predict, but it is believed that the field has not lost rank, though activity has been below normal for the past year. This lessening of action was due, in the main, to three causes: (1) decrease in prices; (2) friction between the State and the pipe-line interests; and (3) arbitrary rulings and demands of the Department of the Interior relative to Indian lands in Oklahoma. The trouble with the State arose out of the attempt of the pipe-line companies to avoid domestication and disposal of production owned by them as provided by law. The three interstate lines, Texas, Gulf, and Prairie Oil & Gas Co., have now accepted the State laws. The Oklahoma Pipe Line Co., the domestic branch of the Prairie Oil & Gas Co., is now building a 12-in. line from Oklahoma to New Orleans. It is hoped that the completion of this line will greatly relieve the market conditions. The Department of

the Interior from time to time changed regulations and made what appeared to be hard and arbitrary rules concerning the leasing of Indian lands. These often rendered operation almost burdensome. Lessees were required to drill whether there were markets or not, and then forced to pay royalties at the rate of 41c. per bbl. while receiving only 28 to 35c. for the oil marketed. Certain restrictions relative to pipe line rights-of-way across Indian lands were also a great handicap. The lessees and pipe line companies have gained some Departmental concessions which promise considerable relief.

The average price for north Texas oil in 1908 was 70c. per bbl., but it was nearly 10c. less for November 1909. The average price during 1908 for Kansas oil was 41c. for light oil, and 30.4c. for heavy grades. Oklahoma light oils were the same price, but heavy oils were 2.2c. higher. These are the prices that prevailed the first of 1909, but they have steadily fallen until the prices posted for November, 1909, were 28 to 35c. per barrel. Statistics for December 1909, are not yet available, but such data as can be had show the Mid-Continet pipe-line runs to have aggregated 42,985,613 bbl. for the twelve months preceding December 1, 1909. Data for Kansas and northern Texas production are incomplete. Statistics of rail shipments and crude used by local refineries and for fuel are not obtainable, but car shipments from the Glenn pool alone averaged 7945 bbl. per day through March and April. Rail shipments fluctuated, to be sure, but it seems that 10,000 bbl. daily would be a conservative estimate for the car shipments and local demands of the entire field for the year. This would give 3,650,000 bbl. in addition to the 42,985,613 run by the pipe-lines, making an aggregate yield of 46,535,613 bbl. for the twelve months preceding December 1, 1909. If these estimates and data are correct the Mid-Continent field will fall but 1,788,197 short of the 1908 production.

Oklahoma holds first in the number of new wells. In spite of the organized effort of the Oklahoma producers to curtail development, there were 3337 wells completed as against 2844 last year. Of the Oklahoma completions 394, or 11.80% were either dry or produced gas only, as against 386, or 13.57%, in 1908.

MID-CONTINENT WELL RECORD AND NEW PRODUCTION,* DECEMBER 1, 1908, TO DECEMBER 1, 1909, BY STATES.

State.	Completed.	Producing.	Dry.	New production.	Average.	Per cent dry.
Kansas	512	287	225	124	4.40	43.94
Oklahoma	3,337	2,943	394	223,650	75.99	11.80
†N. Texas	154	118	36	1,008	8.54	23.37
Totals	4,003	3,348	655	225,922	67.47	16.36*

*Gas wells rated as dry.
†Data April to November only.

Several disturbing elements which caused unrest among operators and purchasing companies have, to a great extent, been removed, and time has proved that both can profitably operate under the new State laws. The factor which causes evil forebodings for the next year is the matter of price. If prices remain as at present the whole field will be under the greatest handicap of its history, but if the completion of the Standard's line, which is now building to the Gulf Coast, causes the advance that is predicted by many, the year of 1910 will be a record-breaker for the Mid Continent oil and gas region.

The number of wells completed in the twelve months under consideration aggregate 4003, or 390 less than for the year 1908. Of these 655 or 16.36%, were dry, as against 903 or 20.57% in 1908. It must be borne in mind however that gas wells are classed as dry holes. The number of holes actually lost in 1908 was only 432, or 9.83% of the number drilled. The 1909 gas well report is not at hand.

MID-CONTINENT WELL RECORD AND NEW PRODUCTION* BY MONTHS, FROM DECEMBER 1, 1908, TO DECEMBER 1, 1909.

Month	Completions	Producers.	Dry holes	Production	Average.
December	405	322	83	26,425	82
January	364	275	89	22,005	80
February	308	279	29	20,340	73
March	408	368	40	21,455	58
April	436	376	60	20,682	55
May	440	340	100	21,607	61
June	345	290	55	18,124	62
July	299	224	75	16,445	69
August	286	219	39	16,510	67
September	261	236	25	14,379	61
October	269	233	36	11,667	50
‡November	182	157	24	14,379	91.58
Totals	4,003	3,319	655	224,922	
Average	333.58	293.25	54.58	18,743.5	67.50

Per cent of dry holes for entire field, 16.36.
*Gas wells rated as dry.
†No data for northern Texas.
‡No data for Kansas.

PETROLEUM IN ILLINOIS IN 1909.

Written for the MINING AND SCIENTIFIC PRESS
By RAYMOND S. BLATCHLEY.

Approximately 29,700,000 bbl. of petroleum is the recorded production of Illinois in 1909, as against 33,685,106 in 1908. The decline was due to overstocking the market and inability of pipe lines to handle the product. The returns for the first eleven months only are available at this time, but if it be estimated that the December output was equal to that of November and the tank-car shipments were 1,500,000 bbl., the same as 1908 only, the total is over 29,700,000 bbl. The following table gives the pipe-line runs of the Ohio Oil Co. by months:

	Barrels.
January	2,494,492
February	2,358,198
March	2,568,393
April	2,388,309
May	2,536,413
June	2,365,956
July	2,413,218
August	2,411,483
September	2,203,706
October	2,228,269
November	2,149,372

The tank-car shipments are those of the Sun Oil Co., Cornplanter Oil Co., and the pipe-line runs of the Indian Refining Co., and the Tidewater company. The latter company opened its line to the field in the spring. The runs of the first half of the year kept pace with those of the previous six months, but with the coming of summer activity was checked and drilling was discouraged. Production was further restricted by a drop in the price of oil. In the late spring the price declined from 68c. per bbl. for oil

above 30° B. and 60c. per bbl. below 30°, to 65 and 57c. Later it took another drop to 62 and 54c., and finally in October it fell to 60 and 52c. for the two grades. These prices prevail at present.

A review of operations shows that the activity shifted southward from Clark and Crawford to Lawrence county, where six distinct oil sands are attracting attention. These are found at varying depths of 850 to 2000 ft., and in their order are, the Bridgeport No. 1 and No. 2, the Buchanan, the Kirkwood, the Tracy, and a deep sand recently discovered at 1975 ft. This latter sand was first found in Sec. 30 of Bridgeport township, and is especially interesting as it yielded an initial production of 50 bbl. per day and has held up to that mark for over two months. The Kirkwood and Tracy sands have developed into the richest found in the field. They are found at average depths of 1400 and 1700 ft. respectively, and have shown both remarkable initial and constant production. The deeper sands have not been tested because of an inactive market and the increased expense due to caving ground in the lower formations. Work has slackened noticeably in Clark, Coles, and Cumberland counties and a great many wells were abandoned during the year. The shallow sands of these counties have gradually lost production and there is now almost no original work in this territory. Crawford county fell but little below the previous year, as extensions of the field were found at Oblong, New Hebron, and Flat Rock.

WELLS DRILLED IN ILLINOIS DURING 1909.

	Wells completed.	New production, bbl.	Dry holes.	Average initial production bbl.
January	213	5,060	41	29 3-8
February	224	4,833	47	26 1-3
March	216	5,018	45	26 1-3
April	263	5,237	38	23 1-4
May	321	7,681	45	27 7-8
June	342	9,050	53	31 1-3
July	346	9,820	50	33 1-5
August	303	8,661	57	35 1-5
September	282	8,324	50	35 7-8
October	242	8,904	48	45 7-8
November	223	9,628	52	56 1-3
Totals	2,975	82,216	526	

WELLS DRILLED DURING 1909 IN ILLINOIS BY COUNTIES.

County.	Wells completed.	New production, bbl.	Dry holes.
Crawford	1,979	41,514	334
Lawrence	677	36,496	52
Clark	174	3,174	44
Coles	11	95	2
Cumberland	29	488	10
Edgar	5	10	3
Miscellaneous	100	439	81
Totals	2,975	82,216	526

On January 1, 1909, it was estimated that 13,346 wells had been drilled. Of these 1821 were dry holes. During 1908 there were 3574 wells put down, of which 561 were dry. The new production for the year was 78,960 bbl. In the first eleven months of 1909, 2975 wells were drilled, with 526 dry holes and a new production of 82,216 bbl. Up to December 1 the total estimate would reach 16,321 wells drilled, of which 2347 were dry. A record of drilling by months, from the *Oil City Derrick* is given above.

There was an increase of 'wild catting' during the year, especially along the western edge of the great structural basin of southern and central Illinois. The territory around St. Louis, in Greene, Jersey, Macoupin, Madison, and St. Clair counties has been widely drilled, however, with but meagre results. At Carlinville a fair gas pressure was tapped, and at Waverly, in Morgan county, a small showing of oil was found. Along the southwestern edge of the basin, near Du-Quoin, a well was drilled with the view to testing a dome-like structure that exists there and which has conditions favorable to the accumulation of oil. A large amount of drilling was done in Randolph county, which was occasioned by the finding of oil at Sparta in 1906. The small production that came in during 1908 has so increased that the Sparta field is all but abandoned at the present time. Further work has failed to bring results. Oil was found in small quantity at Eldorado, in Saline county, but not on a commercial scale. The sand at Eldorado and

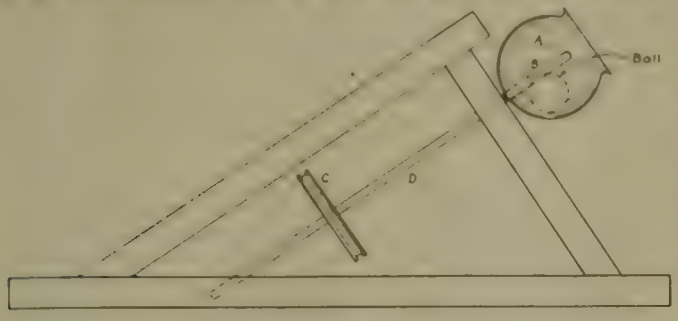
Map Showing Location of Illinois Oil Fields.

those of the deeper formations in the main fields are of the Chester group in the Mississippian rocks. These outcrop near Sparta and are the seat of oil accumulation there. During the year a new field was opened up in Marion county, near Sandoval. Four wells yield oil accompanied by an excellent pressure of gas. The field received its impetus from the finding of oil in a coal mine at Centralia during 1907. This occasioned drilling in all directions, with the result that oil was first found in the coal measures near the mine and later at Sandoval, ten miles away. At the latter place the oil horizon was in the Chester formation. There are two pay sands in the Chester, which apparently may be correlated with the Buchanan and Kirkwood sands of the Lawrence county field. Up to the present writing, the pay seems to be limited to a single area covering 300 acres or more of ground, forming an isolated pool. The wells averaged about 125 bbl. on initial output.

HOME-MADE GRINDING PAN.

Written for the Mining and Scientific Press
By William H. Washburn

During the past ten years I have used the device here described, in connection with stamp mill work, for grinding and testing ore and tailing samples as to their amenability to amalgamation and cyanidation, and for cleaning up amalgam, and have found it satisfactory for such purposes. Referring to the sketch, *A* is a round-bottom iron or steel pot, such as may be bought at any hardware store, the legs of which, if any, may be removed with a hacksaw; *B* is a four-pronged spider, made to fit the pot. They extend about 2 in. above its greatest diameter. This spider should be made of iron sufficiently thin (say ¼ by 1½ in.) to have enough elasticity to hold the pot snugly in place; *C* is a grooved pulley for driving the shaft *D*, to which the spider is attached permanently. A good way to do this is to screw it into a suitable hole in the base of the spider, flush with the inside, and rivet the end of the shaft to keep it tight.



Sketch Showing Mechanism.

In the pot is an iron or steel ball of 4 or 5 in. diam. for a pot 1 ft. diam. In case such a ball is not obtainable, rounded cobblestones may be used. The shaft is driven by a rope belt from some convenient shaft, at a speed of 50 or 60 rev. per min. In setting up and lining the shaft, it will be found necessary to line it at an angle with the driving shaft, the angle depending upon the distance between the two. The closer they are, the greater the angle necessary, to allow the drive rope to lead without too much side-pull. The sample should be first crushed to a size of not more than ¼ in., but ⅛ is better. The ball will then crush it to any finenes desired. If an amalgamation test is to be made, it may be well to allow the ore to be ground until nearly as fine as required before adding the mercury, but this is not absolutely necessary, as it will be found that its tendency to flour is much less with the ball than with a sliding grinding surface. When the pot is in motion, the ore sample is continually turned, both vertically and horizontally, thus preventing any dead corners. When finished the pot may be removed and the sample panned in the usual way. About 2 lb. is a convenient amount for a pot of the size here shown. Should a larger pot be needed, it may be used as large as can be obtained. I have used one 3 ft. diam., in which battery pulp could be ground, but in that case the pot was permanently fastened to the spider, and the material cleaned up with the pot in place. Of course this larger size pot should be run correspondingly slower, perhaps 20 or 25 rev. per min., and have a proportionately larger ball, or rounded stone, as the case may be. It was bought ready made for about $5. When making a cyanide test, after the sample is ground sufficiently fine, it may be transferred to a wooden keg, placed either in the pot or the spider, as most convenient, and the solution added, when it will be found to be a good agitator.

It will be worth many times its cost for preliminary tests as above outlined. Besides it is useful for grinding dirty amalgam, blanket-washings, and the like, including battery pulp, if the pot is large enough for this purpose, and there is no clean-up pan or barrel available.

The accompanying photograph shows a small pot which I recently used for some amalgamation and cyanide tests, where no power was available; so a small impact water-wheel was constructed, having tin buckets, and driven by water under about 15-ft. head, through a ⅜-in. nozzle. The shaft was made of a piece of ¾-in. iron, from which the power was transmitted to the inclined pot-shaft by a rope. The water-wheel is shown at the right of the picture, and it did the work well.

One of the merits of this device is that it may be quickly and thoroughly cleaned, eliminating the danger of the results of one test overlapping another.

Field Mounting of Pan.

One of the first results of the discovery of oil in Mexico has been the diminution of coal imports. Formerly the Mexican railways consumed annually 120,000 tons of patent fuel from South Wales. In the latter half of 1908 half the locomotives were altered to burn liquid fuel, and it is now only a question of providing the necessary oil-storage tanks at suitable points for oil fuel to become universal. Other industrial power plants are being converted to oil fuel and the import of solid fuel is reduced by about one-half.

Special Correspondence.

NEW YORK.

Copper.— Cobalt Dividends and Stocks. — Yukon Gold Dividend. — Braden Copper.—'Orient' Railroad.

The copper situation continues to hold public attention. There is enough uncertainty and diplomatic moving about of the pawns in the game of the big merger to make it unusually fascinating, especially to the small stockholders in the various companies which are being talked of as component parts of the combination. While there is little doubt that the copper merger plans will be carried through eventually, at present the whole matter is outwardly at a standstill. The most important of the preliminary consolidations, that of the Guggenheim properties, by which the Utah Copper was to absorb Boston Consolidated and Nevada Consolidated, has been apparently abandoned for the time being. Nevada Consolidated is to be listed upon the New York Stock Exchange, and a semi-official announcement is made that as a mining company Nevada Consolidated will stand alone. Utah Copper interests claim that this move of the Nevada Consolidated is simply to force, if possible, better terms than the basis now proposed, of one share of Utah Copper for two and a quarter shares of Nevada Consolidated, and that in the end the plan as originally outlined will go through. This contention is strengthened somewhat by the fact that Utah Copper has issued a call for a special meeting on January 17, to increase the capital stock from 750,000 to 2,500,000 shares, which increase is sufficient to make the contemplated exchanges for both Boston Consolidated and Nevada Consolidated and to leave a reserve of something over 410,000 shares in the Utah Copper treasury. The interest of the bankers and financiers at present trying to arrange the copper combination is intensely flattering to many of the smaller shareholders in the companies mentioned as going into the deal. These shares have been mostly handled in the outside market and are largely scattered in the hands of small holders, and as the deals under way have increased the sense of importance of the little stockholder it has also held his undivided attention to the exclusion of nearly everything else in mining. So far as the Eastern market is concerned, it is nothing but copper. A striking instance is the fact that neither the anticipated cut in the La Rose dividend, from 4 to 2% quarterly, nor the declaration of the regular quarterly 7½% dividend of the Nipissing moved either issue fractionally one way or the other. A complete apathy of the public is shown toward Cobalt, notwithstanding the wonderful dividend-record of the Canadian silver camp for 1909, exceeding as it does six and a half million dollars for the twelve months. The royalties exacted by the Government of the Dominion from the Cobalt companies has with many of them been a vital point for a long time. Under strong pressure the Dominion Government has at length made some concessions. Originally all Government leases called for royalties based on the gross production. Two of the Crown grants have been amended, so that hereafter the City of Cobalt Mining Co. and the Chambers-Ferland Mining Co. will pay, as royalties, 25% of the net proceeds, instead of that proportion of the gross output. This means a considerable advantage gained for the companies named. The fight which is being made for the control of Cobalt Central is being adjourned from day to day. J. S. Bradley, who is representing the outside stockholders in the attempt to oust Thos. A. Nevins & Son from the management, states that he expects within a few days to be in a position to hold and absolutely control the adjourned meeting. Mr. Bradley also states that the records show the 238,500 shares of treasury stock have been sold in the open market without any opportunity having been given to the shareholders to subscribe for them.

A quarterly dividend of 10c. per share, which is at the rate of 8% per annum, is to be paid to Yukon Gold shareholders. In addition to taking action on the dividend, the directors accepted an offer of the Guggenheim Exploration Co. of $5 per share for 297,000 shares of the Yukon Gold stock remaining in the company's treasury. The Exploration company had previously advanced some $2,322,000 to the Yukon company in outfitting its dredges and in preliminary operating expenses, and the transfer of the shares mentioned is equivalent to a payment by the Yukon Gold Co. of $1,500,000 upon its indebtedness, while the Yukon shareholders are also to have the right to subscribe for the shares at the rate of one share for each share already held. The Braden Copper Co. of Chile is evidently to be numbered among the low-cost producers. Barton Sewall, president of the company, has issued a report in which the earnings are figured on a basis of 2000 tons per day, with a metal market ranging from 13 to 17c. Mr. Sewall figures copper costs at 7.67c. per pound and makes the statement that costs will probably be reduced to 7c. He says also that over 5,000,000 tons of ore have been developed at the property, with an average copper-content of 2.7%. Several engineers who have examined the properties are quoted as stating that still greater orebodies should be developed. The United States & Mexican Trust Co. is to remove its headquarters from Kansas City to New York. This company is A. E. Stilwell's financial institution, being wholly identified with the building of the Kansas City, Mexico & Orient railway, which has its western terminus at Topolobampo, Mexico, and is looked upon as one of the important factors in the commercial development of the next ten years in Mexico.

CHIHUAHUA, MEXICO.

Mayo River Power-Plant. — El Rayo, Parral. — Las Vegas, Conchos River.—Rio Plata, Santa Barbara.—Mexico Con., Guanecevi. — Batopilas.

A large power-plant is to be erected on the Mayo river in western Chihuahua by the Mayo River Power & Land Co. of Denver. The capitalization of the company is placed at $5,000,000. The plan is to build a series of impounding dams and to erect a hydro-electric power-plant at each site and distribute power to mining companies. The first dam-site has been situated near San Bernardo, Sonora, a station on the new Southern Pacific line. S. Pearsons & Co. have now completed the survey of the railroad that is to be built from the main lines to the site of the Conchos dam, and work will be commenced early in the year.

The El Rayo mines, near Parral, Chihuahua, owned by a New York company, are milling about 4000 tons of ore per month and netting returns of about $20,000 per month. The management claims a reserve of over 20,000 tons of ore, which at the present rate will give four years work. Including several adjacent properties recently purchased, the company now owns approximately 500 acres of claims, and the total length of the workings is nearly two miles. The report for last September shows 4080 tons crushed, averaging $14.14 per ton in value, and the net profits for the month were $18,644, as against $22,116 for July. William Adams, a well known mining engineer of northern Mexico, recently committed suicide at a hotel at Chihuahua by taking morphine. He stated in a letter that bad luck in mining deals had so disheartened him that he determined to try another world. He was a Mason and a Shriner, with no relatives in Mexico.

The adverse tariff on zinc ores going into the United States does not seem to have had more than a temporarily depressing effect on the zinc mining industry of northern Mexico. The increase in price has more than compensated for the tariff, and there is a steady shipment to both the United States and to Europe.

The Las Vegas mine near the Conchos river, close to the line of the Kansas City, Mexico & Orient railroad, has been bonded to the Phelps-Dodge interests. Before the opening of the railroad mine was badly handicapped, as during the wet season the long haul to the nearest railroad was a serious matter, requiring ten days under favorable conditions, but since the new line has been opened to traffic the mine has been making regular shipments of high-grade ore to the Chihuahua smelters.

The Rio Plata Mining Co. has issued a report for the month of October showing the result of the operations on

their mines of Santa Barbara near Guayapares in Chihuahua. The stamp mill ran for 27 days and crushed 1057 dry tons of ore, giving a gross product of 31,147 oz. silver bullion, which was obtained from the total product of the ore shipped and milled, the latter including the product of the cyanide plant and the concentrate. The net returns were $15,000. The Mexico Consolidated M. & S. Co. operating mines at San Pedro near Guanaceve, Durango, reports that from January 1 to November 1, 1909, the profits from the ore milled amounted to $450,000, and that the net value of the ore reserves for January 1909 was $570,000. As a result of development the reserves had been increased to $851,500 by June of this year. The cost of the mining operations have been decreased and the debts of the company have also been reduced. The mill has been rebuilt and the mine stores well stocked. The new mill will start in January and the general prospects of the company are considered to be good. E. Stallforth is president and Alberto Stallforth treasurer.

The Batopilas M. Co. reports that during the first four months operation of its cyanide plant to November 30, 717 tons of second class concentrate and pan tailing was treated, containing 90,406 oz. silver, of which 87,372 were recovered, showing that the extraction was 96.64%. The average saving by the cyanide plant has been approximately 60% in treatment costs, and 11.64% in silver content, or $12,000 U. S. currency.

Chihuahua, Mexico

MEXICO.

Santa Gertrudis, Pachuca.—Sultepec.—Zacualpan.—Hydro-Electric Power Developments.—Zacatecas.—Mining Law.

News comes from Pachuca that all the necessary machinery for the La Blanca mill has been purchased, and the construction work will be pushed ahead rapidly. It is expected that within eight months the mill will be running. There are persistent rumors to the effect that the Camp Bird company has given the eight days notice necessary to the Santa Gertrúdis company, and that the property will be taken over on January 1. This rumor is, however, denied by the representatives of the Camp Bird company here in the city, but the effect has been noticeable on the local stock exchange, as Santa Gertrúdis shares rose to ₱145, though few shares changed hands. The new cyanide plant of the Santa Gertrúdis company that is being erected on the Guadalupe patio is nearly completed. The first of the completed tanks have already been tested and proved satisfactory, and the whole plant will be completed about the end of January.

There seems to be no question that the existing power companies in the Pachuca district cannot supply all the power demanded, and the engineers of the local power company are searching for new sources of power. They are rushing the work on the new canal. This canal is 42 kilometres long and is being constructed by the Cia. Bancaria de Obras y Bienes Raices, S. A., of Mexico City. It has about 2000 men on the work, and according to the terms of the contract the canal must be completed by September 1910 so that the water by that date can reach the new power-plant being erected at Tepetongo. The Mexican Light & Power Co. is about to start active construction on the new line from Tepeapulco to Pachuca. This together with the fact that the existing power companies will increase their plants, will insure an abundance of power for mining companies before the end of next year.

Another rich discovery is reported from the Coronas mine, at Sultepec, State of Mexico. A cross-cut below the bottom of winze No. 6 cut the main vein and developed a width of 12 metres of good milling ore, and then cut a rich streak of over 1½ metres which assays 5 kg. silver and 15 gm. gold. So far the hanging wall has not been reached. The Coronas mine is owned by the Seguranza Mining Co. The construction of the electric power line has now been completed up to this mine, and the power is being supplied so that the 100-ton mill may be started this week.

A new strike of high-grade shipping ore is reported from the Alberta mine, owned by the Coahuila Mining & Smelting Co. Development work is being pushed as rapidly as possible. W. H. Williams is in charge. The result of the work on the La Fortuna mine in Zacualpan has shown that the property is really valuable. Work will be continued on a large scale. The bulk of the stock in the company is owned by local merchants in Pachuca.

The Chapala Hydro-Electric & Irrigation Co. is arranging to increase its sphere of operation. It has made a contract with the State Government of Aguascalientes to run power-lines to the important mines of that State. A new company is to be formed that will be controlled by the Chapala Hydro-Electric company for the purpose of consolidating the local power, light, and tramway interests. Other contracts of a similar nature are being arranged with the State Governments of Zacatecas and San Luis Potosí. The transmission lines from the present site of the main power-plant of the company to the centre of distribution of the various States will be: to Aguascalientes, 108 miles; to Zacatecas, 160; to San Luis Potosí, 182. To meet this largely increased demand for power, the Chapala company will have to build another large power-plant. With this object in view, surveys have been made, and a site selected on the Santiago river, where a total head can be obtained of 1609 ft., with an ultimate capacity of 90,000 hp. This will entail the construction of a canal 26 kilometres long to carry the water of the Santiago river from Juanacatlán falls to Las Juntas. The distribution of cheap power to all the mining camps of these three States will mean a great revival of mining in this section of Mexico. At Zacualpán there are great dumps of low-grade milling ore which it will be possible to handle economically, particularly those of the Veta Grande, which are among the largest in the Republic.

During the past year mining has been dull at Zacatecas. A great many properties have been lying idle, and others have been kept going by dint of rigid economies and by avoiding all dead-work. The famous old mines of San Rafael, Cantera, Veta Grande, Austriana, and Mala Noche, have been entirely idle during 1909. The San Rafael has sold its ore-dumps to the National railroad for ballast, subject to a preliminary sorting to save any ore that will pay. Occasional pumping operations are carried on to keep the water-level down to a point within control. The property is at present being sampled by Carpenter, Brennon & Ryan, of Mexico City, on behalf of the owners. The only important event that has taken place at Zacatecas during the year has been the completion and blowing in of the Magistral smelter on March 31 of last year. It has been running steadily ever since, supplied by ores from the Magistral mines, and has proved succesful.

The other mines that have been at work in the camp are as follows: The El Bote Mining Co. has remodeled its milling plant and has added a cyanide plant. This company

is developing cheap power with producer-gas engines. The mine has immense dumps estimated to contain upward of 500,000 tons of milling ore, and the company is now re-working these. A considerable amount of exploration has been done during the year, and the deepest shaft is now down 1100 ft. The Zaragosa mines have been worked steadily and a new concentrating plant has been put in. A considerable amount of high-grade ore has been taken out by the lessees from the San Roberto. The lessee is Theodore Van Wagenen, of the Cape Copper Co. of London, who holds the property under bond. This ore has been taken from superficial development, the deepest workings being only 80 metres. Goertz-Doers, of London, hold an option on the Rio Tinto property and have done a considerable amount of development on the main vein, which is over 30 ft. wide and contains lead and silver. In sinking, more water was encountered than could be conveniently handled with the pumps available, so that work has been suspended, and the management intends to sink a new shaft. A custom mill equipped with a cyanide plant is being erected on the outskirts of the city, and will be ready to start operations in about a month. There is no doubt that it will materially assist the small mines of the district. The prospect of introducing electric power into the camp within a short time is causing a slight boom at present, and it looks as though the coming year will be more prosperous. The new Mexican mining law which comes into force in January was affirmed by the Senate without any alteration from the bill as passed in June by the Chamber of Deputies.

GOLDFIELD, NEVADA.

Goldfield Annual Output.—Milling Developments.—Goldfied Consolidated.— Florence Goldfield. — Combination Fraction. — Sandstorm & Kendall —C. O. D. Consolidated.

Estimates made by mining men familiar with conditions in the Goldfield district, and who are regarded as competent authorities, place the gold production of the Goldfield district for the year 1909 at approximately $10,000,000. Of this sum the Consolidated Mines Co. has produced about $6,500,000 gross. Exact figures of production will be difficult to obtain for some time, as final returns from ore and bullion shipments and from concentrate will not be available for at least a month after shipment has been made. While business and financial conditions during the past year have militated against the beginning of development in virgin territory, there have been some encouraging results from work upon what is known as outside ground, and the results of development upon the better known mines of the inside part of the district have been of the greatest importance and far-reaching in their influence upon the mining industry in Nevada.

While much has been written of the exceedingly rich ore found in the Goldfield district, it is realized that the district must eventually rely on lower grade milling ores for its chief revenue, and this has influenced the railroads in making Goldfield the railroad centre of southern Nevada. Already the terminus of three railroads, the Tonopah & Goldfield, Tonopah & Tidewater, and the Las Vegas & Tonopah, the camp will have another road tapping the timber country of Mono and Inyo counties in California, and as a division point and terminus of the Ely-Goldfield road it will be an important point on a system that will practically be a trans-continental line. This will afford a shorter haul to the smelters of Utah for the silicious ore of the district that is being keenly sought by the smelting companies.

Foremost in importance among the year's developments in Goldfield has been the upbuilding of the great mines and reduction works of the Consolidated Mines Co. On December 26, 1908, the new 100-stamp mill was first put in operation, with a stated daily capacity of 600 tons. When the announcement was first made by the management that such a mill would be built to treat the product of the mines at a given cost per ton, and to start its work upon a specific date, mining and milling men were skeptical, but every promise of the management was kept to the letter and the plant has surpassed in efficiency the expectations of its founders. For months past the 100 stamps have been treating a daily average of 650 tons, and on December 26, one year to the day from starting the machinery, three Chilean mills of the new equipment were placed in commission. The entire plant will be treating 900 tons per day before this is on the press. Development in the mines of the Consolidated company has been carried on vigorously and on a larger scale than heretofore. A large production is being made from all four centres, the Red Top, Clermont, Mohawk, and Combination. The doubt existing a year ago as to the persistence of the orebodies in depth has been dispelled by the discovery of the richest bonanzas in the district at depths far below any attained at that time. Sill floors have been prepared at the 750-ft. level in ore 20 ft. wide, averaging $500 per ton, and this ore-shoot has been developed on three levels, at the 600, 750, and 900-ft., for over 350 ft., with cross-veins of almost equal proportions. The deepest level in the mines, 1000 ft., is now nearing the point at which, from indications above, it is expected that the same ore-shoot will be penetrated. The underground workings in these mines now total nearly 40 miles in length.

Next in importance come the new developments in the Florence Goldfield. The improvements to that company's mill increased its capacity to 160 tons per day. In this mine a large tonnage of excellent ore has been blocked. Old lease workings in which the ore was supposed to have been exhausted are proving to contain great wealth, in addition to new discoveries of rich material. The deepest workings of the Florence are but 500 ft., but the main shaft will be sunk to a depth of 1000, and enlarged to three compartments. The management claims to have sufficient ore blocked in workings near the main shaft and above the 400-ft. level to supply the mill at full capacity for more than a year. The saving effected is nearly 98 per cent.

The Combination Fraction mine during several months made a production of 80 tons per day of $25 ore, but its present reserves of paying ore are depleted, and the leased mill is now idle, although a force of 30 men is employed in developing, chiefly at the 500-ft. level, while the main shaft is being sunk from the 600 to the 800-ft. level. The ore-shoot opened in September above the 380-ft. level has been stoped out and the same vein, carrying ore of fair milling grade, has been opened at the 500-ft. level. Nothing of value was developed in driving a cross-cut to the west at the 600-ft. level, and this is being extended by the Consolidated company across the Combination claim to the January. A lease for a term of five years has been granted to a group of local and Eastern operators embracing the main workings and plant of the C. O. D. Consolidated Co. on the Gold Bar claim, and the lessees will shortly begin the construction of a 50-ton mill. The only work on the C. O. D. this year has been that carried on from the Victor shaft from which a small production of high-grade ore carrying a large percentage of copper was made. On the main workings over 1000 tons of free-milling ore averaging $25 per ton remain, which will be treated by the lessees in their mill, which will also treat the product of the Thomas lease on Columbia mountain.

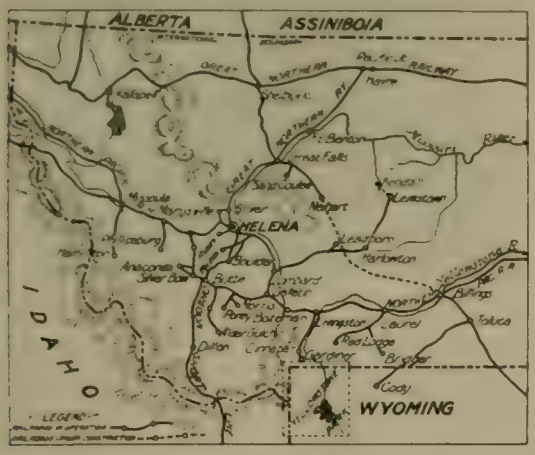
A consolidation of the Sandstorm and Kendall was effected a short time ago by the formation of a leasing company which secures a long-term lease on both properties, and funds for development will be raised by means of levying an assessment on the stock. Little work has been done on the Jumbo Extension, but lately lessees have taken rich ore from the Gold Coin claim near Diamondfield. Several lessees continue operations on the Atlanta with three shafts past the 600-ft. level and new ground is being opened. The ground of the Goldfield Daisy Co. is practically all leased, with high-grade ore exposed at several points. The Cracker Jack is being developed by lessees. A new lessee has begun work on the Booth, near the boundary of the Red Top; rich ore has been mined by lessees on the Velvet and St. Ives claims of the Goldfield Merger Mines Co. Company work was suspended for the time being on the Great Bend, where one lessee found some good ore at the 400-ft. level; no work is being done on the Red Hills; a good vein has been exposed and is being followed by driving on the Nancy Donaldson; lessees exposed paying ore on the Blue Bull; and shipments were made from the Goldfield Belmont.

BUTTE, MONTANA.

December Output. — Switchmen's Strike. — Butte & Superior and Butte & New York Consolidation. — East Butte Smelter. — Barnes-King.

The December production by the Butte mining companies will not exceed 16,000,000 lb. of copper, which is about 12,000,000 less than normal. This is due to the strike of switchmen on the Great Northern and Northern Pacific railroads, preventing the transportation of ore to smelter and stopping the supply of coal.

Official announcement has been made that the Butte & Superior Copper Mining Co. has acquired a controlling interest in the Butte Milwaukee Mining Co., owner of the Colonel Sellers group of claims. It is provided that the stock of the Butte Milwaukee shall be exchanged for that of the Butte & New York and the latter will be turned over to the Butte & Superior, the exchange to be on a basis of two and a half of Butte Milwaukee for one share of Butte & New York, giving the Butte Milwaukee stock a value of 50c. per share. The acquisition, however, will cost the Butte & Superior 40c. per share for Butte Milwaukee. The Butte & Superior has agreed with the



Montana.

Butte-Milwaukee to sink the shaft on the Colonel Sellers claim to 1600 ft. and connect with the Blackrock mine of the Butte & Superior. By this arrangement both companies will save money in order to comply with the new laws of Montana requiring two shafts for each property in order to insure safety and provide better ventilation. The Butte-Milwaukee has half a dozen good claims, all paid for, and has a splendid plant on the Colonel Sellers, the shaft of which is about 700 ft. deep. One of the best and largest veins on 'the hill', judging by surface showings, is on the Colonel Sellers and Bird claims, two properties adjoining and including 2400 ft. along the vein.

The East Butte Copper Mining Co. is making preparations to install another furnace in its smelter, and put in a sampling mill. A stone crusher is being installed at the company's lime quarries east of Butte and a new loading trestle has been completed. A new quarry is also being opened. The company made a new and important strike in the Pittsmont mine last week on the 800-ft. level, about 1000 ft. north of the main workings on the Silver Bow vein. The orebody has an average width of 4 ft. and gives an average assay of 6.5% copper, and is high in silver. The company has 1400 ft. on this vein.

The directors of the Barnes-King Development Co., acting on a suggestion of some of the stockholders, are looking for a good property in which to invest the treasury-surplus of the concern instead of dissipating it in a discouraging effort to make something out of the fraudulent Barnes-King mines. They have been negotiating for the purchase of a property in Idaho, on the line of the new Pittsburg & Gilmore railroad in which, reports say, $250,000 worth of ore is blocked out.

WASHINGTON, D. C.

Geological Survey Estimate of Production. — Coal Increases 10 Per Cent. — Metal Output Larger. — Petroleum Declines.

Estimates of production made by the Geological Survey indicate that 1909 will prove to have been in many particulars a prosperous year for the mineral industries. C. W. Parker estimates that the increase in coal production over that of 1908 amounted to between 8 and 10%, and that the total output amounted to between 440,000,000 and 450,000,000 tons. This, while highly satisfactory, fell short of the record production in 1907. Pig iron was made, according to E. C. Harder, to the amount of 25,500,000 long tons, which is 9,500,000 more than in 1908, and just short of the record output of 1907. The iron ore output is placed at 51,000,000 tons, which again greatly exceeds that for 1908 and is only slightly less than for the preceding year. Copper, lead, zinc, all had a prosperous year, and increased outputs are certain. Quicksilver is estimated by H. D. McCaskey at 20,425 flasks, which at the average New York price of $46.17 would be worth $943,022. Tungsten concentrate, according to F. L. Hess, to the value of $746,130 were sold and important increases occurred in other materials. The total petroleum production, as estimated by David T. Day, was between 173,000,000 and 178,000,000 bbl., as against 179,572,479 in 1908. The decrease was less than had been expected in view of the great accumulation of stocks during the preceding year. This accumulation occurred entirely in States east of the Rocky Mountains that have no trade connection with California, and this State, therefore, showed a great gain, in which nearly all its pools participated.

That the production of 1908 was more than the market could reasonably stand was shown by the decline in price in the Eastern and Middle fields. The price for Pennsylvania crude oil, which had been $1.78 per bbl., began to decline on May 3, and had fallen to $1.43 by December 9. A cut was made in Lima oil from $1.04 to 84c.; in Illinois oil from 68 to 60c., and in the Oklahoma fields the price likewise declined from 41 to 35 cents.

There were no significant discoveries of new fields during the year, although outside of the well known regions prospecting was particularly active in Wyoming, Utah, and New Mexico. The decline in southern Louisiana was offset by increase in production in the Caddo field under the stimulus due to the starting of work on the refinery of the Standard Oil Co., at Baton Rouge, and on a pipe-line connecting it with the Caddo field. The significant feature in this drilling has been the success of persistent efforts to discover oil at lower levels, particularly north and northwest of the former productive region. Normal conditions prevailed in Texas, with a small decline.

In Oklahoma the strenuous efforts of the Producers' Association to suspend drilling operations was successful to the point of reducing production, and even stocks. The transportation facilities improved throughout the year. The assurance of a pipe-line to Baton Rouge, Louisiana, has given to the operators confidence in their ability to dispose of the product on favorable terms and has put new life into the field. In September an exceptionally large gusher was developed five miles north of Okmulgee. The success of this well led to the development of the Pearson pool, with the usual period of active speculation in leases. Drilling was greatly hindered by the extreme drought.

California now stands first in oil production, producing fully 10,000,000 bbl. more than Oklahoma, which ranks second. Developments begun in 1908 continued with increasing rapidity in 1909, many sections producing wells of large capacity. One of the important events of the year—an event that created excitement in oil circles—was the drilling in September of the Silver Tip well on Sec. 6, Coalinga field. This is said to be, with the possible exception of the Hartnell well, of the Union Oil Co., drilled at Santa Maria in 1904, the greatest well ever drilled in the State. Other important developments have extended the Coalinga field to the west and south. Successful wells drilled in the Sunset, Midway, and other districts, show the wonderful richness of the oil fields of the State.

General Mining News.

ARIZONA.

COCHISE COUNTY.

A streak of oxide ore was opened on the 1300-ft. level of the Cole shaft of the Superior & Pittsburg. Work has been resumed in the Biggs shaft.——The shaft at the Bisbee & Arizona, six miles south of Bisbee, is being unwatered and the property will be prospected by diamond-drilling. R. Harlan is manager.——Operations are to be resumed in the Empire State mine in the Bisbee district and the main adit will be advanced 500 ft.——A 30-ft. body of oxide ore has been opened in the porphyry of the Sacramento shaft of the Copper Queen company. The ore previously opened has been on the contacts of the limestone and porphyry.——A boiler, hoist, and No. 5 Cameron pump have been purchased by the California & Paradise Mining Co., and will be installed at the property near Paradise.——F. H. Mitchell, manager for the Johnson Copper Co., has purchased a 40-hp. hoist and air-compressor for the property at Johnson, and will sink the shaft to the 1000-ft. level.

GILA COUNTY.

(Special Correspondence).—Homer Crumrine, president of the Arizona-Colorado Copper Belt & Gold Mining & Mill-

Map of Arizona.

ing Co., has been spending the past two weeks in Globe outlining the future policy in regard to the development work at the company's property three miles north of Globe. A test shipment of ore from the 800-ft. level will soon be made to the El Paso smelter which will, to a large degree, determine the plan to be followed in the future. S. C. Phillips is superintendent.——Recent work on the 300-ft. level of the Warrior mine in Miami district has opened an orebody in a cross-cut from the main drift, which, at the present face of the cross-cut, averages 11% copper. A. Ball is superintendent. M. E. McCarthy is general manager of the Warrior, Cordova, and Live Oak mines, all of the same district.——The Globe Mining Co., operating the Mineral Farm property in the northern part of Copper Hill district, has just finished unwatering the 415-ft. vertical shaft preparatory to resuming cross-cutting on the 400-ft. level. At another part of the Mineral Farm property a lode containing much hematite has been cut in an adit 350 ft. long. This lode is thought to be the Yuma vein, which yielded a considerable amount of ore during the time the Old Dominion Copper Mining & Smelting Co. worked it on its property adjoining the Mineral Farm.

Globe, December 31.

MARICOPA COUNTY.

A new mill containing Nissen stamps is being erected at the Vulture mine, at Vulture, and an aerial tram built from the mine to the mill. A large body of high-grade ore is being opened on the 600-ft. level preparatory to starting the new plant and the old mill is being run on ore mined above this. Robert Johns is superintendent.——At the Interior, southwest of Wickenburg, the shaft is down 100 ft., and the company is planning the installation of power-drills to facilitate the work.

MOHAVE COUNTY.

At the Keystone mine, in the Mineral Park district, which has been recently taken over by S. R. Porter and associates of Los Angeles, the shaft has been re-timbered and a new steam-hoist and air-compressor is being installed. The mine has been idle for 35 years as the ore is complex, containing gold, silver, lead, copper, and zinc. Much of the ore is high grade and the company will confine its present operations to development work.——The Metallic Accident, in the same district, has been bonded to Carl Hand.——A new shaft has been started at the Pinkham mine between Mineral Park and Chloride.——A. P. Anderson, representing the United States Smelting, Refining & Mining Co., has secured a ten-year bond and option on the Tennessee and Empire mines in the Chloride district.——F. M. Drescher, of Prescott, purchased the Surprise, Great Eastern, Ore Shoot, Little Bessie, and Gold Beginner group of claims in the San Francisco district.——The Hercules mine, in the same district, is to be equipped with new machinery and a cyanide annex is to be added to the mill. A. W. Brattlund is manager.

CALIFORNIA.

EL DORADO COUNTY.

(Special Correspondence).—The owners of the Gold Hill are considering the installation of considerable equipment at the property.——At the Mount Pleasant a vein of $22 ore is being opened at the 310-ft. level. Several shoots of ore, assaying over $15 per ton, are being worked above this point. The No. 2 shaft has been unwatered to the 300-ft. level and several drifts extended since the present company took charge about three months ago. The payment of dividends has been resumed. A. V. Judson is manager.——At the Capitola a 40-ft. vein has been opened at a depth of 100 ft. Assays range from $1 to $40 per ton. John F. Cowan is manager.——Eastern capitalists have taken an option on the Nellie Hume property.——Operations will be shortly resumed on the Pease mine, near Greenwood.——The Jasper has resumed operations.

Placerville, December 31.

MERCED COUNTY.

The Yosemite Dredging & Mining Co., operating on the Merced river, paid an initial dividend of 2oc. per share, together with an extra dividend of the same amount. The company is operating a Bucyrus dredge on a 340-acre tract.

NEVADA COUNTY.

(Special Correspondence).—The North Star Co. has declared a dividend of $300,000 for the last quarter of 1909, making a total of 23% in dividends on the $2,500,000 capitalization for the year. The mine produced 100,000 tons of ore for the year, average value $12.50 per ton, making a total of $1,250,000. Owing to the vast amount of ore on hand it was found necessary to lay off 40 employees a few days ago. A. D. Foote is manager.——Leases have been granted on several blocks in the Idaho-Maryland, and considerable ground will be worked by this method.——Four machines are at work in the bottom of the Empire shaft and sinking is progressing rapidly. The electric pumps are easily handling the water. It is estimated that the production of this property for 1909 amounted to approximately $900,000. George W. Starr is manager.——The shaft at the Brunswick has passed the 125-ft. point.——Contracts have been let for the sinking of the shaft at the Pittsburg to a point 140 ft. below the 1000-ft. level, and for the extension of the drifts on the 700 and 900-ft. levels an additional distance of 250 ft. The mill is operating on ore from the 700-ft. workings.——The driving of a lower adit at the Sunshine will soon commence. In the upper workings the vein is 24

in wide and assays over $10 per ton. The 300-ft. crosscut adit at the Oakman will be extended 200 ft. farther to cut the main vein. Preparations have been made to resume operations at the Red Point mine in the Washington district. The main vein has been opened 300 ft. from the adit at the Fairview. It is 10 ft. wide and samples average $30 per ton. C. M. Wilson is superintendent. The Red Cross has installed a Huntington mill and Dodge crusher.

The Yuba Consolidated Mining Co. has made the final payment on the Grey Eagle mine and paid up back taxes

Tool Car, Central Shaft, North Star Mine.

on the Yuba, Grey Eagle, and Bluejay Extension. Dan McFall is superintendent.——It is reported that work will be resumed at the Eureka in the spring.——The Lucky vein has been cut at the Union Hill. Clifford Graham is superintendent.——The Champion is being operated steadily by a large force of lessees. The deal for the transfer of the mine to Chicago people is still pending.

Grass Valley, January 2.

SAN BERNARDINO COUNTY.

(Special Correspondence).—The financial difficulties of the Orange Blossom mine have been adjusted and John Denair, president of the company, announces that work will be resumed on January 1.——The Orange Blossom Extension will resume within a short time. It is proposed to install a pumping plant and sink the 715-ft. shaft to greater depth. W. H. Holcomb is manager.——It is announced that a Catton oil-burning smelter will be erected at Silver Lake to handle custom ores.——The F. M. Smith interests have decided to commence work on the Mount Blanc borax deposits. Mining will still continue at the Lila C., but on a smaller scale. The Mount Blanc deposits can be worked for 50c. per ton, while it costs $1.50 to mine the deposits of the Lila C. and transport the borax to the railroad.——It is reported that the Swift Packing Co., of Chicago, is interested in the development of eight promising potash claims 22 miles from Tecopah.——Announcement has been made that the Needles smelter will resume operations on custom ore in the near future. This means the reopening of numerous small properties in the Needles district.

San Bernardino, December 30.

TRINITY COUNTY.

The Ruggles property, situated three miles north of Carrville, has been bonded to J. O. Nelson, of Goldfield. The amount involved in the bond has not been made public.

TUOLUMNE COUNTY.

(Special Correspondence).—Phenomenally rich ore has been opened on the 1300-ft. level of the App. The vein is over 2 ft. wide.——The sinking of the Omega shaft an additional 400 ft. is under way. Good ore has been developed in the main workings.——The shaft at the Dutch mine has been placed in excellent shape and the overhauling of the mill is progressing rapidly. Active production will soon be resumed.——Good ore is being opened at the Hance.

Tuolumne, December 31.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—As soon as the weather breaks work will be started on a 50-ton mill for the Kennedy Gold Mining Co.——A body of smelting ore 2 ft. wide has been uncovered on the Charter vein cut by the La Moe adit 1250 ft. from the entrance. J. I. Bonner is manager.

G. D. Parks has secured the Atlantic No. 1 and 2 lode mining claims, situated on Covode mountain, under bond and lease from F. L. Peck. Work has been put under way in the adit and mill ore is now being extracted. The old Clear Creek mill at Empire Station has been secured and the machinery is being overhauled.——A body of smelting ore 18 in. wide has just been uncovered on the Anamosa vein which is being worked through the Rochester adit. A shipment of 20 tons made this week assayed 625 oz. silver per ton. O. W. Mann is manager.

Georgetown, December 31.

GILPIN COUNTY.

(Special Correspondence).—The Chase mine, in Willis gulch, has been taken over by Forbes Rickard, of Denver, representing New York and Boston capitalists. Work was put under way last week in cleaning out the workings preparatory to starting development. H. C. Willis is superintendent.——Work has been started in the remodeling of the mill building that is to be used by the Denver Mining & Reduction Co., McFarlane & Co. having been awarded the contract for the installation of the equipment.——The St. Anthony property, on Negro hill, has been taken under option by Denver men. The shaft, down 185 ft., is being cleaned out and re-timbered and will be sunk another 100 feet.

Central City, January 3.

TELLER COUNTY.

Dividends to the amount of $217,411 were paid in December by Cripple Creek mining companies as follows: United Gold Mines Co., 1c. per share, $40,000; Elkton Consolidated, 2c., $50,000; Jerry Johnson, 1c., $25,000; El Paso Consolidated, 1c., $24,500; Granite, 1c., $16,000; Doctor-Jack Pot, $15,000; Acacia Gold Mining, 1c., $14,500; Mary McKinney, 1c., $13,042; Free Coinage Gold Mining & Milling, $10,000; and Gold King Mining Co., 1c., $9368.——A rich streak has been opened by lessees on the Pueblo claim of the Free Coinage Gold Mining Co., and the ore is being sacked for shipment. Assays have been as high as 2400 oz. gold per ton.——The Success Mining Co., operating the Gold Hill mine, under lease, shipped two cars of ore that averaged $30 per ton.——A rich shoot was opened recently on the 600-ft. level of the Bonanza King mine on Gold hill, operated by the Gold Issue Mining Co., and several tons of 10-oz. ore shipped.——A spray washer has been installed on the dump of the Vindicator No. 1 shaft under lease to John Sharpe.

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—Steve Chitwood, operating on a lease of the Connor land at Prosperity, has bought a 200-ton mill for this mine. Five hand-jigs are working on the lease, cleaning dirt estimated to run from 10 to 20%. The ore is found at 195 ft., and unlike most properties operating at that depth, is in soft dirt instead of sheet ground. A number of drill-holes have blocked out the ore for some distance from the shaft.——The old Lehigh camp, near Carl Junction, is to have six new mills in the near future. Two are to be erected on the Jubilee property, one on the Knight land, one on the Hanway lease, one on the Excelsior lease, and the sixth on the sub-lease operated by George Meese. The ore in this community is free in character and occurs from 80 to 100 ft.——Freeman & Miller are planning a new mill for a lease of the Katherine land at Zincite. The hand-jig equipment on the land is proving inadequate, as much ore is lost in the tailing. The ore is

taken from 170 ft. where a 14-ft. face has been exposed.——W. W. Sylvester, operating on a portion of the Shifferdecker land, southeast of Duenweg, is planning a large mill for that property. The ore is taken from 116 ft. in soft ground, though no timbering is required, as a cap-rock is above the ore. There is almost no development in this immediate vicinity.——A good prospect is being worked on a sub-lease of the Connor land, west of Joplin, where a large pile of crushed rock is accumulating. A part of the ore is being cleaned on hand-jigs, but owing to the character of the ore a great part has to be stored awaiting a mill. A shaft is down 100 ft., which shows a 12-ft. face.——The Puritan company, on the Old Dominion ground, is opening a good body at a deeper level which is proving much richer than the former shallow development. The lower run occurs from 118 to 135 ft., as shown in three drill-holes. Estimates of the ore are from 10 to 20%. The company has two shafts, one already in the deep run, and the mill shaft is to be sunk at once.——A rich zinc find has been made in the Sarcoxie camp by J. W. Boyd on a lease of the McNallie farm. Ore was cut in the second hole at a depth of 20 ft., the cuttings being especially good from 25 to 30 feet.

Joplin, December 30.

MONTANA.

SILVER BOW COUNTY.

(Special Correspondence).—The secrecy that is maintained by the North Butte management regarding development on the new levels of the mine is giving rise to unfavorable reports about the property. The information coming from the mine is to the effect that the new levels, both on the Edith May and Jessie veins, continue disappointing. The ore in the Edith May, on the 2000 and 2200-ft. levels, since the drift passed the faulted portion of the vein, has been regular but of a low grade.——The experience of Parrot stock during the past few weeks, in which it dropped 9 to 10 points, was not due to any change in the condition of the mines. The Parrot mine was shut down, with many other properties, on account of the strike of railroad switchmen, and the production was limited to the Little Mina. There has been no recent change in the showing in either mine.——The Tuolumne Copper Mining Co. has resumed the shipment of ore, hauling it by team to the smelter. There is no change in the controversy between the Tuolumne and North Butte over the Jessie vein, and both companies are engaged in surveying and doing development work for the purpose of proving ownership of the vein in question.

Butte, December 31.

NEVADA.

ELKO COUNTY.

(Special Correspondence).—The Jarbidge district, situated in the northern part of this county, is attracting attention of mining men and many claims have been staked, mostly by people from Twin Falls, Bruneau, and Boise, Idaho. Ore specimens brought to Boise assay offices consist of quartz containing free gold and a little tellurium. The North Star Gold Mining & Milling Co. has been organized to develop claims there and is headed by J. E. Clinton, of Boise, M. E. Reynolds, of Bruneau, and D. A. Born. The camp is 85 miles southwest from Twin Falls, and much of the travel there is by that route.

Twin Falls, December 29.

NYE COUNTY.

(Special Correspondence).—Julius Lemie, Charles Ryan, and A. B. Gibson, have been appointed a committee to carry on action against A. C. Eisen, president of the Mayflower Consolidated Leasing Co., by dissatisfied stockholders of the Mayflower Consolidated Co. Those opposed to turning over of the mine to the leasing company for a period of 20 years assert that the property has been mismanaged and will ask the courts to appoint a receiver for the property. The stockholders opposed to the transfer have levied an assessment of 1c. per share in order to raise a sum to carry on litigation.——The Belmont vein has been opened on the 1100-ft. level of the Belmont. It is 8 ft. wide with streaks assaying $60 to $100 per ton. The entire body is good ore and that broken in the course of developments is shipped to the Mammoth smelter at Kennett, California. The mill remains idle.——The litigation affecting the Old Oriental mine, at Gold mountain, has been decided in favor of the original locator M. J. Drumm and associates. Arrangements are being made to commence work.——The Marvel mine, at Lida, is sending out small shipments of rich copper ore to Goldfield. The last shipment averaged 37% copper. The shaft is down 75 ft. D. P. Marvel is managing owner.——The Tonopah Mining Co. has completed the shaft-house at the Sand Grass claim and the work of sinking the new 3-compartment shaft is progressing steadily. A regular dividend of 25c. and an extra one of 10c. have been declared, making a total of $350,000, or $1,400,000 for 1909. Since its organization this company has disbursed over $5,300,000 to stockholders.——The directors of the Belmont have decided to move the mill from Millers to Tonopah.——A 3-ft. body of $20 ore has been opened for a distance of 102 ft. on the 50-ft. level of the Nevada Johnnie. The main shaft is down 122 ft. with another down 78 ft.——The Peterson mill is running steadily at Manhattan on Stray Dog ore. The last shipment of bullion amounted to $4000.

Rhyolite, December 30.

WHITE PINE COUNTY.

(Special Correspondence).—The Nevada Consolidated is taking out another slice at the glory hole which will widen the pit 42 ft. This is on the east side, where work is now centered. On the third terrace an unexpected body of good ore has been exposed.——The raise in the 5-compartment Giroux shaft is rapidly nearing the surface and prospecting with diamond-drills continues in the Alpha shaft. The spur from the mines to the tracks of the Nevada Northern is nearing completion.——It is reported that the McDonald Ely will resume operations within a few weeks.——The west cross-cut on the 400-ft. level of the Zack shaft has cut 25 ft. of low-grade oxidized ore in the leached porphyry formation. The Zack shaft will be sunk deeper to cut the sulphide zone. S. M. Levy is manager.——The Buckhorn Fraction has been taken over by the Cole-Ryan interests.——Developments at Boston-Ely continue on a vigorous scale.

Ely, December 30.

OREGON.

BAKER COUNTY.

(Special Correspondence).—The Lewisohns, of New York, have a force of between 50 and 60 men on the Snake river, in this county, developing the Iron Dyke mine and the McDougall group of copper claims. The Iron Dyke has 200,000 tons of ore blocked out. They also have a 20-year contract on the total output of the Arkansas mine across the river, and are opening the Iron Mountain group where there is more than 100,000 tons of iron exposed, which will be used for fluxing purposes. The proposed operations include the erection of a 300-ton smelter, between the Iron Dyke and Ballard's landing, in the very near future. W. B. Fisher is manager.——While driving east in the Rainbow mine on the 240-ft. level an orebody 13 ft. in width was opened which milled $39.50 per ton. Previous to this engineers have estimated the ore in sight to be worth about $1,500,000 gross, the average value for the whole mine being about $24 per ton, of which 80% is free gold.——At the Humboldt mine, adjoining the Rainbow, 35 men are employed developing the property and milling 40 tons of ore per day. The mine is equipped with ten 875-lb. stamps and six Johnson concentrators. The ore averages about $10 per ton, 70% of which is free milling. The total saving is 93%. The mine produces some high-grade shipping ore.——The Poorman group of eight copper claims, situated 22 miles northeast of Baker City, and owned by the Oregon-Idaho Investment Co., has been surveyed for patent. The outcrop on this property is 200 ft. wide and over 2000 ft. long. A crew of seven men is employed and at 150 ft. the orebody is opened for a distance of 500 ft. in length and 70 ft. in width, leaving 130 ft. more cross-cutting before reaching the hanging wall. The last sampling in cross-cut No. 3 across the face gave 2.2% copper, 0.3 oz. silver, and $4.30 gold per ton.——The Highland mine, on Rock creek, is ship-

gold. Crude ore regularly to the Butte City sampling works. The last shipment of 17 tons netted the company $1,105, after deducting smelting and railroad charges. The Cornucopia Mines Co. is now shipping its concentrate to the Baker City sampling works. The Cornucopia concentrate ranges in value from $100 to $250 per ton.

Baker City, December 30.

WALLOWA COUNTY.

D. G. Davies has completed the installation of a 600-hp hydro-electric plant and 4800 ft. of 3-ft. continuous stave pipe at Joseph.

SOUTH DAKOTA.

LAWRENCE COUNTY.

Sinking has been resumed at the 200-ft. level of the Golden Crest shaft and a new level will be opened at the 300-ft. point. The attempt to resume work on the 200-ft. level has been abandoned temporarily and the ore will be worked through one of the other levels.

TEXAS.

JEFF DAVIS COUNTY.

James Ingle is doing extensive development work upon his zinc property, situated in the Capote mountains, near Valentine. It is stated that he has opened a body of rich ore and that regular shipments to the smelter will soon be started.

LLANO COUNTY.

(Special Correspondence).—Renewed activity in the Llano mining district, 100 miles northwest of Austin, is being shown, due largely to the prospects of the early building of a railroad into that district from the north, which will place it in close touch with the coal fields of Stephens and other counties. McCarty Moore, of Dallas, and associates, who own the Heath gold mine, situated five miles east of the town of Llano, will erect a 50-ton mill upon their property, and install a complete equipment of machinery in the mine. This mine is partly developed and has produced some rich ore.

Llano, December 30.

UTAH.

JUAB COUNTY.

A rich body of ore has been opened on the 300-ft. level of the Provo mine by the lessees. As the ore was found north of the shaft in the quartz it is thought that it will contain considerable gold. This shoot has been worked on the 160-ft. level and a winze will be sunk to connect the two.——A 30-ton shipment of lead ore netted the East Tintic De-

Tintic Smelter, Utah.

velopment Co. $1380. The company is now shipping two or three cars per week and will increase this output in the spring. A car of ore averaging 70% lead is to be sent out shortly.——The mineral right of the property owners of Eureka was sold to the Eureka City Mining Co. for $10,000. ——A stope has been opened from the drift on the 1600-ft. level of the Chief Consolidated and the ore is being forwarded to the smelter.——A churn-drill has been hauled to the Copper Jack mine in West Tintic and the property will be thoroughly prospected before any dividend work is undertaken. J. H. Webber is in charge of the development.

SUMMIT COUNTY.

The Daly West shaft has been completed to the 1200-ft. level and work through the No. 3 shaft of the Ontario Mining Co. stopped. A quarterly dividend of 20c. per share has been declared for January 15, totalling $54,000.——A new adit has been started on the McGregor group on Scott mountain, and considerable work is planned for the spring.——Some excellent ore is being opened at the Iowa Copper mine in Thaynes canyon and a winze will be started in the Spooner drift.——A 12-ton motor and a new compressor is being installed at the Daly Judge power plant which will double the supply of compressed air for power in the mine.——At the New York Bonanza the drift is in over 100 ft. and is expected to cut the ore shortly.——An assessment of 10c. per share has been levied on the capital stock of the Silver King Consolidated Mining Co., payable before January 17.

CANADA.

BRITISH COLUMBIA.

(Special Correspondence).—The ore shipment for the district of southeastern British Columbia will go over the 2,000,000 ton mark for the past year, showing an increase over 1908 of about 100,000 tons. The year closes with all of the big properties in operation and the outlook for 1910 far better than it was a year ago. Among the large mines that will produce in 1910 and which were closed down in 1909 will be the Sullivan group in East Kootenay, the Big Ledge zinc property on Arrow lake, and the No. 7 and New Dominion mines in the Boundary, as well as the B. C. Copper mines in Wellington.——The Vermillion Forks Mining & Development Co., Ltd., are now installing a hoisting plant and expect within a month to be producing 400 tons of coal per day. This property producing and the Nickel Plate operations being doubled will make a big gain in the Similkameen district in 1910.——Work is now going on steadily at the Slocan Star mine, which has been shut down several years owing to litigation. There is a good ore reserve in the property and it is expected that regular shipments will be begun at an early date.——The new general manager of the Crowsnest Pass Coal Co., Mr. Ashworth, states that the shipments from the Michel and Coal Creek mines are averaging about 4000 tons per day. The Fernie and Michel coke ovens are turning out about 800 tons per day at each place.——The Morrissey mines are shut down at present, and will not be given attention until the plan of development being carried out on the other two properties is nearly completed.——The Hedley Gold Mining Co., operating the Nickel Plate gold property at Hedley, has declared a dividend of 30c. per share, amounting in all to about $36,000. ——The Consolidated Mining & Smelting Co., of Canada, is going to build a two-mile tramway from the recently acquired No. 7 mine to the concentrator site at Boundary Falls, where a mill will be erected to treat the gold-quartz ore from this property.——The convention of those interested in the zinc mining industry of this locality was held December 15, and it is hoped that the movement will culminate in the building of a commercial zinc smelter near Rossland.——It is officially stated that work at the Kamloops mine will be resumed with a large working force in about six weeks. The Duluth men behind the deal, as soon as sufficient ore is taken out, intend to erect a smelter and tramway. E. C. Wallander is manager.——Colonel Eagleson, of Washington, D. C., has bonded 80 claims on Cadwalader creek, and if the experts report favorably on the ground, the syndicate he represents will spend $350,000 on a hydraulic plant in the spring.

Rossland, December 30.

MEXICO.

MEXICO.

A new company has been organized in Mexico City to extend the railroad system from Teziutlan to Nautla. The company is capitalized for ₱5,000,000 all of which has been subscribed, and construction work will be started in a short time. The road will open a large tract of country rich in mineral and agricultural resources.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

J. A. Taff has gone to Utah.

Frank H. Probert has gone to Boston.

William Boardman is in New York for a month.

F. L. Bosqui is experimenting with vacuum filtration on the Rand.

H. R. Norsworthy is with the Ione Copper Co., Ione, California.

Theodore Gross sailed from New York on December 27 for London.

Horace F. Evans has removed from Grant's Pass to Portland, Oregon.

Whitman Symmes has returned to Virginia City, Nevada, from San Francisco.

F. Lynwood Garrison has returned to Philadelphia and will shortly visit Mexico.

Ulyses S. Grant lectured at Evanston, Illinois, January 10, on 'Some Alaskan Glaciers'.

W. K. Betty is visiting plants in the United States, studying American filtration methods.

John S. Oglesby, of Dallas, Texas, has been in San Francisco, Cal., and Yerington, Nevada.

Lafayette Hanchett will sail from San Francisco in February for a journey around the world.

Forbes Rickard has returned from Mexico, and is now examining mines at Central City, Colorado.

Arthur H. Lawry has returned from Nicaragua, and is at the Black Oak mine, Soulsbyville, California.

Victor Tomilin is returning to Russia, and will go to the mines of the Syr-Darja Copper Co. in Turkestan.

John B. Farish, in company with his son, George E. Farish, has opened offices at 25 Broad street, New York.

Victor E. Tull, the general manager of the Tubal Cain Copper & Manganese Mining Co., Olympic Mountains, Washington, is at the Palace Hotel for a stay of several months.

Walter Harvey Weed has returned to New York from the Southwest, having just completed his report upon the Tajo de Dolores mine at Guanajuato, which he examined for the Proprietary Mines Co. of America.

G. H. Dowell, formerly with the American Smelting & Refining Co., and more lately metallurgist and ore-buyer for the Copper Queen Co., has been appointed superintendent of the Old Dominion Copper Mining & Smelting Co. in place of R. B. Hegardt, resigned.

Obituary.

Charles B. Dudley, the well known chemist and engineer, died at Altoona, Pennsylvania, December 21, after a brief illness only. A more extended notice of Mr. Dudley's life and work will be given later.

J. V. Bohn, superintendent of the Tennessee Copper Co.'s mines, died of typhoid fever at Copper Hill, Tennessee, Wednesday, December 22, 1909. Mr. Bohn was the second son of A. V. Bohn, of Leadville, Colorado. He was born in Dayton, Ohio, April 17, 1868, and entered Washington University, St. Louis, changed to Cornell, and completed his education at the Colorado School of Mines, Golden, Colorado. He then went to Butte, and thence to British Columbia, where he was connected with the smelter at Trail and the British American Investment Co., Ltd., at Rossland. He had charge of the Green Mountain mine for the American Smelters Securities Co., and then went to Chile as superintendent for the Braden Copper Co. He accepted a position with the Tennessee Copper Co. six months ago. In this short time he brought the company's mines and mine organization to a better condition, and materially facilitated the resumption of dividend payment in November by the betterments he introduced. Mr. Bohn leaves a widow, the eldest daughter of Admiral John A. Howell.

Market Reports.

LOCAL METAL PRICES.

San Francisco, January 6.

Antimony	12—12¾c	Quicksilver (flask)	50½—51
Electrolytic Copper	15¼—16½c	Spelter	7⅛—8¼c
Pig Lead	4.95—5.90c	Tin	36—37½c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver per oz.
Dec. 30	13 57	4.70	6.21	52⅝
" 31	13.63	4.70	6.21	52⅝
Jan. 1	Holiday.	No market.		
" 2	Sunday.	No market.		
" 3	13.68	4.70	6.21	52½
" 4	13.68	4.70	6.21	52⅝
" 5	13.68	4 70	6.21	52⅝

ANGLO-AMERICAN SHARES.

Cabled from London.

	Dec. 29. £ s. d.	Jan. 6. £ s. d.
Camp Bird	1 8 9	1 8 0
El Oro	1 6 9	1 7 6
Esperanza	2 18 0	2 18 9
Dolores	1 8 9	1 8 9
Oroville Dredging	0 10 6	0 10 6
Mexico Mines	6 6 3	6 0 3½
Tomboy	1 0 0	0 18 0 ex div.

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

SOUTHERN NEVADA STOCKS.

San Francisco, January 6.

Atlanta	$ 11	Mayflower	$ 3
Belmont	89	Midway	19
Booth	11	Montana Tonopah	82
Columbia Mtn	5	Nevada Hills	70
Combination Fraction	38	Pittsburg Silver Peak	86
Daisy	9	Rawhide Coalition	21
Fairview Eagle	12	Rawhide Queen	21
Florence	2.67	Round Mountain	60
Goldfield Con	7.87	Sandstorm	3
Gold Kewenas	7	Silver Pick	9
Great Bend	3	St. Ives	8
Jim Butler	9	Tonopah Extension	70
Jumbo Extension	14	Tonopah of Nevada	6.75
MacNamara	27	West End	22

(By courtesy of the San Francisco Stock & Exchange Board.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices. January 5.		Closing prices. January 5.
Amalgamated Copper	87¾	Miami Copper	28⅛
A. S. & R. Co.	101¾	Mines Co. of America	½
Boston Copper	21⅞	Montgomery-Shoshone	1¼
B. C. Copper Co.	8¾	Nevada Con.	26½
Butte Coalition	28⅛	Nevada Utah	1½
Cumberland-Ely	9	Newhouse	37⅛
Davis-Daly	4⅝	Nipissing	10¼
Dolores	7⅜	Ohio Copper	5½
El Rayo	2⅞	Ray Central	3⅜
Ely Central	2¾	Ray Con.	26⅞
First National	6⅜	Superior & Pittsburg	16⅛
Giroux	11¾	Tenn. Copper	39⅝
Guanajuato Con	1⅞	Trinity	10½
Inspiration	9⅞	Tuolumne Copper	3⅜
Kerr Lake	10⅞	United Copper	8¾
La Rose	4⅞	Utah Copper	59¾
Mason Valley	2	Yukon Gold	4⅞

COPPER SHARES—BOSTON.

	Closing Prices. January 6.		Closing Prices. January 6.
Adventure	6	Mohawk	67
Allouez	56	North Butte	45¼
Atlantic	10	Old Dominion	53
Calumet & Arizona	101	Osceola	161
Calumet & Hecla	670	Parrot	21¼
Centennial	36	Santa Fe	2⅝
Copper Range	84¼	Shannon	17⅛
Daly West	8¾	Superior & Pittsburg	16¼
Franklin	17½	Tamarack	76
Granby	110	Trinity	10½
Greene-Cananea, ctf.	11⅞	Utah Con	44⅛
Isle Royale	27½	Victoria	5
La Salle	16¾	Winona	11⅞
Mass Copper	5	Wolverine	14

(By courtesy of J. C. Wilson, Mills Building.)

Supreme Court Decision on California Eight-Hour Law.

The following is the full text of the decision of the Supreme Court of California in the test cases brought to determine the constitutionality of the law restricting labor in mines and reduction works to eight hours per diem.

IN THE MATTER OF THE APPLICATION OF FRED J. MARTIN FOR A WRIT OF *Habeas Corpus* (Crim. No. 1539.)

Upon the application of Fred J. Martin a writ of *habeas corpus* was issued by this court. Martin had been arrested upon a charge of violating the terms of a statute entitled "An act regulating the hours of employment in underground mines and in smelting and reduction works" (Stats. 1909, c. 181, p. 279), approved March 10, 1909. The provisions of the act are as follows:

"Section 1. That the period of employment for all persons who are employed or engaged in work in underground mines in search of minerals, whether base or precious, or who are engaged in such underground mines for other purposes, or who are employed or engaged in other underground workings, whether for the purpose of tunneling, making excavations, or to accomplish any other purpose or design, or who are employed in smelters and other institutions for the reduction or refining of ores or metals, shall not exceed eight hours within any twenty-four hours, and the hours of employment in such employment or work day shall be consecutive, excluding, however, any intermission of time for lunch or meals; *provided* that, in case of emergency where life or property is in imminent danger, the period may be a longer time during the continuance of the exigency or emergency.

"Sec. 2. Any person who shall violate any provision of this act, and any person who as foreman, manager, director, or officer of a corporation, or as the employer or superior officer of any person, shall command, persuade or allow any person to violate any provision of this act, shall be guilty of a misdemeanor and upon conviction shall be punished by a fine of not less than fifty dollars ($50) nor more than three hundred dollars ($300), or by imprisonment of not more than three months. And the court shall have discretion to impose both fine and imprisonment as herein provided.

"Sec. 3. All acts and parts of acts inconsistent with this act are hereby repealed."

It is not questioned by the petitioner that the complaint which furnished the basis for his arrest stated a violation of the terms of the act. His position is, however, that the act is void as being in contravention of constitutional provisions. The ground of attack usually advanced in cases of this character, namely, that the statute is in conflict with the guaranties of the XIVth amendment to the Constitution of the United States, is not here urged. Indeed, such contention is hardly open to the petitioner in view of the decision in Holden *v.* Hardy, 169 U. S. 366, where the Supreme Court of the United States decided that a statute of Utah, substantially identical in its main features with the one before us did not deprive persons affected by it of any right conferred by the Federal constitution. Conceding the binding force of that decision as an adjudication of all Federal questions involved, the petitioner here bases his claim to immunity from prosecution upon certain provisions of the constitution of this State. Before proceeding to a consideration of the particular points made in this connection, it may be well to briefly state the basis of the decision in Holden *v.* Hardy, since, in our opinion, the points there decided go far toward answering the main objections predicated upon the State constitution. The right on the part of the State to restrict the freedom of citizens to make contracts concerning their callings or occupations was there upheld with respect to the particular callings covered by the Utah statute, i. e., mining and working in smelting and reduction works, upon the ground that the restriction in question was a proper exercise of the police power for the preservation of the public health. "The right of contract," says the court, "is itself subject to certain limitations which the State may lawfully impose in the exercise of its public powers. While this power is inherent in all governments, it has doubtless been greatly expanded in its application during the past century, owing to an enormous increase in the number of occupations which are dangerous or so far detrimental to the health of employees as to demand special precautions for their well being and protection, or the safety of adjacent property. While this court has held * * * * * that the police power cannot be put forward as an excuse for oppressive and unjust legislation, it may be lawfully resorted to for the purpose of preserving the public health, safety, or morals, or the abatement of public nuisances and a large discretion is necessarily vested in the legislature to determine, not only what the interests of the public require, but what measures are necessary for the protection of such interests." Again, in the same opinion, it is said that "while the general experience of mankind may justify us in believing that men may engage in ordinary employments more than eight hours per day without injury to their health, it does not follow that labor for the same length of time is innocuous when carried on beneath the surface of the earth, where the operator is deprived of fresh air and sunlight, and is frequently subjected to foul atmosphere and a very high temperature, or to the influence of noxious gases, generated by the processes of refining or smelting." The right to limit the hours of labor generally was not involved in Holden *v.* Hardy. No such right was asserted. It was, however, decided that the particular occupations affected by the act possessed such elements of danger and risk to the employee that the legislature might reasonably conclude that in such occupations a restriction of the time of labor was necessary for the protection of those engaged in such labor.

The limitations of the doctrine are well illustrated by the subsequent decisions in Lochner *v.* New York, 198 U. S. 45, in which the court, reversing the decision of the Court of Appeals of New York in People *v.* Lochner, 177 N. Y. 145, declared invalid a law limiting the hours of labor of bakers. The real ground of that decision is, we think, to be found in the following extract from the opinion of Mr. Justice Peckham: "We think that there can be no fair doubt that the trade of a baker, in and of itself, is not an unhealthy one to that degree which would authorize the legislature to interfere with the right of labor, and with the right of free contract on the part of the individual, either as employer or employee." The decision of the Lochner case was by a bare majority of the court, but the majority itself recognized the correctness of the decision in Holden *v.* Hardy and distinguished that case upon the ground that the callings involved in the two statutes were essentially different.

It follows, from a comparison of these two decisions, that in determining whether an act limiting the hours of labor in any occupation is in violation of the provisions of the Federal Constitution, the primary consideration is whether or not the occupation possesses such characteristics of danger to the health of those engaged in it as to justify the legislature in concluding that the welfare of the community demands a restriction. And this brings us to the petitioner's contention that the act is violative of the provisions of the State Constitution respecting special legislation. It is contended that the act violates subdivision 2 of section 25 of article IV, in that it is a special law for the punishment of a crime or misdemeanor created by said act; that it violates subdivision 35 of said section, in that it is a special law passed in a case where a general law can be made applicable; that it violates section 21 of article I in that it grants to citizens or classes of citizens privileges or immunities which are not, upon the same terms, granted to all citizens; that it violates section 11 of article I as not being of uniform operation. These various specifications are in effect direct to the same point, namely, that the law arbitrarily selects for its operation a special class of persons. It is, of course, unnecessary at this date to cite any authorities in support of the proposition that a law is not special or lacking in uniformity merely because it does not apply to every person or subject within the State. "An act to be general in its scope need not include all classes of individuals in the State; it answers the constitutional requirements if it relates to and operates uniformly upon the whole

of any single class." (Abeel *v.* Clark, 84 Cal. 226.) The classification created for the purposes of legislation must, of course, be a reasonable one. The test of its propriety is well stated in City of Pasadena *v.* Stimson, 91 Cal. 238, where the court declared "that although a law is general and constitutional when it applies equally to all persons embraced in a class founded upon some natural or intrinsic or constitutional distinction, it is not general or constitutional if it confers particular privileges or imposes peculiar disabilities or burdensome conditions in the exercise of a common right upon a class of persons arbitrarily selected from the general body of those who stand in precisely the same relation to the subject of the law." But in view of the decision in Holden *v.* Hardy, based as it was upon the fact that the occupations covered by this act were so peculiarly dangerous as to justify special regulation, how can it be said that the legislature in selecting these occupations and applying to them provisions designed to protect the health of those engaged in them was making "a class of persons arbitrarily selected from the general body of those who stand in precisely the same relation to the subject of the law?" The very grounds which led the Supreme Court of the United States to hold that the Utah statute did not deprive any person of life, liberty, or property without due process of law, nor deny to any person the equal protection of the laws, requires the conclusion that the legislation was not special within the meaning of our State Constitution. (See Julien *v.* Model B. L. & I. Co., 116 Wis. 79.) For if it could be said that the limitation of the hours of labor of miners and those engaged in smelting and reduction works could not be supported by any natural or intrinsic distinction between these occupations and others the legislation would, for the reasons declared in Lochner *v.* New York, necessarily fall before the provisions of the Federal Constitution.

The appellant relies with great confidence upon the decision of the Supreme Court of Colorado, *in re* Morgan, 58 Pac. 1071. In that case it was held that an act similar to the one under consideration was unconstitutional, this conclusion being based upon the ground, among others, that the law was "class legislation." We have not had access to the constitution of Colorado, and are not informed of its precise terms regarding general and special legislation. It may be observed, however, that some of the grounds relied on by the Colorado court for its decision are clearly in conflict with the views of the Supreme Court of the United States in the Holden case. In other States, having constitutional provisions directed against the passing of special laws, legislation of this character has been upheld. (*Ex parte* Boyce, 27 Nev. 299; *ex parte* Kair, (Nev.) 80 Pac. 463; State *v.* Cantwell, 179 Mo. 245.)

It is argued by the appellant that the act is special because it does not include in its scope many occupations other than mining which are equally dangerous to the health of the persons engaged in them. Reference is made, for example, to marble cutters and marble drillers; diamond cutters; workers in furnaces and laundries; men employed in wine cellars, breweries, and ice houses; men in boiler works, match makers, cleaners of clothes, makers of white lead, of china and earthenware, and many others. The argument is, apparently, that any law is special which does not include all of these occupations. This view is obviously unsound. Whether these other occupations present the same dangers to health as those involved in mining, etc., and whether, if they do, these dangers can best be met by restricting the hours of labor, are primarily questions for the legislature. The legislature has determined one or both of them in the negative by enacting this law. The selection of the businesses requiring regulation is confided to the legislative discretion, and this discretion is not subject to judicial review unless it clearly appears to have been exercised arbitrarily and without any show of good reason. It certainly cannot be justly said to be apparent that each or any of the trades instanced by counsel is, in its effect upon the health of workers, identical with the occupations covered by the act under discussion, nor that the most appropriate method of counteracting any injurious effects pertaining to any of them is necessarily the same as that found to be suitable for miners and men working in smelting and reduction works. In other words, the law is not rendered special by the mere fact that it does not cover every subject which the legislature might conceivably have included in it. It is enough that the subjects covered possess such intrinsic peculiarities as to justify the legislative determination that those subjects require special enactment.

It may be questioned whether, in view of the title of the act, the limitation of hours applies to all underground work or only to that performed in mines. But if we assume, with petitioner, that only work in mines is covered, the act is not thereby rendered obnoxious to the constitutional provision against special legislation. This point was made in State *v.* Cantwell *supra*, and was met by the answer that the discrimination between work in mines and that in other underground diggings was justified by the fact that mining is a permanent business in which men are engaged steadily for long periods of time, whereas other underground diggings are ordinarily temporary and irregular in duration and for that reason do not require the same measure of regulation.

The act and the title thereof do not embrace more than one subject (Const., art. IV, sec. 24; *ex parte* Boyce *supra*). It is designed, as we have said, for the protection of the health of persons engaged in occupations regarded by the legislature as dangerous. Such occupations as in the legislative view were subject to the same kind of danger and which required the same kind of regulation could properly be joined together in one act. We may remark the inconsistency between the argument that the act is void because it covers different kinds of employment and petitioner's other contention that the act is void because it does not cover a greater number of employments.

Petitioner attacks the provisions of the act that the hours of employment shall be consecutive (excluding, however, any intermission of time for lunch or meals). We are not prepared to say that this limitation bears no reasonable relation to the protection of the health of the workmen. The legislature may have considered that persons working in underground mines, in smelters, or in reduction works required for their protection, not only that the total number of hours of employment in a day should be limited, but that the hours of labor should be so adjusted as to allow the employee a long consecutive period for rest and recreation. This is a question of legislative policy with which the courts have no concern. Upon the whole case, we are satisfied that the act is a valid exercise of the legislative power and that the petitioner is properly held. It is ordered that the writ be dismissed and the petitioner remanded to the custody of the constable.

Sloss, J. (concurring: Shaw, J., Angellotti, J., Lorigan, J., Melvin, J., Henshaw, J.)

IN THE MATTER OF THE APPLICATION OF FRED J. MARTIN FOR A WRIT OF *Habeas Corpus* (Crim. No. 1540).

The petitioner in this case was also petitioner in Criminal No. 1539, just decided, and is held under a complaint purporting to charge him with a violation of the terms of the act regulating the hours of employment in underground mines and in smelting and reduction works, approved March 10, 1909. The validity of the act as a whole was considered and upheld in the foregoing case. The present proceeding presents solely a question of construction. The petitioner is charged in the complaint with having required a miner to work eight full and consecutive hours at the face of a drift in a mine in addition to the time necessarily occupied in traversing the shaft, underground drifts, and tunnels, between the surface of the mine and the face of said drift. The time so occupied in going to and from the place of work was in excess of thirty minutes. We think the petitioner's contention that no violation of the act is here charged is correct and should be sustained. The act provides that the period of employment of persons employed or engaged in work in underground mines, etc., shall not exceed eight hours in any twenty-four hours. The purpose of the act is, as has been pointed out in the opinion in Crim. No. 1539, the protection of the health of men working in underground mines. The injury to health which

seems to have been apprehended is that which would be encountered by one subjected to the strain of performing manual labor under detrimental conditions. Giving to the words of the act their ordinary and reasonable meaning, the limitation of time is to be construed as referring to the time when men are actually engaged in work, not when they are going to or from their work. There is nothing in the language of the act which would justify a more restricted interpretation.

A somewhat similar question has arisen under the Federal statute (5 Fed. St. Ann. 819) providing that "if any letter carrier is employed a greater number of hours per day than eight he shall be paid extra for the same in proportion to the salary now fixed by law." The 'employment' which entitled a carrier to extra pay under this law is held to be an employment "in work that is not inconsistent with his general business under his employment as a letter carrier" (United States v. Post, 148 U. S. 124). It does not include short intervals, or 'swings', between trips, when the carrier is not actually employed in work, and not required to remain in or about the post office (United States v. Langston, 85 Fed. 613; United States v. McCrory, 119 Fed. 861).

The petitioner is discharged.

Sloss J. (concurring: Shaw, J., Angellotti, J., Lorigan, J., Melvin, J., Henshaw, J.)

IN THE MATTER OF THE APPLICATION OF FRED J. MARTIN FOR A WRIT OF *Habeas Corpus* (Crim. No. 1541).

This case was submitted upon the same briefs and at the same time as the two cases with the same title, numbered, respectively, 1539 and 1540. The only point wherein it differs from the other two cases is that in this case the petitioner was charged with having commanded a workman to work more than eight hours in one day, upon a mill in control of the petitioner and then in operation crushing and pulverizing quartz for the purpose of extracting precious metals therefrom, in other words, in an ordinary stamp-mill. The only arguments in favor of the writ, not answered in the opinions in the other two cases, are, first, that the mill in question is working free-milling ore and the metal is extracted solely by the process of pulverizing and washing, which, it is claimed, is not embraced within the phrase "smelters and other institutions for the reduction or refining of ores or metals," contained in the act, and, second, that the occupation of laboring in a quartz mill of this kind is not sufficiently injurious to health to bring it within the scope of the police power. As applied to mining, the word 'reduce' means to bring to a specified form or condition, as, to reduce a rock to powder, or, to deprive an ore of non-metallic constituents, and the word 'reduction' means the separation of metals from their ores (Standard Dic.). The application of heat to flux the ore is not necessary in order to make the establishment an "institution for the reduction of ore." A quartz mill comes as clearly within the meaning of that phrase as a smelter. We cannot agree to the proposition that the insertion of the word 'smelters', at the beginning of the phrase used in the statute, brings it within the rule *noscitur a sociis*, so as to confine the application of the statute to institutions wherein ores are reduced by smelting.

The legislature has by this act declared that in its judgment the occupation of laboring in reduction works of this character is so dangerous to the health of those engaged in it as to make it a proper subject of regulation. As was remarked in the opinion in case No. 1539, *supra*, the legislative judgment upon a matter of fact such as this "is not subject to judicial review unless it clearly appears to have been exercised arbitrarily and without any show of good reason." In a quartz mill the ore is first crushed and then washed in order to separate the metal from the rock. In this process it is obvious that frequently the air in the vicinity of the crusher will become filled with fine particles of the rock in the form of dust, which the workmen in breathing must draw into their lungs. We cannot say that this will not be detrimental to their health to such an extent as to make it advisable to shorten the hours of labor therein. It has been so held in cases in other States, with respect to similar statutes (*Ex parte* Boyce, 27 Nev. 33, 75 Pac. 3; *ex parte* Kair, 28 Nev. 141, 80 Pac. 665; State v. Holden, 14 Utah 98; Holden v. Hardy, 169 U. S. 366.) For these reasons we are of the opinion that the facts charged in the complaint against the petitioner state an offense defined in the statute, and that the statute is, in this particular, a constitutional enactment. The process upon which he is in custody is therefore valid. It is ordered that the petition be dismissed and that the petitioner be remanded to the custody of the officer.

Shaw, J. (concurring: Sloss, J., Angellotti, J., Lorigan, J., Melvin, J., Henshaw, J.).

Monthly Statement of Dividends Paid by Active Listed Oil Companies to December 31, 1909.

Company.	No. of Div.	Date paid	Amount per share.	Amount of dividend.	Total paid to date.
Alma	13	Oct. '09	$ 3	$ 11,400.00	$ 148,200.00
Amalgamated Oil.	27	Nov. '09	1.00	50,000.00	1,350,000.00
Amer. Petroleum	6	Dec. '09	1.00	119,281.00	680,441.50
Apollo	2	Mar. '05	1	2,000.00	4,000.00
Associated Oil Co.	4	Mar. '07	1.50	446,955.00	1,548,368.55
Bay City	3	Dec. '09	30	30,000.00	70,000.00
Brookshire	44	Dec. '09	1	5,000.00	437,500.00
Caribou	56	Dec. '09	25	20,175.75	640,004.49
Chicago Crude	2	Mar. '07	0½	5,000.00	15,000.00
Claremont	55	Dec. '09	2	9,000.00	287,000.00
Coalinga Pacific	18	Dec. '09	10	6,500.00	107,250.00
Columbia	34	Dec. '09	0½	4,996.31	248,815.32
Del Rey	3	May '09	0½	3,927.50	11,782.50
Esperanza	26	Dec. '09	2	3,200.00	49,450.00
Euclid	34	Dec. '09	1	3,500.00	113,500.00
Four	67	Dec. '09	1	3,000.00	210,000.00
Globe	19	Oct. '09	1	6,000.00	75,000.00
Hanford	30	Jan. '06	2.00	4,000.00	80,000.00
Home	A14	Dec. '09	2	2,000.00	468,000.00
Homestake	41	Dec. '09	10	1,000.00	76,250.00
Illinois Crude	34	Dec. '09	1	2,000.00	82,000.00
Imperial	66	Oct. '09	60	60,000.00	1,880,000.00
Junction	8	June '09	1	2,500.00	20,000.00
Kern Oil	2	Nov. '09	22	22,000.00	42,000.00
Kern River	39	Feb. '09	10	2,000.00	98,000.00
Linda Vista	18	Nov. '09	1	3,838.50	65,254.50
Lucile	15	Nov. '09	10	2,670.44	40,056.60
Mex. Petroleum		Dec. '09	1¼	84,740.32	3,220,393.44
Mecca	6	July '09	3	12,675.00	71,825.00
Monte Cristo	58	Oct. '09	3	15,000.00	340,000.00
Nevada County	3	Oct. '08	4	10,000.00	40,000.00
Palmer	7	Dec. '09	1	18,020.05	196,300.75
Paraffine	2	Dec. '09	1	3,000.00	6,000.00
Peerless	77	Sept. '09	6	6,000.00	801,000.00
Piedmont	6	Aug. '09	1	3,890.00	22,987.30
Pinal		Dec. '09	10	15,000.00	864,841.00
Pittsburg	10	Nov. '07	24½	58,800.00	124,800.00
Record	6	Dec. '09	7½	7,500.00	32,500.00
Reed Crude	11	Dec. '09	12	12,000.00	1,121,000.00
Rice Ranch	15	Dec. '09	1	3,000.00	90,000.00
Royalty	13	Dec. '09	2	400.00	7,600.00
S. F. & McKittrick	20	Dec. '09	30	15,000.00	295,000.00
Sauer Dough	46	Dec. '09	5	9,975.00	502,341.90
Sesnon	5	Dec. '09	15	15,000.00	75,000.00
Silver Tip Oil Co.	3	Dec. '09	10	7,500.00	22,500.00
Sovereign	16	Oct. '09	1	5,000.00	85,000.00
Sterling	21	Sept. '09	25	62,500.00	747,000.00
Superior	10	Nov. '09	1½	7,500.00	52,500.00
S. W. & B.	7	Sept. '09	1	3,770.00	41,470.00
Thirty Three	58	Sept. '09	30	30,000.00	670,000.00
Traders		Dec. '09	1.00	11,550.00	135,250.00
Union	161	Dec. '09	50	124,813.00	5,993,816.15
United Petroleum	100	Dec. '09	50	40,375.50	2,057,833.43
Wabash	24	Dec. '09	1	3,000.00	111,000.00
West Coast (pfd.)	3	Nov. '09	2.00	20,816.00	62,448.00
Western Union		Dec. '07	2.00	20,000.00	481,951.00
West Shore	47	Dec. '08	5	5,000.00	235,000.00
Total dividends paid to date					$27,362,230.52
Total dividends paid by the above companies for December 1909					655,523.24

Joplin District in 1909.

Figures compiled by Otto Ruhl show that the output from the mines surrounding Joplin in 1909 was the greatest in the history of the district, reaching a total of 301,205 tons of zinc ore valued at $12,192,770, and 44,186 tons of lead ore valued at $2,420,878. The total value was a trifle less than in 1907, the previous record year, owing to the low

price of the metals during the early part of 1909. For the first time the outputs of the calamine and blende ores are shown separately. The calamine approximates 10% of the blende in amount and averages $20.05 per ton, while the 'jack' brought an average of $42.21. The calamine sold on a basis of 40% zinc and the blende 60%. At the time of the panic a large amount of development had been completed, and a number of old mines reopened. In the latter part of 1909 the higher prices made possible the resumption of mining at these properties. The greatest increase over 1908 has been from the mines operating in the sheet-ground at Webb City, Duenweg, and Prosperity, while the zinc output from Carthage, Sarcoxie, and Miami was practically doubled, and the lead output of Miami trebled. Consistent drilling has extended the known fields both in Missouri and Kansas and opened payable ore in a number of properties at greater depth. One of the most significant features of recent development has been the discovery of payable ore below the Grand Falls chert at Cave Springs, Empire, and elsewhere. During the earlier part of the year the price of blende varied between $35 and $42 per ton, but in the latter half rose to as high as $52 for standard 60% grades, the price for lead ore ranging between $50 and $60 per ton. The following table shows the output in pounds and amount paid for lead and zinc ore by camps.

Camp.	Blende		Calamine		Lead		Total value.
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	
Webb City and Carterville...	202,660,905	$4,283,179	.....	.....	42,654,860	$1,176,341	$5,459,520
Joplin	97,089,515	2,110,836	4,015,360	$ 47,851	14,315,185	392,846	2,551,533
Galena, Kansas	40,656,690	854,245	1,505,970	16,855	3,357,180	92,253	963,353
Duenweg	28,559,140	602,982	5,620,520	67,344	5,342,900	143,998	814,324
Prosperity	22,922,250	488,880	.....	.....	6,294,545	172,641	661,521
Miami, Oklahoma	24,744,690	411,789	.....	.....	7,907,385	211,852	623,641
Alba	22,530,430	483,182	.....	.....	356,890	9,853	493,035
Aurora	13,173,160	280,531	11,710,815	140,607	687,010	18,752	439,890
Granby	6,713,910	133,281	21,430,080	263,990	655,260	18,249	415,524
Spring City	8,600,880	176,201	7,935,170	92,876	3,801,400	103,717	372,794
Oronogo	15,829,480	325,129	.....	.....	1,924,830	51,286	376,415
Badger, Kansas	15,720,180	340,333	.....	.....	95,350	2,677	343,010
Carthage	13,350,740	289,756	610,790	7,119	24,070	600	297,475
Quapaw, Oklahoma	9,618,910	208,991	75,020	831	494,500	13,279	223,101
Zincite	9,253,310	212,228	.....	.....	313,490	8,663	220,891
Sarcoxie	4,838,870	105,471	3,176,825	37,739	.....	.....	143,210
Cave Springs	3,744,760	83,005	.....	.....	10,240	275	83,280
Carl Junction	3,432,290	77,649	.....	.....	37,600	996	78,645
Stotts City	1,209,995	26,854	.....	.....	.....	.....	26,854
Wentworth	397,100	7,977	350,950	3,128	.....	.....	11,105
Peoria, Oklahoma	.....	.....	687,195	8,513	51,100	1,400	9,913
Seneca	.....	.....	47,050	470	48,150	1,200	1,670
Everton	.....	.....	122,660	1,200	.....	.....	1,220
Purdy	.....	.....	35,070	490	.....	.....	490
Davis, Oklahoma	.....	.....	31,670	434	.....	.....	434
Ash Grove	.....	.....	10,060	200	.....	.....	200
District	545,047,155	11,503,099	57,362,185	689,671	88,371,975	2,420,878	14,615,048

Commercial Paragraphs.

The Broderick & Bascom Rope Co., St. Louis, Missouri, has received an award of a gold medal for its Yellow Strand wire rope from the directors of the Alaska-Yukon-Pacific Exposition.

The Wood Drill Works, Paterson, New Jersey, is distributing Circular No. 60, giving a description of the test applied to Wood rock-drills, and the opinions of A. C. Dart, of the University of Wyoming, and J. M. Carson, Jr., of the West Point Military Academy, as to work accomplished with the Wood rock-drills.

John Wellington Nesmith, president of the Colorado Iron Works Co., died December 17, 1909. Mr. Nesmith had been identified with the progress of the West from the early days, coming to Colorado in 1860, engaging in mining and milling in Gilpin county. He subsequently became interested in Langford & Co.'s foundry, the nucleus of the Colorado Iron Works, of which he became manager in 1879 and president in 1886. In the advancement in ore-treatment methods he took an active interest, and specialized in the blast-furnace smelting of lead and copper ores.

Catalogues Received.

The San Francisco office of the Allis-Chalmers Co. has been moved to the Jackson Bdg., 160 Second street. It is in charge of R. B. Elder.

The Dings Electro Magnetic Separator Co., Milwaukee, Wisconsin. Bulletin No. 21. 'Magnetic Separators'. 20 pages. Illustrated. 6 by 9 inches.

Guy M. Vail, formerly with the A. S. & R. Co., Denver, and Braden Copper Co., in Chile, has become the partner of W. C. Stewart in assaying and ore-testing, at Portland, Oregon.

The American Well Works, Aurora, Ill. 'Report on the Results of Certain Efficiency Tests of American Centrifugal Pumps.' By Arthur L. Adams. 16 pages. Illustrated. 6 by 9 inches.

The Fred M. Prescott Steam Pump Co., Milwaukee, Wisconsin, has recently opened a district sales office at 617 Newhouse Bdg., Salt Lake City, Utah. It will be in charge of R. E. Burke.

The firm of Trippe, Thompson & Co., expired by limitation, December 31, being succeeded by Thompson, Towle & Co. and Trippe & Co. The address of both firms is 25 Broad street, New York City.

The A. Lietz Co. San Francisco Solar Ephemeris for 1910. A convenient pocket manual for those having solar observations to make. It also contains a table of the azimuths of Polaris. Sent free on request. 10 pages. 3¼ by 5½ inches.

The Risdon Iron Works, 272 Steuart street, San Francisco, California. Catalogue No. 17. Seventh Edition. 'Gold Dredging Machinery.' The latest description of this well known type of dredge. 53 pages. Illustrated. 6½ by 10 in. It may be mentioned that the Risdon Iron Works now has five dredges under construction in its works.

The F. Mayer Boot & Shoe Co., of Milwaukee, Wisconsin, reports that the past year has been a prosperous one for it and that its sales of the Mayer line of miners' and prospectors' boots have increased steadily. The Washington Shoe Mfg. Co., Seattle, Washington, is acting as the Western branch of this company.

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EDITORIAL.

QUICKSILVER, in 1909, faced a somewhat unexpected increased demand. California producers in general were not in position to profit from the increased price reached in the latter part of the year, but at least one considerable sale at $51 per flask was recorded, and the prospect for still better prices is strong. In Texas the industry thrived, and in Nevada, as recorded in our issue of November 13, production has begun.

OIL PRICES are on the ascendant. Contracts have been entered into by the Producers' Agency at $1.62½ per barrel. It is the opinion of those well informed in the business that the demand for California oil in 1910 could only be met by a production of 65 million barrels. Evidently the rosiest days for the oil producers are still ahead of them, and the search for petroleum will offer constantly increasing opportunities for the use of large amounts of capital.

TELEGRAPHIC code-messages are permissible under the modified ruling of the telegraph companies when the code-words are words found in the dictionaries of the English and the Germanic and Romance groups of languages. The permitted list of code-words also embraces the official vocabulary adopted at a convention of the telegraph and cable companies of the world, held a few years ago at Berne, Switzerland. This list embraces the words found in practically all the old standard telegraphic codes, such as the Bedford McNeill, Lieber, and others. Artificial code-words not found in the vocabulary or regular dictionaries are charged for at the rate of five letters to a word.

PRACTICAL rough and ready methods are always worthy of description. American progress has been in no small measure a result of that so-called Yankee ingenuity which is readiness of wit to play Crusoe and find a way to do things well with the facilities at hand. In our last issue we printed an account of a home-made grinding pan devised by Mr. William H. Washburn. It is in reality a modified Berdan pan, though Mr. Washburn has clearly not derived his idea from this Australian prototype. We note his suggestion that trituration by ball-grinding is less likely to produce flouring of mercury than the attrition of a muller, which is worthy of consideration.

LOCAL OFFICES of the United States Geological Survey are maintained in Denver, Salt Lake, and a number of other Western cities. In California the Topographic branch has headquarters at Sacramento, the Water Resources branch at Pasadena,

and the Mineral Resources branch at San Francisco. Mr. Charles G. Yale is the local representative, and has an office in the Appraisers' Building. On January 1, Mr. Yale was given substantial promotion, and it is proposed to make his office in name, as it has long been in fact, a general bureau of information regarding Geological Survey work in the Western States. This is a good move. The Survey will gain greatly by maintaining in the leading centres of mining activity, offices where accurate information regarding its work is at hand, and where visiting engineers and others can come into direct contact with responsible Survey officers. Mr. Yale is peculiarly qualified by training, experience, and wide acquaintance to fill such a position, and our congratulations go quite as much to the Survey as to him.

CONFIRMATION of the purchase of the Santa Gertrúdis mines at Pachuca, Mexico, by The Camp Bird, Ltd., has been received. The transaction would have been completed many weeks sooner but for the opposition by minority stockholders of the Mexican company who were averse to selling. Thus it comes as a cheering new year's promise of the continued influx of foreign capital into Mexico during 1910. The Camp Bird company has increased its capital stock to £1,350,000 by the creation of 250,000 additional shares of £1 each in order to provide funds for the exercise of option to acquire the Mexican mine. Accordingly, this move represents a policy of expansion, instead of an investment of a reserve fund. The treasury reserve stock of the Camp Bird is 280,000 shares. The new stock brings this up to 530,000, which it is said will be offered to present stockholders at five shillings above par. A large extra dividend is expected out of accumulated surplus before the subsidiary company to control the Santa Gertrúdis mine is launched.

Mining Engineers in 1909 and 1910.

For mining engineers the year just past has not been bad, but 1910 will be better. The chastening influence of the financial crisis has given a healthier tone to the mining world. It has shown the value of wise prevision and capable management. It has dignified more than ever the services of the trained technologist. Despite the cautious spirit of the business world, groping its way back out of the mazes of tangled commercial relations, the year now ended stands conspicuous for the greatest production of metals ever known in the history of the world. Moreover, this enormous contribution of iron, copper, lead, and zinc has been absorbed almost completely by the demands of trade. No one troubles himself longer about a copper or spelter surplus. Known metal stocks amount to no more than a convenient reserve supply. Preparation for increasing production of the metals has been made throughout the year upon a scale of unprecedented magnitude. Mines of copper, gold, lead, and zinc have been opened and developed, proving tonnages which, in many cases, insure successful operations for decades. Noteworthy and cheering to professional pride is the fact that this progress has taken place under the trained guidance of engineers to an extent previously unknown. The public lends a willing ear to the underwriter only on certificates of assets known and demonstrated by mining engineers and economic geologists of established reputation. The growing demand for the latter class of technologist is a splendid tribute, first of all to the confidence in the practical utility of geology as proved by the contributions of the United States Geological Survey, and by the able guidance which geologists have given to the leading mining enterprises of the country in preventing wasteful search for ores. It is significant that the staff of but few of the large mining corporations is now deemed complete unless it include one or more such men. The future of the professional man in mining is growing brighter.

Mr. Pinchot's Dismissal.

The President has taken a bold step, and one which we believe to be unfortunate. He has separated from the public service one of whom he earlier said, "his loss would be almost irreparable to the Government," and the public is unable to understand what justifies the action. The charge of insubordination is not taken seriously. It is true that Mr. Pinchot, in communicating directly with Mr. Dolliver, violated a rule laid down by Mr. Taft, but the rule itself is widely held to be illegal and, in practice, Senators and Representatives have always been free to obtain information from the Department without resorting to the highly technical method of formal application to the Secretary in charge. However, granted that a rule was broken, and even that the rule was a proper and legal one, Mr. Pinchot's real offense lies in his refusal to accept as final the President's 'vindication', of Mr. R. A. Ballinger. In this he seems to be no more guilty than the great majority of the American people, and we would point out that a good many years ago it was determined to be impossible to indict a whole nation. It is just this fact, that the public will evidently not accept at its face value a maturely expressed judgment of the President, which is the most striking feature of the case. It is true, despite a widespread and unshaken belief in his integrity and good purposes. For this Mr. Taft has only himself to thank. After having repeatedly and emphatically promised a 'revision downward' he not only signed the Payne-Aldrich tariff bill, but has gone out on the stump to defend it. There is a widespread and deep-seated conviction that the bill was not an honest one, that it did not revise downward, that it was formulated in the interests of the few rather than the many. All this is supported by the further fact that the cost of living has gone up rather than down. So the President, who went into the office with almost universal good will, has lost so much of public confidence as is involved in the general demand for evidence rather than decrees.

The so-called Pinchot-Ballinger controversy has been frequently noted in these columns. We have no desire at this time to enter into the merits of the case. Our concern is with the result in its bearing on the public land laws, particularly the mineral land laws. Our conviction that the latter are archaic and in need of complete revision has been frequently stated.

We furthermore believe that in this revision not only must changed business methods be taken into account but adequate provision should be made for the conservation of those resources which are vital to our future those which are akin to public utilities. For this doctrine Mr Gifford Pinchot has been the foremost champion. Young, rich, and able he has devoted his services with rare zeal and fidelity, to public service of the highest type. In his administration of the Forest Service he has at times and in places aroused a storm of protest. The MINING AND SCIENTIFIC PRESS has not hesitated to criticise him, as have others, but he has a strong and deserved hold upon the people of the West as well as the East, and his essential disinterestedness is not seriously questioned. Mr Ballinger is not so fortunate. Justly or unjustly, he is widely distrusted, though opinion in the matter is by no means unanimous. His recommendations for new legislation in the interest of conservation are excellent, and there is good cause for congratulation in the fact that one result of the focusing of public attention on the matter is quite certain to be the enactment of some of this legislation. The unfortunate aspect of the case is that the present situation throws Mr. Taft into alliance with Mr. Cannon and Mr. Aldrich, and he is dependent upon them for whatever may be achieved. Remembering the tariff and a long series of previous bills, the people are undeniably distrustful, and whether he be concealed in the woodpile or stalking in the jungle, the shadow of the African broods over the scene.

The defeat of the House organization in its attempt to give to Mr. Cannon the naming of members of the committee to investigate the Department of the Interior and the Forest Service, is an extremely significant sign of this popular distrust. The standpat element of the Republicans must walk circumspectly beyond compare or they will surely lose control, and it seems here as ever, that whom the Gods would destroy they first make mad.

Goldfield Consolidated.

America can now boast of possessing the premier gold mine of the world, thus wresting first place from the Transvaal. The Robinson mine had for some years distanced all others, reaching an annual output of approximately $4,500,000. The Goldfield Consolidated Mines Company reports a production from its properties in Goldfield, Nevada, of $6,832,652 in its last fiscal year. This splendid showing was the result of milling 194,479 tons of ore. The net profits were $5,026,619, out of which dividends amounting to $5,000,000 were paid, being at the rate of $1.40 per share. The management has been beyond criticism, both in its technical and business aspects. This has been due to the high attainments of Mr. J. H. Mackenzie. Beginning with the pioneer work of Mr. J. W. Finch during the period while the properties were being selected and brought together, progress has been steady until now, when these mines have been finally placed on a solid basis for future success, working out many difficult problems in economical mining and milling. The construction of the new Consolidated mill was an achievement of which engineers might be proud and Mr Mackenzie Mr A H Howe and the others concerned may take honor to the record it is making. It is the most notable structure for gold milling in America and represents a plant of the highest type of efficiency in accord with modern practice, complete in its details from the very beginning. Perhaps no other great plant in America dealing with the precious metals is freer from the disadvantages of partial reconstruction, a point of importance in economical operation. System and close attention to detail have been responsible for reducing the total cost to $6.77 per ton. In view of the high costs of supplies and labor, the irregularity of the deposits, and of the further fact that this figure includes fixed charges, such a result is remarkable. The items of labor and supplies made up $940,836 out of a total of $1,200,071. The milling costs were $1.951 per ton, and the extraction reached 94.49%. This again is a remarkable achievement, when it is remembered that the average assay value of the ore sent to mill was $33.45. A full analysis of the year's work will appear in our issue for next week. We may remark here that Mr. Mackenzie announces the perfection of an economical method of refining on the spot which will enable the company in future to ship bullion 990 fine. The activity in development is worthy of commendation, nearly twenty-five per cent of the entire operating cost being on that account. The result is that the year closes with over 800,000 tons of ore reserves developed, representing about four years' supply, which gives a safe margin. We have frequently urged that a well conducted mine should at least keep its development three years ahead of mill-needs. This allows a safe margin in case of unforeseen contingencies.

The production has been increased since the annual report was issued, the amount of ore milled in November having been 19,285 tons, averaging $37.57 per ton. Additional equipment for increasing the capacity of the mill has arrived, so that the current year will witness a still larger output of bullion. For several years to come the Goldfield Consolidated will manifestly hold its place securely as the greatest gold mine in the world. The speculating public will accordingly watch the fruits of development with keen interest. In the price of the stock the future possibilities have been discounted heavily. This is a matter which admits of mention, not of criticism. The market value of anything is what people are willing to pay for it. Intrinsic value is different. In the case of the Goldfield Consolidated the policy of publicity has been frankly adopted. Anyone who buys on the strength of supposedly 'inside information' is proceeding from premises which are evidently not justifiable. We believe the public is informed of the situation fully by the monthly statements, and such new development as can take place within any single month is insufficient to warrant an appreciable change in the price-level of shares. We have already extended our congratulations to Mr. J. R. Finlay upon his accession to the management. His capability, resourcefulness, and high character are a guarantee of faithful and efficient discharge of the large responsibilities which he has assumed.

NEW CONCENTRATOR OF THE BUNKER HILL & SULLIVAN.

Written for the MINING AND SCIENTIFIC PRESS
By GELASIO CAETANI.

The new concentrator of the Bunker Hill & Sullivan Mining & Concentrating Co. was completed and put in operation on December 8 last. The design of this plant has been the result of a thorough metallurgical investigation carried on during the past three years, and though it does not differ essentially from the other lead-silver mills of the Coeur d'Alene, it contains many features which are novel. The plant is divided into three main departments which are mechanically independent of each other. They are (1) the crushing plant, (2) the coarse concentrating department, and (3) the slime plant.

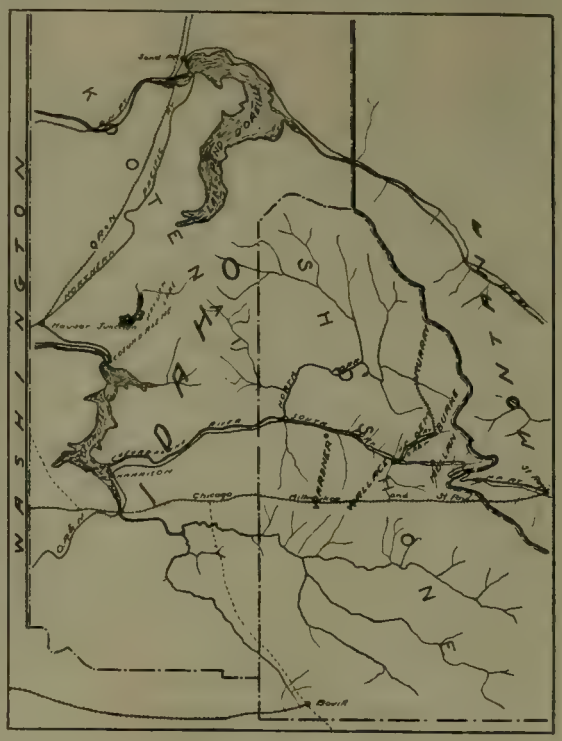
The ore consists of silver-bearing galena, siderite, and quartzite. The siderite is the predominating mineral, and represents from 40 to 45% of the ore. The galena is a metasomatic replacement of the siderite, and as this replacement has seldom been complete, the galena and siderite are intimately intermingled, the galena being often minutely disseminated through the iron carbonate. The ore assays from 12 to 13% lead, and contains about 0.42 oz. silver per unit of lead.

Electric motors haul the ore from the mine in trains of 15 cars, each of 3½ tons capacity, and dump it into the 'rock-house' bins, which hold about 1400 tons. From these bins it is fed by chutes to a slow-traveling 42-in. belt-conveyor that dumps it on an inclined grizzly with 1¼-in. clearance intervals. The oversize goes to a No. 5 Kennedy gyratory crusher, set to about 1½-in. maximum aperture, while the undersize is fed to a 24-in. Jeffrey belt-conveyor, and acts as a bed on which is discharged the ore from the crusher. This conveyor elevates the ore at an angle of 20° to three 30-mm. trommels, 4 ft. diam. and 7½ ft. long. The screening is discharged to another 24-in. conveyor, while the oversize goes to a set of 14 by 36-in. rolls. A bucket elevator raises the re-crushed product to a 30-mm. trommel, the oversize of which is returned to the rolls with the ore from the gyratory crusher. All the ore which has been screened through 30 mm. passes through the sampler before being elevated to the mill storage-bins, where it is distributed by a Jeffrey self-moving tripper.

Coarse-Concentrating Plant.—The mill storage-bins rest directly on the ground, and the ore is fed by five Challenge feeders to a 24-in. belt-conveyor which elevates it to the mill. This arrangement was copied from the old Dominion mill at Globe, Arizona, the only difference being that the feeders are operated by an 8-speed induction motor, controlled from the jig-floor. The feeders revolve about twice per minute, and the amount of feed is regulated by varying their speed. With the baffle-plate half open, two feeders are sufficient to deliver 550 tons, which is the rated capacity of the mill. This feeding arrangement is the most perfect I have seen for comparatively dry ores. The belt conveyor elevates the ore at an angle of 20°, and at a speed of 275 ft. per minute to the top of the mill, about 80 ft. from the ground. As the ore is dumped it passes in a thin stream under a 12-in. Browning magnet, which catches the spikes, nails, and other pieces of iron that would be the cause of trouble in the mill. Two 10-mm. trommels then divide the feed into two products, (1) that between 30 and 10 mm., which goes to the bull-jigs, and (2) the 10 mm. and finer which goes directly to the classifying jigs.

The jigs are of the Harz type, but are of a special design evolved in the Bunker Hill plant, the result of an extensive series of experiments. The bull-jigs have four, and the classifying jigs five compartments. Such a number of compartments is called for by the necessity of making five different products on the coarse jigs and nine on the classifying jigs.

The bull-jigs separate the following products: (1) first-cup concentrate, assaying from 50 to 55% Pb,



Map of Idaho

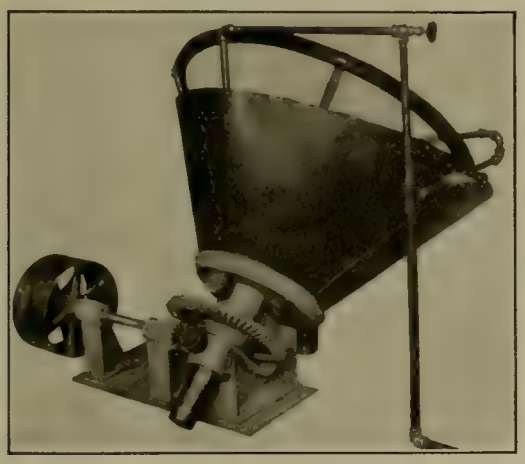
shipped directly to the smelter; (2) second-cup concentrate, assaying from 35 to 40% Pb. This could be shipped direct, but owing to the high freight and treatment charges it is more profitable to grind this concentrate in Huntington mills, and to raise its grade by eliminating a large part of the iron carbonate gangue on Card tables. The tailing from the 'grading' tables assays from 5 to 8% Pb. The galena is so finely disseminated in this tailing that further grinding and concentration is not profitable. The elimination of this high-grade tailing involves a considerable loss, but the high-grade concentrate obtained increases the market-value to such a degree as to more than compensate for the tailing losses. (3) The third and fourth-cup discharges are middling, which is crushed by rolls to 10-mm. size, and is rejigged on two classifying jigs that work exclusively on middling. This arrangement eliminates all the disadvantages caused by returning the crushed middling to the original feed. The character, tonnage,

and assays of the coarse jig middling can be observed at any moment on the middling jigs. The tailing from these jigs is higher in grade than that from the other jigs, as it represents that part of the middling in which the galena is so finely disseminated through the siderite that further handling is not profitable. 4. Hutch product, returned to the middling jigs. 5. Tailing, assaying from 1 to 1.6 Pb.*

The classifying jigs separate the feed into nine

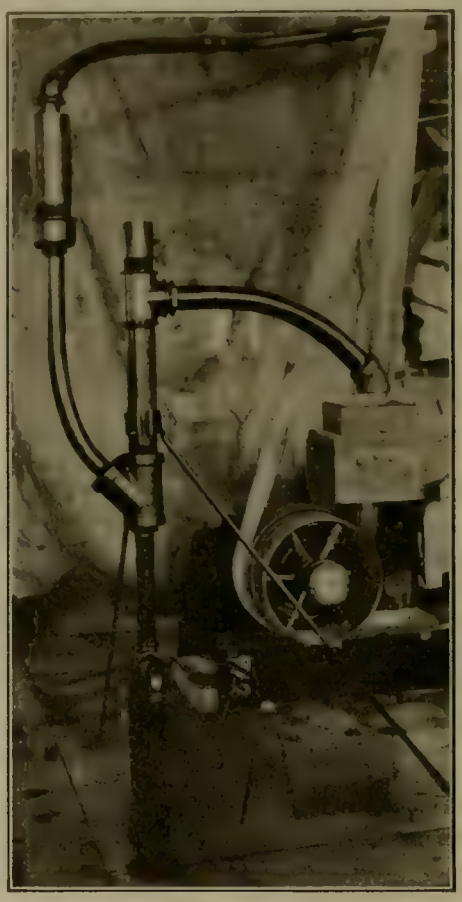
Bunker Hill & Sullivan New Mill.

products. (1) Slime. The first compartment of the jig is provided with two transverse dams dipping into the ore-bed. The current of water pulsating through the jig-bed throws the slime to the surface, and effectively discharges the whole of it through two lateral openings. The slime then passes through a curved stationary screen (which separates all wood-pulp) to a spitzkasten, the sand discharge from which is piped to the No. 2 elevator. The overflow carries no particles coarser than 200-mesh, and is led



Bunker Hill Screen.

to settling tanks, whence it is fed to 28 Frue vanners. (2) First-cup concentrate, assaying from 60 to 65% Pb, shipped to the smelter. (3) Second-cup concentrate, assaying 40%, sent to the grading department, as explained for the similar product from the bull-jigs. (4) Third and fourth cups discharge a middling assaying about 10% lead and 30% iron. This is either shipped as lead-iron ore, or is treated together with the fifth product. (5) The fifth cup discharges middling assaying from 3 to 5% Pb, which is crushed by rolls and goes to the No. 2 elevator. 6. The hutches of the third, fourth, and fifth compartments that have passed through the 3-mm. jig-sieves go to the sand-rolls and then to the same elevator as the fifth product. 7. The hutch of the first compartment, assaying about 50% Pb (and which has passed through a 2-mm. sieve), flows to the sand-plant, where it is passed through a hydraulic (pipe) classifier, which divides it into two products, (1) a coarse spigot-discharge, assaying from 76 to 77% Pb, and (2) an overflow which is fed directly to a Card concentrator. This concentrator eliminates as middling that fine sand contained in the hutch which is bound to occur, as the



Pipe Classifier.

jig-feed is unsized. These classifiers are built out of pipe-fittings, there being one classifier for each table. The high efficiency of these simple contrivances is due to the fact that the coarse particles of the hutch are high-grade cubes of galena, while the finer particles are low grade. (8) The hutch of the second compartment assays from 25 to 30% lead, and is treated in the same way as the first hutch-discharge. The spigot-discharge of the pipe-classifiers assays from 55 to 60% Pb. (9) Tailing, assaying about 1.3% Pb. Summing up, it is seen that all the mill-feed passes over the two sets of jigs described above, and, from these, four kinds of products flow to the sand-plant. These products are: (1) low-grade concentrate to the grading department; (2) crushed middling, hutch-products, and sand, to the No. 2 elevator; (3) first and second

*All assays of lead are wet assays.

hutches to the pipe-classifiers; (4) slime to settling tanks.

Sand-Plant.—The second of these products is raised by the No. 2 elevator to a 2-mm. trommel, the oversize of which is ground through 20-mesh screens by 6-ft. Huntington mills. The sand from the Huntington mills joins the undersize from the trommel, and is elevated to the No. 3 elevator to four 22-mesh Bunker Hill revolving screens. These screens, invented by L. Warner, the foreman of the new mill, have successfully taken the place of other fine-screening machines previously used. They are conical trommels, with their axes set at 45°. The angle at the vertex is about 80°, and they revolve at a speed of 20 rev. per min. The pulp is fed across the descending surface of the screen, and the oversize clings by centrifugal force to the ascending portion of the screen until it is raised to a certain height, when, partly by gravity, and partly by the action of a spray, it falls directly into the vertex of the cone, and is discharged through the hollow shaft of the machine. As the screens undergo no bending, and have no tendency to crack, they are made of steel-wire cloth, and last about six weeks. One machine will handle from 50 to 80 tons of feed that has passed through a 2-mm. screen. The illustration shows one of these Bunker Hill screens as built by Hendrie & Bolthoff.

The oversize from the screen is sent to a Huntington mill to be ground to a size slightly smaller than the mesh-opening of the Bunker Hill screen. In short, all the material elevated by the No. 2 elevator is passed through 22-mesh, 0.6-mm. opening, and is then fed to three 'duplex' classifiers. These classifiers, evolved in the Bunker Hill mills, are of the spitzlutten type, and have the advantage of being compact, economical in water, and perfectly foolproof. They yield three products, and an overflow, which latter is separated by conical slime-classifiers into fine sand and slime. These slime-classifiers consist of two cones. The first one is similar to a small Callow tank, and the second is suspended within the first. The angle of the inner cone is such that the area of the annular space between the two cones is about constant from bottom to top. Spitzlutten action, or the principle of classifying through channels of constant area, is consistently observed at each stage of classification.

The slime from the cone-classifiers is thickened in settling tanks together with the slime from the jigs and the slimy head-waters of the Card concentrators. The four products of the classifying system are sent to four sets of Card concentrators. They are distributed to these tables by pocket launders which effect a marked classification on the already classified products. The result of this two-stage classification is that each table has a differently classified feed. The Card concentrators have proved to be the most efficient machines for this kind of ore. They yield five products, as follows: (1) First-class concentrate assaying 76% Pb. (2) Second-class concentrate, assaying about 45% Pb, which is re-concentrated on a grading table with a view to making more 75% product, and to separate any sand which may accidentally have been thrown into the second-class. (3) Middling which is re-concentrated on special middling tables, or is returned to a 40-mesh Huntington mill. (4) Tailing, assaying about 2.5% lead. This comparatively high assay of tailing is due to the fact that the feed consists exclusively of crushed middling, and that owing to the character of this middling it would be necessary to grind it to less than 100-mesh if if were aimed to reduce the assay to 1% lead. This is not economically possible. (5) Slime to settling tanks and vanners.

Summing up, the general arrangement of the mill is mechanically simple and metallurgically complex. The ore moves rapidly through the mill, and none of the products is returned to the machines that produced it. The mill is very sensitive, in that any variation in tonnage or grade, or any faulty operation of any machine, is immediately shown on the next following machine. Another important feature of the design is that all the products of a machine are re-handled on other machines, thereby correcting any faulty operation of the first. The main object of the mill is to produce lead with the highest possible economical, not metallurgical, efficiency. Where the lead cannot be saved with profit it is allowed to run to waste; and where the market value of a concentrate can be raised, it is re-treated until there is nothing left to improve.

This mill represents the results of three years experimental work, and though it has not been in operation over a month it has been working smoothly and has answered perfectly in every detail.

Dimension-books which give the size of the largest object that will pass through the smallest tunnel, bridge, or opening on the road, are issued by many railroads. The data are important to firms that manufacture large objects. Where the weight does not prohibit, parts of structures are put together in the shops in as large portions as possible, the limiting feature being the possibility of shipping. In many cases it has been necessary to ship large pieces by round-about routes on account of the old-time small tunnels or light bridges on the direct route. These dimension-books give, first, the dimensions governing the size of the object that can be shipped over the entire system of the railroad, and second, those of each division. As soon as the smallest of these openings is re-built and enlarged a new dimension-book is issued. These data are tabulated in three columns. In the first is given 'height above top of rail'; in the second, the corresponding 'width of lading on open cars must not exceed'; and in the third, the location of this point on the railroad.

Cadmium yellow, a brilliant yellow pigment, is cadmium sulphide. It forms one of the most permanent colors obtainable for artists. This pigment is used also by some railways and street-car companies as a protective covering for other less permanent yellows that are employed in painting their cars and coaches. Yellow paints that are darkened by the sulphide gases in coal smoke or that fade under the action of sunlight are in this way kept brilliant by a semi-transparent coat of cadmium yellow.

COARSE CRUSHING AT THE BOSTON CON MILL AT GARFIELD, UTAH

Written for the MINING AND SCIENTIFIC PRESS
By L. S. AUSTIN

The mill of the Boston Consolidated Mining Co. is situated at Garfield, Utah, 27 miles from the Bingham mines of the company. An extended description of the mill is given in *Mines & Minerals* for May, 1908, but the coarse-crushing plant merits special attention as indicating how cheaply the ore can be handled and crushed. Fig. 1 is a view of the mill. The present article is confined to a description of the building attached in the rear for the storage and crushing of the run-of-mine ore. This building is approached by a double track on a trestle, and this trestle is extended beyond the building to enable the handling of the ore-trains. There are two parts, the ore-storage or crude-ore bin, 300 ft. long, and the coarse-crushing mill at the right. From the latter building a conveying-belt carries the coarsely crushed material to the ore-bins above the stamps in the large main building. Fig. 2 is a plan of the ore-storage bin and coarse-crushing plant; Fig. 3, a transverse section of the ore-storage bin; and Fig. 4, a section of the coarse-crushing mill.

Fig. 1. Boston Consolidated Mill.

The receiving ore-bin is 300 ft. long, 32 ft. wide and 22 ft. high to the tracks, and is set 12 ft. 6 in. above the ground. It has a capacity of some 10 000 tons. The ore is brought from the mines at Bingham in 50 ton drop-bottom cars, in trains usually of 30 cars each. The two tracks are set at 17 ft. centres and the contents of the cars are dropped into the bin below. The flat bottom and the sides of the bin are of two thicknesses of 2 in. plank. There are 40 discharge-openings in two rows, set at 15 ft. centres, 24 in. square at the narrowest point. The ore drops upon an endless chain conveying apron 3 ft. wide and 4 ft. 6 in. centres. Opposite each gate in the side of the bin is an opening 4 ft. wide by 4 ft. 6 in. high, having 12 in. channel-beams set as slats to close it, so that the ore can be poked down when it lodges in the discharge-opening. To get convenient access to the openings a gallery or walk is built at the proper height on each side of the bin. The apron delivers to two 30-in. 'Scandinavian canvas' conveying belts running longitudinally beneath the bins to the crushers. The steel apron-belts are driven by three rope-drives from the main driving-shaft in the crusher building. Each rope drives a shaft which communicates its motion by worm-gear to two of the six short shafts operating, as shown in the plan, by pawl and ratchet wheel, the apron-belts moving them about 4 in. at each revolution of the short shaft. The other four shafts are driven by belts from the centre shaft. Several of the aprons are feeding to the conveying belt at once, their united feed not only being enough for the crusher, but furnishing an average mixture of the ore. The ore as it drops from the steel apron is deflected by a steel chute (not shown in Fig. 3), sloping at an angle of 30° and pointing in the direction of travel of the conveyor. Any feed-apron can be stopped independently by throwing its pawl back and out of action. At the end of the bin the 30-in. conveying-belts rise 14 ft., at an angle of 19°, discharging over grizzlies, sloping at an angle of 35° to a No. 6 Gates crusher.

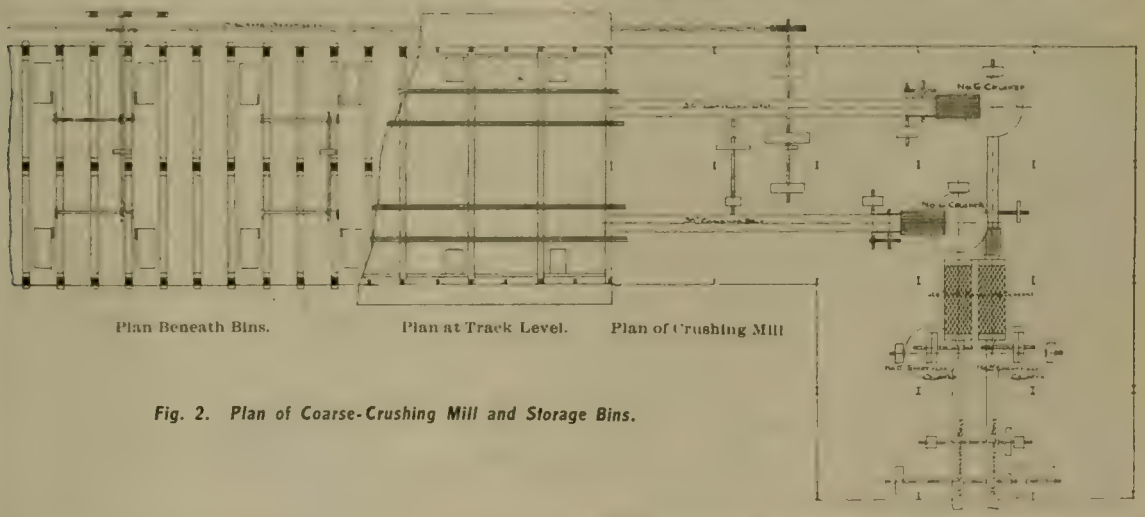


Fig. 2. Plan of Coarse-Crushing Mill and Storage Bins.

The coarse-crushing mill is divided into two in-

dependently operated units, each of 1500 tons daily capacity. As seen in plan in Fig. 2, and in elevation in Fig. 4, the undersize from each grizzly joins the

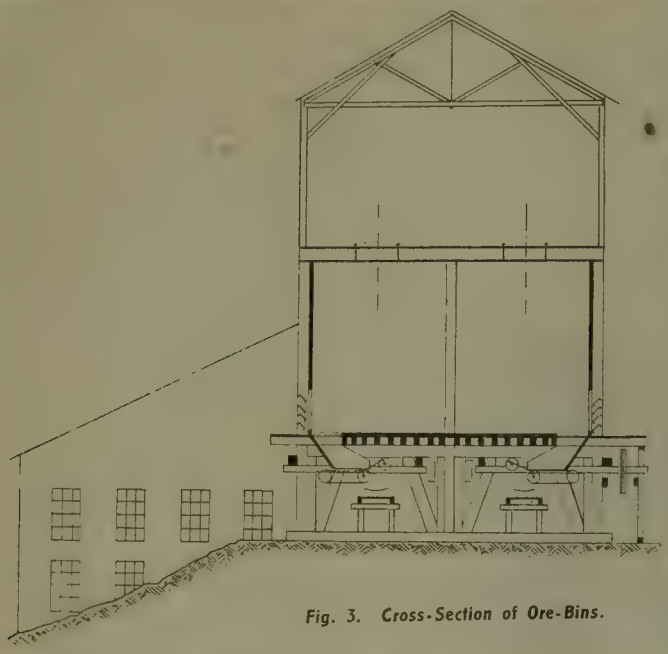


Fig. 3. Cross-Section of Ore-Bins.

crushed product of the crusher as a feed to a trommel 4 ft. diam. by 10 ft. long, having a screen of 1.25 in. round holes. The oversize of the trommel drops to a No. 5 short-head Gates crusher, and later joins the undersize upon a 20-in. belt-conveyor, rising at an angle of 23° to deliver to the 18-in. troughed conveyors, which run the length of the feed-bins of the stamps in the main mill. These 18-in. conveying-belts are provided with automatic trippers for filling the feed-bins at any point.

Referring again to the coarse-crushing mill, it is seen that in order to raise the product from the more distant of the No. 6 Gates crushers to its trommel, a 20-in. troughed belt-conveyor is employed, but its discharge goes over a grizzly before entering the trommel. It will be noticed that the ends of the ore-chutes, which guide the ore to the conveying-belt and bins, is made rectangular, so that these may fill with ore, thus protecting those places against the impact of the falling ore. The hoppers of the crushers are kept full of ore, so that no hand-feeding is needed. A 150-hp. electric motor drives the feed-aprons, the conveying-belts beneath the bin, and both No. 6 gyratory crushers, while one 75-hp. motor runs the trommels and the No. 5 short-head crushers. These motors are three-phase alternating, operating at 440 volts.

Summarizing the good points of this plant, I find (1) The ore is mixed when fed to the crushers. (2) Attendance is needed only to regulate the feed and to adjust and oil the machinery. (3) The ore itself is used to form its own slope, and protects the bottom of the bin from wear. The ore can be conveniently reached to poke it down. (4) The conveying-belts used are certain in action, durable, and simple. (5) The grizzlies relieve the crushers from the fine ore; the trommels insure a uniform coarse-crushed product.

The waning natural gas supply in some fields brings up the question as to the future of the business. The outlook is in some ways discouraging. Nevertheless, according to F. G. Clapp, the indications are that new wells and new fields will continue to be found and to be productive for many years. During the past year there has been improvement and increase in the business and in the area of the productive fields in Pennsylvania and West Virginia. That the companies are not discouraged is evinced by the fact that during 1909 the mains of the principal producers have been greatly extended. Cincinnati is now supplied, with every prospect that in another year Baltimore, Altoona, and possibly Washington, will have natural gas mains. Most of the shallow sand-fields exhausted years ago have been recently replaced by adjacent new fields in deeper sands. In all cases yet examined by Mr. Clapp, these fields bear a constant relation geologically to each other and to the structure. The subject was discussed by the Geological Society of America.

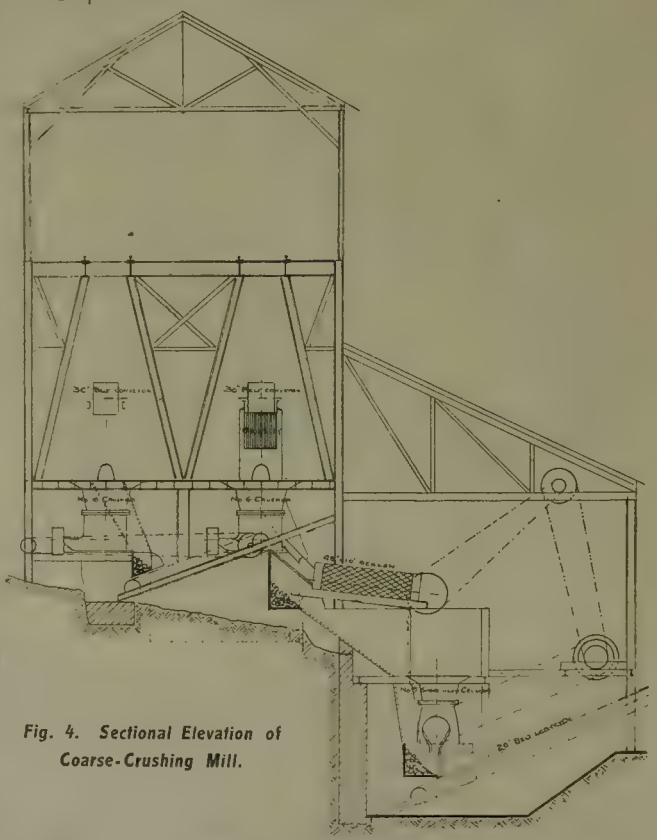


Fig. 4. Sectional Elevation of Coarse-Crushing Mill.

Fuse for blasting should always be tested, as different lots may possess irregular rates of burning. It should also be carefully handled so as not to disturb the powder-core.

NITRATE OF SODA INDUSTRY OF CHILE.—I

Written for the Mining and Scientific Press
By S. H. Logan

A full description of the nitrate industry with its diverse conditions and enormous area, would fill a fair sized volume, in fact has done so in the excellent report of Doctors Semper and Michels, made for the German Government in 1903, and translated into Spanish with considerable addition by Gandarillos and Ghiglotti in 1907. Also data are available in Dr Darapsky's 'Das Department Taltal', and in other smaller works in English, German, and Spanish, too numerous to mention.

The western slope of the Cordillera of the Andes in Chile is desert country from Lat 18° to 28° S., and within narrow limits, namely from Lat. 19° 30' to 26° S., comprising the drier portion of this region, are found the deposits containing nitrate of soda. The cross-section is indicated by the topography. There are some irregularities, notably in part of the Taltal district. Moreover the coast range is repeatedly cut by narrow valleys running down to the Pacific; while the main valley is often partly or totally broken by ranges of hills having a general westerly trend. The coast range for the greater part of its length is made up of diorite and aphanitic volcanics, while the western range of the Cordillera, is principally composed of eurite. Between the two are some patches of limestone, probably Jurassic; but the bulk of its main branches is covered with a marine deposit of alternating beds of sand, gravel, and clay, formed during the uplift of the southern portion of this continent. Fossils are absent, but from its similarity to deposits farther south, it is deemed to be of late Miocene age. This is covered by a deposit of partly stratified mud and angular fragments from the later sub-aerial denudation of the surrounding hills. Workable nitrate is found exclusively within what corresponds to this north and south valley, and, with few exceptions, in the above-mentioned surface deposit. There seems to be little connection between its composition, or that of the surrounding rocks, and the nitrate of soda; the nitrate may exist mixed with the decomposition products of dioritic or euritic rocks. When in the neighborhood of limestone, there seems to be a decided increase in the proportion of calcium nitrate.

As the deposits are found at altitudes varying from 500 to 2000 metres above sea-level, and over nearly seven degrees of latitude, the climate varies according to the location, but in general the region east of the coast range is one of extreme dryness. It is so dry that an ivory billiard-ball, kept with the usual care, will crack and become useless in three months. On the other hand, though said to be a place where it never rains, this is not correct. Through long periods there occurs a cycle of change, occupying perhaps 15 or 20 years. Rain sufficient to run off the surface in the nitrate region is an extremely rare occurrence, and is then generally caused by a short violent storm. The last one in Antofagasta was in 1882. The variation of temperature between day and night is extreme, often amounting to 20° C. On the nitrate grounds there is generally a strong wind blowing from the sea to the Cordillera during the day and from the Cordillera to the west at night, with about two hours comparative calm at sunrise and sunset. The most peculiar climatic feature is the dense fog which forms along the western side of the precipitous coast hills almost every afternoon, and especially in winter. It is probably caused by the cold wind from the Cordillera meeting the warm damp air from the sea. It is piled up against the coast by the eddy caused by the same east wind passing overhead. On the coast this fog-bank usually rises to about 1400 metres, and as the hills are for the most part higher than this, the bulk remains against them, and is sufficient to support scanty vegetation and to form numerous water-holes and springs. Wherever the coast hills are lower, or where a valley cuts through them, the fog rolls up and spreads on the comparatively level ground of the north-south valley beyond, where it remains until the next day's sun drives it off. This fog covers a larger region than the nitrate-bearing ground, but, on the other hand (with few exceptions which can be explained), there is no nitrate found where the fog does not reach, and there seems little doubt that a direct relation exists between the two. The only river in the entire region is the Loa, which, rising in the high Cordillera on the Bolivian frontier, passes Calama with a volume of from four to seven cubic metres per second, varying with the season. Springs and small streams from snow-water exist high up the flanks of the Cordillera, but run for a short distance only; many are caught and carried by pipe-line down to the nitrate grounds, but a larger quantity of the water finds its way down between the beds of marine deposit in the valleys, and wherever there is drainage-connection with the Cordillera. Sinking through these has given the supply upon which most of the nitrate works depend.

'Caliche' the local name given to the nitrate-bearing mixture, is of extremely varied composition and character, ranging from almost pure nitrate of soda, down to traces only; the balance is made up of earthy matter (stones, sand, and clay) salt, sulphates of soda, lime, and magnesia in different proportions, sometimes containing smaller amounts of nitrate of calcium and potassium, perchlorate of potash, and iodate of soda. The following analyses may be taken as typical:

	I.	II.	III.	IV.
Nitrate of soda.....	29.35	39.44	31.90	25.50
Chloride of soda.....	42.72	4.18	8.00	41.86
Sulphate of lime.....	3.61	3.25	7.00	1.97
Sulphate of magnesia.	0.61	3.97	6.90	5.99
Sulphate of soda....	4.72	....	8.60	13.75
Nitrate of potash....	....	....	....	0.545
Perchlorate of potash.	0.18	....	....	Trace
Iodate of soda.....	0.104	0.089	0.033	0.136
Chloride of magnesia.	....	3.87	....	....
Moisture	1.03	....	2.40	2.97
Insolubles	17.59	45.24	34.30	7.28
	99.914	100.039	99.133	100.001

The grade of caliche usually worked, depending on economic conditions, varies between 50 and 18% nitrate of soda, the average being about 25%. The richer portions are crystalline masses; white, when only mixed with salt; yellow, when rich in iodate

of soda; pink, from iron or manganese; violet, stated to be due to a hydrogen carbide; and of various other shades due to earthy impurities. The bulk of the material worked is a light reddish brown compact mass, which shows crystal faces when burned in the hand, but at first sight has somewhat the appearance of typical eurite. Its toughness depends largely on the composition. Generally a 2 ft. 6 in. cube would be broken with a sledge hammer, but if much sulphate is present a block of this size would be more economically cracked with a small charge of dynamite. The specific gravity of pure caliche is 2, but for calculating the weight of a given volume in bulk 1.5 is taken, which includes porosity. As before stated, sub-aerial denudation products cover the marine deposits in the valley bottoms, and the lower slopes of the surrounding hills of the whole region; the surface of this deposit is covered with wind-polished stones, the finer particles having been blown away until a protection is formed. Immediately underneath these is a loose powdery earth, generally from 20 to 40 centimetres thick, often containing quantities of calcium sulphate (thenardite) as white powdery crystals. Below comes the ordinary talus of stones and earth that rests on the marine deposit, or on the rock bottom if farther up the slope than the former reaches. Where caliche is found, it is generally on the slopes, and particularly around the base of the hills; toward the lower or central part, it thins out or disappears altogether; sometimes it shows up on the surface, but generally below the loose powdery earth is a layer of semi-compact sandy clay, containing small quantities of nitrate of soda, considerable salt, and sulphates of soda and magnesia. This covering varies up to 3 metres in thickness. On an average it is about 50 centimetres. Directly underneath comes the caliche, rarely occurring as a uniform bed, but usually in flattened masses of varying thickness and of irregular outline. Its economic value naturally depends upon the assay-value, the depth of overburden, and the situation with reference to the works, but commercial limits may be said to range from 30 cm. upward. Its extreme thickness rarely exceeds 4 m., while the average is about 60 cm. Between the caliche and the talus there is frequently, but not always, a bed of fine earth containing more than half its weight of a mixture of salt and sulphates of soda, magnesia, and lime, grading on the under side into the ordinary deposit of angular fragments, sand and debris. In Tarapacá above the caliche is found a porous friable crystalline deposit known as 'costra.' Its composition is approximately as follows:

	Per cent.
Nitrate of soda	13.6
Nitrate of potash	1.7
Chloride of soda	27.2
Sulphate of soda	....
Sulphate of lime	3.8
Sulphate of magnesia	7.5
Chloride of magnesia	0.4
Iodate of soda	0.1
Moisture	2.6
Insolubles	42.2
	99.1

For quarrying the caliche, low-grade powder is employed, which is made at the works, from nitrate of soda, sulphur, and coal-dust. The loose surface earth is cleared away, and holes about 7 in. diam. are drilled vertically through the caliche by 'jumping' with a sharp pointed steel bar, or blasted out in small portions with dynamite if too tough for the bar, and then chambered in the soft ground below to hold the necessary charge. Work is started by opening a trench at right angles to the direction in which the excavation is to proceed, and deep enough to reach below the bottom of the caliche; this is then carried broadside across the ground to be worked, as regularly as the payable caliche permits, like a single bench in a stone quarry. After each blast the earth and waste are stacked at the back of the trench, the caliche sorted out, spalled clean, and piled on top in pieces as big as can be comfortably lifted, ready for transport to the works, either by mule-cart, broad-gauge, or portable railroad. For isolated or thick beds of caliche, holes 30 to 40 cm. diam. are put down and chambered by small boys. The charge of powder in such cases is often as much as 200 lb. Both methods are incomplete and wasteful, fully 25% of the caliche being lost. As the workmen are paid by the cart-load extracted, there is a further tendency to leave behind the thinner portions, which are afterward covered with waste, and lost. Against machine-drilled holes, steam-shovels for stripping the over-burden, and other mechanical appliances, it has been argued that the irregularity of the deposits would be an insurmountable difficulty. Little, however, has been done in this direction by competent persons.

Apart from the main deposits of caliche already described, it is found in Tarapacá filling cavities in limestone, when, according to Darapsky, a considerable quantity of calcium nitrate is present. Deposits of this type have been worked underground as mines to a depth of 30 to 40 ft., and are known to continue deeper, but not under paying conditions. Farther up the slopes of the hills, above the sub-aerial deposits, the rock in place is often broken and is decomposing to a depth of 50 to 60 cm.; this is occasionally cemented with, and covered by, caliche, which is generally free from earthy matter and of high nitrate assay. The whole has a covering of wind-blown sand, but the total depth is small, shading into solid rock below. It is also found on the surface of some salt-pans, formed by underground water that has passed through the nitrate region and come to rest in a land-locked depression where it evaporates. In the Salar del Carmen in Antofagasta, which is of this origin, nitrate crystallizes upon the surface and is worth removing about every four or five years. It has been cited as a case where nitrate 'grows,' and has led to a confusion as to its origin.

Although the above deposits have been, and still are, worked, the product is a quite insignificant proportion of the total. Nitrate of soda has also been found to the east of the main north-south valley, between the western and central Cordillera, as at Maricunga in the Department of Chañaral, but these deposits are quite small, and of scientific interest only.

Attempts have been made to explain the origin

Saltpetre District of Antofogasta, Chile.

Translation of legend: Distrito Salitrero, Saltpetre district; caminos, roads; aguadas, swampy ground and watering places; mineral, mining camp; salar, saline deposit; pertenencias salitreras, saltpetre claims; ferrocarril en esplotación, railroad in construction; ferrocarril en proyecto, projected railroad; caminos de herradura, bridle paths; cañerias de agua, ditch or pipe-lines; limites de Departamento, State boundaries; quebradas, narrow valleys or gorges.

of the nitrate deposits by several theories, the chief of which are here given.

Noellner's sea-weed theory predicates that during the elevation of the continent, large, almost land-locked, seas containing enormous growths of sea-weed were drained, and the decomposing sea-weed producing ammonia in the presence of salt and carbonate of lime, formed nitrate of soda. Against this lie several important objections, such as the absence of bromine and phosphorus in caliche, although both are found in sea-weed, and more particularly the fact that the caliche is not found in the marine beds, but is inter-stratified in the upper portion of the talus deposits often 50 ft. thick, lying on the top of them, where the marine deposits do not exist.

Muntz and Plagemann's microbe theory is based on the known formation in several parts of the world of calcium nitrate from decomposing organic remains, under suitable climatic conditions in the presence of calcium carbonate. The theory has been extended to the Chilean deposits by supposing this to have taken place in the presence of salt water containing iodine, the nitrate of lime being afterward decomposed by sodium chloride with the formation of sodium nitrate. The present deposits are supposed to be concentrations brought to their present position by water, and freed from phosphates by their greater solubility. In opposition to this it is objected that there is no satisfactory explanation as to the origin of organic remains in anything like the required quantity, and still less to account for the complete disappearance of all traces of such, while the position of the nitrate deposites on the slopes, as distinct from the salt-pans in the hollows, is entirely against their having been deposited from evaporating solutions, particularly in quantity sufficient to reach their present level.

In the guano theory of Ochsenius, it is assumed that carbonate of soda was formed by passage of CO_2 through salt-lakes in the central Cordillera, and that waters charged with sodium carbonate burst or filtered through the intervening mountain chain, and were detained against the coast range, where wind-blown nitrogenous matter from the guano deposits on the islands off the coast had been added, the decomposition of which produced nitrate. Apart from extreme improbability in general, in which an inadequate supply of guano is conspicuous, it is open to the last objection made against the previous theory, particularly as many of the nitrate deposits rest on slopes that have uninterrupted drainage to the Pacific. Pissis in his 'Desert of Atacama' (Annals of the University of Santiago, 1877) stated his belief that nitrate was formed by the property of alkaline carbonates, in the presence of oxidizable matter, of converting atmospheric air into nitric acid; and that the feldspars decomposing to kaolin and alkaline carbonates in the presence of the oxidizing silicates of iron (mica, hornblende, etc.) provided the necessary conditions; while the occasional rains dissolving out the nitrate so formed on the hillsides, would precipitate it again around their bases.

An electrical theory is also advanced. The formation of ammonia from air and water—vapor under electrical tension, the conversion of this by ozone into ammonium nitrate, and this again by salt into nitrate of soda, has been put forward, and quite generally accepted; in fact Ochsenius at a later date admitted its probability as the chief agent, placing his guano-formed nitrate in the rôle of a 'nitrifying exciter.'

It is difficult to appreciate the electrical conditions of the desert without having visited it; but to those who have patiently waited for a frosty night in Europe to make experiments with Leyden jars and the like, it would be a 'happy hunting ground.' It is generally impossible or useless to comb one's hair without dampening it, the ends fly out as fast as brushed down. Often turning over in bed and bringing the hand near the iron bed-stead is sufficient to produce a 1½-in. spark, sometimes of intensity enough to be disagreeable. I have many times drawn a 10-in. continuous brush discharge from every finger-end to a copper-sewn leather engine belt, running over iron pulleys at about 1100 ft. per minute. Passing a cotton handkerchief once over the glass of a miner's dial, is enough to make one end of the heavy 6-in. needle stick to the under side. Under these conditions, it is reasonable to suppose that the wind-friction against the ground (particularly the hills) must cause almost constant minute discharges from every little projecting point.* This would lead to the production of oxides of nitrogen from the atmosphere, and where the wind meets with the fog rolling up from the coast, there would be moisture for the formation of nitric acid, which, either in the presence of carbonate of soda from decomposing feldspar, or of slate of marine origin, would form nitrate of soda. In fact here exists in nature the method employed for the manufacture of nitric acid by Bradley and Lovejoy applied by the Atmospheric Products Co. of Niagara, where a column armed with spikes is made to revolve inside a cylinder also lined with projections, sparking from a high-tension current taking place between the points on passing. The nitrate so formed would be concentrated around the base of the hills by the occasional showers (as explained by Pissis) which, without being sufficient to take the nitrate into solution in bulk, would be enough to cause it to creep down little by little, much in the way that a stalagmite grows, thus accounting for one of the frequent modes of occurrence noted by Semper and Michels. There would also be a tendency owing to the hygroscopic property of nitrate for the dew-bearing nitric acid to find its way down where nitrate already existed. It is well known on the nitrate grounds that early in the morning, after the fog, and before the sun has power to drive off the moisture, the nitrate-bearing area may be readily distinguished from the barren ground by its darkened color owing to the moisture on the surface, a phenomenon utilized in prospecting.

Toward the Cordillera, and at a considerable alti-

*I have noticed on several occasions that bringing a compass-needle within 6 ft. of a landmark, built to the same height as the instrument out of loose stones, was sufficient to cause a 2° deflection, when the composition of the rock certainly did not indicate the presence of sufficient iron to account for the movement on magnetic grounds, although it did not occur at the time to have watered the pile to prove the point.

tude there may be some deposits presenting exceptions to the general statement that the fog covers the nitrate-bearing area. At all events it may be a rare occurrence. But when the rapid elevation of the land is taken into account, Miocene marine deposits being found at 1400 m. above present sea-level, and even higher, it is possible that the nitrate may have been formed while the ground was at a lower elevation. Moreover, being small and poor as compared with those nearer the coast, they may be due to having been partly removed since their formation; or, being built up under adverse conditions, they may have never attained greater extent. With regard to the deposit of Marcunga at 3690 m. altitude, where certainly the coast fog never reaches, it is possible that the necessary moisture may have been supplied by the lake, the nitrate being found from 50 to 100 m. above it. I do not know of similar

Quarrying Caliche, Nitrate Fields, Chile.

deposits in connection with other lakes, but even if such existed, being of no value, their presence may easily have been unnoticed, or unreported, in the little known interior. One other general condition seems to be noticeable, namely, that where a north-south valley exists, the nitrate is found on the western side, that is, on the slope on which the east wind would impinge. This is shown particularly by the Tocopilla and Iquique deposits.* To estimate the nitrate content of a given area, lines of holes are bored similar to the smaller ones used for blasting, generally at intervals of 100 m. In each one the thickness of the caliche is measured, its character noted, and a sample taken by chipping a channel down one side of the hole. Under normal conditions anything less than 30 cm. thick, or under 18% nitrate of soda, is considered valueless and is left out of the calculation. The thickness of overburden is also noted. A plan is constructed showing the position of all the holes, and on this is platted the area of caliche proved. It is assumed that between two holes, one showing commercial caliche and the next one not, the payable deposit extends half way across. The total area of caliche-bearing ground is now calculated from the plan, and the commercially valuable contents arrived at in the following way: for each hole, the thickness of the caliche, in metres, is multiplied by the assay percentage of nitrate of soda, and from this result, if the assay gave under 30% $NaNO_3$, 35% is subtracted. If the assay gave over 30% $NaNO_3$, 30% is subtracted, if the caliche was porous, and a heavier loss to be expected in blasting, 10% is subtracted. This is supposed to cover loss by what is left behind or scattered by blasting, plus extraction losses, amounting to about 8% on the caliche that arrives at the works.

Taking the specific gravity (1.5) it is easy to estimate the weight of nitrate in metric tons that a given area is supposed to be capable of producing; but in several cases under exceptionally favorable conditions of even thickness of deposit, and where careful check had been kept, actual working results showed still about 10% below the calculated content.

In Tarapacá, where the 'costra' commonly carries 12 to 18% of nitrate, a separate calculation is often made of it, in addition to the caliche; and many of the older works with nearly exhausted grounds, depend largely upon it for their running. In the southern grounds it is limited, and often entirely absent. Ordinary working is effected by 'costra' in another way, the barren material that gets mixed with the caliche and leached, leaves the works with 7 to 8% of nitrate, a loss that is offset and sometimes more than made up for, in working grounds where 'costra' is abundant, as it replaces, at all events in part, the otherwise sterile mixture.

Alkali works are situated at Saltville, Smythe county, Virginia, where extensive beds of salt and limestone occur together, with abundance of coking coal cheaply available.

*In Antofagasta also the greater amount is on the west, although there is caliche on the lower part of the eastern slope.

COAL MINING IN THE MIDDLE WEST.

Written for the MINING AND SCIENTIFIC PRESS
By GEORGE H. CUSHING.

For the first six months of 1909 mining and allied interests in the Middle West were approaching the climax of the period of depression. For the last six months they have traveled almost as precipitately toward the crest of another boom. Early in the year coal companies engaged in an orgy of price-cutting in order to corral the contracts which are placed around the first of April. It was not unusual to hear about that time that contracts had been accepted at, or a few cents below, the actual cost of production of mine-run coal, and it was quite common for railroads to be able to place orders for steam lump on the basis of 95 and 96c. per ton at the mines. This is from 10 to 12c. below the lowest price made in the preceding ten years. Upon such a basis of price the amount realized for screenings could not bring the average for the mine-run coal up to the cost of production. Price-cutting went so far that a dispute arose over the contract figures at which the Dering Coal Co. should sell its tonnage to the United States Steel Corporation for the South Chicago mills. Because the Dering company would not accept prices which were common on the first of March, the long-time contract between those two organizations was terminated rather dramatically, resulting in the receivership for the Dering Coal Co. Dering coal going to the South Chicago plants amounted to about 2000 tons per day, and the diversion of this tonnage to other companies caused a rather rapid re-alignment of market connections, not altogether advantageous to the trade. The Dering company, closely affiliated with the Rock Island railroad, might have been able to command sufficient funds to save itself from insolvency, but certain other problems were involved, including the relation between the parent organization and a number of subsidiary companies for which it was selling-agent. It began to be realized that the Dering company had been financed on the basis of extreme prosperity and was dependent upon its jobbing trade for sufficient revenue to pay fixed charges, which could not be met by selling coal from the company mines only, especially at the prices then prevailing. It was believed that no more opportune time could be found for the re-adjustment than in the middle of a period of business depression. Subsequently certain adjustments were undertaken, among them the sale of the Kelly mines to the Brunson Coal Co., which is closely affiliated with the United States Steel Corporation. The separation of the Oak Hill properties from the Dering, and their management by Jackson K. Dering, followed. The remaining mines were leased to the Brazil Block Coal Co., for which the Dering Coal Co. had acted previously as selling-agent. It is too soon to tell what will be the ultimate outcome, but it seems likely that if the reorganization is undertaken some time during 1910 the equity of the stock will be wiped out, and the property will be reorganized by the bondholders.

Several other and smaller companies went into the receivers' hands within the year, all as the direct outcome of the extremely low prices, the poor buying movement, and unfavorable general conditions. While not actually toppling over into insolvency, it is a known fact that some of the larger (and supposedly invincible coal companies) were seriously embarrassed within the year. All of these facts have led to a demand for remedial measures. It is freely declared by economists and government authorities, as well as by the operators themselves, that the basic wrong in the coal trade is the lack of balance between domestic and steam-coal prices. It is not implied that the former are too high or are in any way unjust, but it is declared unequivocally that the steam-coal prices are entirely too low. The sale of screenings, for instance, on an average basis of 40 or 45c. per ton at the mines, and the sale of railroad steam-coal at less than $1 are declared to be out of line with the cost of production, even without consideration of overhead charges and profits. To remedy this situation a selling syndicate for all the mines in what is known as the Carterville or southern Illinois field, was discussed. It was subsequently planned to cover the whole southern and central Illinois territory. This proved to be in opposition to the Sherman anti-trust law, and was abandoned. A little farther to the east the same condition and the same distress resulted in the same proposal, and a selling syndicate or centralized organization was proposed in the smokeless territory of West Virginia. It was intended to divide the smokeless field into the New River and the Pocahontas districts, each of which should have a centralized organization, with possibly a dove-tailing of interests, the object being to prevent the extremes of competition. Because this, too, would be in violation of the Sherman anti-trust law, it also was abandoned, and a form of centralized organization in the New River field providing uniformity of preparation through the appointment of inspectors was substituted. All such efforts were ultimately given up. The individual companies, which had been doing business through the Pocahontas company, of which Castner, Curran & Bullitt were the selling-agents, dissolved relationship with the central organization and established individually their own selling organizations. The last end of the effort to control the smokeless condition is worse than the first because competition is now admittedly unrestrained.

Since all efforts toward fusion of the various coal interests have been violently broken because of the interference of the Sherman anti-trust law, the operators of the Pittsburg field, toward the end of the year, undertook to accomplish the most logical thing, namely, the revision of the law. The Pittsburg Coal Operators' Association appointed a comittee, headed by S. A. Taylor, of the Crescent Coal Co., which sought and obtained an interview with Mr. Taft. The President declared that he was wholly opposed to any plan which would remove all forms of competition, but suggested that some mild restraint should be decided upon by the operators themselves. He proposed that, having selected a plan, they submit it to him in tangible form, and he in turn would present it to Congress.

Quite another phase of the fuel problem is pre-

sented in the somewhat rapid development of natural gas in the Middle West, beginning with West Virginia and ending with Oklahoma. Production and sale of gas in northwestern Ohio and northeastern Indiana have gone on logically, but naturally, to a point where there is practically no consumption of coal for domestic purposes in the immediate territory of the gas wells. The influence of the West Virginia field has been extending directly to the north and directly to the west, and then over a wide quadrant between. Gas has already been piped from the West Virginia field as far north as Cleveland, and facilities for handling it have been increased materially during the summer. Natural gas is quite a factor in the Cleveland coal trade. Within the last year, a company headed by Charles Davis, president of the First National Bank of Cincinnati, has succeeded in putting through a $6,000,000 deal for piping West Virginia gas to Cincinnati. On the extreme western end of the territory under discussion the gas companies are unable to supply the demand, and consumers are reverting to the use of coal. The Southern Pacific railway has gone into the market for a good deal of coal because insufficiency of the oil supply made it necessary to use coal on a certain number of engines in Texas. A good deal was purchased in southern Illinois. The influence of the Texas oil on the fuel business seems to be receding. While production of fuel oil in southern Illinois has not as yet reached formidable proportions, a great deal is being produced.

Toward the end of 1908 coal men were disturbed by the Mariana mine disaster, and coal men are firmly convinced that the explosion was occasioned by leakage of natural gas through some of the fissures in the coal into one of the working places. This brought out considerable talk about the loose method of casing natural-gas wells and the insufficient provision made for preventing its escape into adjacent coal mines. West Virginia was much disturbed recently over that same subject, and I. C. White, the State Geologist, urged that this matter be handled vigorously by the mining interests. About the same time there was a small explosion in the Leiter mine, in Franklin county, Illinois, which resulted subsequently in a disastrous fire in the coal, and caused the temporary abandonment of the pit. At the same time, there was a small explosion in one of the mines of the Rend Collieries Co., in Franklin county, Illinois. This, together with the previous explosions in one of the mines of the Dering Coal Co., aroused grave fears for the whole of the Franklin county field. It is now beginning to be appreciated that gas in the mines of southern Illinois, western Pennsylvania, and West Virginia is a factor with which operators will have to reckon seriously.

Another mine disaster of an entirely different character was that of the Cherry, Illinois, mine of the St. Paul Coal Co., on November 13, 1909. The start seems to have been solely the result of carelessness on the part of the mine workers, and would be devoid of engineering significance except for the possible consequences in the way of legislation. Following the disaster, the Governor, C. S. Deneen, issued a call for a special meeting of the legislature, one subject to be discussed being outlined as follows: "To enact laws providing for suitable fire fighting equipment to be installed at or in all coal mines; to provide that all stables in and about coal mines shall be established above ground or made fire proof with cement or other material if placed below; to enact laws requiring that a designated area about the bottom of all coal mine shafts shall be made fire proof and safe for operation, for the miners who may be entrapped; and that stopes and drifts shall be properly protected." The issue is uncertain.

These developments have been dwelt upon to the exclusion of the improved condition which has crept over the trade, beginning with the first of September. This improvement is really without significance, being incidental to the return of prosperity generally. Operators and consumers have believed that the period of depression was going to hold for almost an indefinite period, and made no provision for any such reversal of industrial conditions as actually has taken place. The operators sacrificed their product for what it would bring, and took long-time contracts at extremely low figures. Consumers, including the industrial plants and the retail dealers, failed to supply themselves with coal ahead of time, and as a consequence winter has approached with practically no provision made, and with a car shortage through the entire territory. Prices have risen in the last three months, in some instances 100%, and even at that there seems not to be enough coal to go around. Add to this the strike of the switchmen in the northwestern States, and the fear that we are in for a prolonged labor struggle on the railroads, and the situation is really serious. Not the least of the troubles is that of the operator who finds himself confronting high prices with low-price contracts to fill.

One of the most famous gold mines of the State of Sinaloa, Mexico, is known as the Minas del Tajo, at Rosario, a short distance north of Mazatlán. This mine made the fortune of the Bradbury family in Los Angeles, and it seems destined to a long life. During the past year the ore has averaged, gold 0.27 and silver 6.5 oz. per ton, and a total extraction of 90% has been obtained. The ore treated within the year amounted to 70,000 tons. The cost of operation was $3.45, of which $1.88 was for mining and development, and $1.57 for milling and cyaniding. The slime in the cyanide plant is treated with the Oliver rotary filter. The mine workings are very extensive, there being 80 miles of workings above the 500-ft. level. The San Antonio shaft has been sunk to a depth of 600 ft. within the year, this being the lowest limit of development yet carried out.

Basalt is by some prospectors regarded as evidence of a poorly mineralized country. There is no warrant for such an opinion, except as regards special conditions. Basalt is associated with ore deposits in many parts of the world. To cite no further examples, a prospector would have made a great mistake to have gone away from the Rico district, Colorado, or the Clifton district, Arizona, because he saw some basaltic dikes.

MINING AT ALLEGHANY, CALIFORNIA.

Written for the MINING AND SCIENTIFIC PRESS
By F. L. LOWELL.

The Alleghany mining camp is situated in Sierra county, California, at an altitude of 4500 ft. It did not claim much attention from mining men until an exceptionally rich find of bonanza ore was made in the Sixteen-to-One mine on April 1, 1909. The wide publicity given to this event attracted investors, and during the past summer, men from all parts of the country have paid the camp a visit and there has followed an expenditure of considerable money in new development. The unfortunate litigation involving the Sixteen-to-One mine has temporarily deprived the camp of a valuable producer, but this is not a 'one mine camp', as the amount of bullion produced by the different properties testifies.

The most thoroughly exploited vein is the Tightner

Map of Claims, Allegheny District.

contact upon which are situated the Tightner group, Rainbow group, Red Star placer, the Rainbow Extension, and the Twenty-One claims. These properties are all working. The big discovery in the Tightner was made in 1904, and a large amount of rich ore was extracted from the upper workings. Some of the milling ore is on the dump awaiting the erection of a mill. H. L. Johnson, the owner of this mine, is driving a lower adit to cut the pay-shoot at greater depth. This contact has a hanging wall of serpentine and a porphyry foot-wall, and the vein dips 45° to the east. The vein may be cut at any moment, as the talc lying between the serpentine and the vein has been reached. The adit has been driven by hand, no power being available for machine-drills.

On the south side of Kanaka creek, on the same vein, is the Rainbow group, upon which considerable development has been done by the former owners, and from which considerable gold was taken. This group of claims is under bond to Coloradans, and is being operated by L. P. Woodbury, president and general manager for the company. The Rainbow is developing and stoping in the lower adit on Kanaka creek, and is also repairing and opening the old workings of the upper adit. The company has a water-right on Kanaka creek, also one on the north fork of the same creek, and with the new flume put in this summer the 10-stamp mill is able to run the year round. This mine has taken out some 'specimen ore' under the present ownership, and is crushing ore from stopes in the lower workings. The company is contemplating putting in a new compressor, in which event considerable new ground will be opened.

On the north end of this same vein is situated the Red Star placer mine which is patented ground. It is also under bond to Coloradans, and L. P. Woodbury is president and general manager. On this property, an adit is being driven to cut the Tightner vein, and the present company has expended considerable money. There is a 1-stamp Nissen mill on this property crushing ore from the Osceola vein, and a Wilfley concentrating table, both driven by a Fairbanks-Morse gasoline engine. During the summer months, when water is insufficient, the long adit is ventilated by a fan, driven by a Fairbanks-Morse gasoline engine, which also furnishes power for the electric light plant.

Both the Twenty-One and the Rainbow Extension claims came to notice last summer, good discoveries of rich ore having been made. This contains both free-gold and arsenical sulphides. The Twenty-One is controlled by California people, and is under the management of F. N. Phelps. The Rainbow Extension is controlled by San Jose people, and is managed by O. A. Harlan. The Eldorado claim, owned by Fessler brothers, and under bond to H. L. Johnson, has been working all summer, and the 10 stamps kept going until water became short. The mill has been closed for the present. The vein on this claim is well defined, and shows a strong outcrop where it joins the Hope Extension, the northern claim of the Plumbago group. This group is owned by New York people, and has been under the management of Mr. Mather for a number of years. He was succeeded by C. W. McMeekin who is pushing the work of development vigorously. This property consists of 7 claims, and has produced handsome returns on the money invested. The company owns a water-right on the middle Yuba river, and develops power for the working of the mine, and also furnishes power for the Gold Canyon mine which is farther down the river. The Plumbago has a modern plant including a 10-stamp mill, machine shop, compressors, and electric plant, its power-house being one of the best equipped in the county.

The Gold Canyon, which is not far from the Plumbago power-house, has been bonded by Eastern people, who have been putting the mine in shape this summer so that it is now equipped with compressor and hoist, and has run its 5-stamp mill for a part of the season. Unlike most of the properties in this district, the Gold Canyon is a deep-level mine. The greater part of its production in former years has

been taken out of a shaft sunk below the bed of the Middle Yuba river. There has been trouble with water until the installation of sufficient power to cope with it. It has been a good producer and has a good future. Charles Smith is superintendent. The Oriental group of claims is one concerning the output of which there is little known. It certainly has been a good mine, and the rumor is current that Mr

Alleghany, California.

Mather, who controls the stock, will endeavor to reopen the mine next spring. Perhaps the most remarkable discovery in this district lately has been the uncovering of a large rich orebody in the Sixteen-to-One claim, which is close to the town of Alleghany. This claim was under bond to Wilson and Van der Bugle, and large quantities of ore, contain-

Tightner Adit.

ing both free gold and arsenical pyrite, were taken out. The quantity mined up to the time the mine became involved in litigation has been estimated at approximately $400,000, but the actual amount returned from the mill-run will not be known until the case is settled in the coutrs. From indications the vein appears to be a branch of the Tightner, and dips to the east also. There are several individual claims being worked in this camp that I have not mentioned, and I might say that any of them has a good chance of becoming a mine if the work is carried on with diligence, since the producing mines here had little to recommend them when taken up. With the advent of electric power next spring from the Pacific Gas & Electric Co., there should be a prosperous season, and more development will be undertaken than at any time in the past.

PHELPS, DODGE & CO. IN 1909

Stockholders of Phelps Dodge & Co. have received during 1909 $12 on each share of their holdings, the entire distribution for the year totaling $6,000,000. The output of the company's mines for the current year will approximate 134,000,000 lb., and, assuming that the disbursements represent the entire earnings for the year, the company is making a profit of 4½c. per pound. As a matter of fact, the company is probably turning out the metal at a cost of nearer 8c. per pound than 9, since the above calculation on costs makes no account of surplus requirements. In the following table comparisons of production and rate of distribution in former years on the basis of the new company's capitalization are given:

Year.	Production Pounds.	Dividends Paid.	Rate Per Cent
1909	134,000,000	$6,000,000	12.00
1908	115,871,304	3,480,000	6.90
1907	90,955,963	4,010,000	8.02
1906	112,281,878	8,224,000	18.40
1905	89,418,083	3,184,000	6.30
1904	77,637,595	2,000,000	4.00

During 1908, the Phelps-Dodge properties earned about $5,500,000 available for dividends. During the present year production has increased steadily from month to month, enabling the company to show lower costs and lager earnings. The company sells its own metal to a clientele of many years standing. Its stock is closely held and transactions are rare. The last sale recorded was at 197½.—*Boston News Bureau.*

New light on the geology of the Wasatch mountains was shed by Eliot Blackwelder at the recent meeting of the Geological Society of America. The past season's work of the United States Geological Survey in the Wasatch and Bear River ranges of Utah, has added several facts of importance to the current interpretation of the structure and stratigraphy of the region. The Weber quartzite thins rapidly north and northwest of the type locality and there is evidence indicating that this thinning has been caused by erosion during the Pennsylvanian period. The Ogden quartzite appears to be neither Devonian, as first reported, nor Ordovician, as stated in more recent years, but merely a repetition of the lower Cambrian quartzite upon a large overthrust. The great body of 'Wasatch quartzite' of the King Survey was found to be separated from the known Cambrian quartzite by a distinct although readily overlooked unconformity.

Sulphide determinations in alkaline cyanide are discussed by Ewan as follows: (1) The rapid 'works' method consists in dissolving 10 gm. of the sample in 15 c.c. of water, and titrating with a standard solution of $Pb(NO_3)_2$ until a spot-test of the liquid shows no brown on a paper moistened with a Pb solution. Some oxidation of the sulphide always occurs. The results should be multiplied by 1.25. (2) Colorimetric methods are only accurate when the conditions of concentration, presence of certain salts, are identical in the standard solution and the one tested. (3) Feld's method—distilling with $MgCl_2$ in a current of CO_2 and passing the H_2S into I solution—is accurate but troublesome.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Bullion-Tax Law in Nevada.

The Editor:

Sir—Referring to your recent editorial on the above subject, I wish to say that in looking over the authorities on accountancy, I find them practically agreed that depreciation on mines, and their dependent plants, is in direct proportion to the amount of mineral extracted, but that the law does not require that a mining company shall write off a commensurate depreciation before declaring a dividend. This seeming inconsistency in the law may have its cause in the general beliefs that in accountancy mines are regarded as non-permanent undertakings, and that, viewed in this light, no system of accounts can be adopted that will insure that the capital in such an undertaking will always be maintained intact. The stockholders in the average mining undertaking object strenuously to a depreciation charge, on the ground that it leads to the accumulation of large sums of money in the hands of directors, earning a low rate of interest at the best, which might be distributed as a dividend, although in point of fact such sums constitute a return of capital, which might, through re-investment, be the means of perpetuating the undertaking. Therefore, while the law does not require a depreciation charge, it is still optional to embody such an element in the accountancy of mine and reduction plants. Such a charge would then be such proportion of the total cost, less residual value of plant, as the year's output bears to the estimated total producing power of the mine. The erection of a customs reduction plant in an isolated district is only justified when the profits accruing through the treatment of its tributary ores will repay the capital invested, and pay in addition a return on the same, commensurate with the venture. In other words, the cost of the site, the plant, and the maintenance, are directly chargeable to the estimated tonnage of ore that can be treated. This can either be expressed in a depreciation charge, based on the relation borne by the annual capacity to the total estimated tonnage of the contributing sources, or as a charge per ton, to which, in the treatment charge exacted from shippers, is added a sum that will be a return on the total capital invested.

The same kind of procedure is adopted by a contractor who has installed a material-handling plant, say a steam-shovel, with which he contracts the handling of a stated amount of material. His estimate as to the cost of doing this work always includes the price of the plant, plus the labor required, and a reasonable return on the capital so invested, expressed in cost per cubic yard of material. Having completed this contract, his plant is worth simply its salvage value, which, in isolated districts, amounts to practically nil. In the event the competition is strong, his charge for return on capital invested is proportionately less than in cases where he practically commands the situation. The same line of argument applies to reduction plants competing for the treatment of ore, such as are situated in districts they can command by virtue of contracts, the existence of prohibitory freight rates to other plants, or through special forms of treatment controlled by them under patent. Concerning the depreciation of the machinery constituting ore-handling or treatment-plants, the depreciation is governed by wear and tear through becoming obsolete as a cheap means of handling, or through becoming unfitted as an element in a plant requiring to be re-adjusted in order to meet changed ore conditions.

Summing up the above, I consider that in mine and reduction undertakings, depreciation constitutes an equitable charge against revenue. Reserve capital so created through the return of capital giving greater elasticity in that it can, through re-investment, be made the means of perpetuating an undertaking. While this course is not followed by many operating companies in the United States, still a number are accomplishing the same result through re-investment of their surplus earnings, for instance, the Calumet & Hecla, which is purchasing additional territory so as to prolong its career.

BULLION-TAX PAYER.

Reno, Nevada, December 20.

Modern Quicksilver Reduction.

The Editor:

Sir—In your issue of November 20, 1909, there appeared a note by myself drawing attention to the fact that, on the whole, much more than 20% of the mercury in modern quicksilver furnaces is obtained direct as free metal from the condensors, in contradistinction to that obtained by working over or retorting the soot. This note was reviewed in your issue of December 4 by Clifford G. Dennis, and in that of December 11 by Arthur Feust, of New Almaden. As Mr. Feust states, the amount of soot is dependent: (1) on the character of the ore; (2) on the grade of the ore; (3) on the kind of fuel.

It was my fortune to visit all of the producing quicksilver mines of California in 1883-1885. At that time most of the mines were operating on a fair grade of ore, and certainly the larger part of the quicksilver produced came out as free metal. It would appear from a paper by S. B. Christy on New Almaden that in 1882, about 96% of the mercury produced came out as free metal, and 4% was obtained from the soot. In conversation Clifford G. Dennis stated that during the time of his residence at New Almaden about 87% of the mercury came out of the condensors as free metal. As there are presumably complete records on this point at New Almaden, it would be interesting if Mr. Feust could give us the benefit of them. The veteran quicksilver miner of California, J. W. C. Maxwell, who was superintendent of the New Idria mine for many years, states that from 1872 to 1884 at least 70% of the mercury produced came out as free metal, the ore at that time being of a good grade. Mr. Maxwell also states that at Sulphur Bank, in Lake county, where there was an excess of sulphur in the ore, probably only 10% of free metal was produced. In this case the character of the ore was the domi-

nating feature. I am indebted to R. M. Newcomb, manager of the New Idria and Oath Mines, for the following facts. At the Oathill mine in 1908 .2% of the product was free metal, and in 1909 0.2%. At the New Idria in recent years only 1% to 2% of free metal has been obtained, the remainder, or more than half, coming from the soot. Mr. Newcomb states that he had less soot when using oil fuel than when using wood fuel. John Andrews, superintendent of the Great Western mine, in Lake county, using a Litchfield furnace, informs me that while no exact record was kept, not more than 20% of the mercury was obtained as free metal in recent years, and that at the small furnace of the nearby Helen mine practically all the product is soot.

It is thus evident that with certain ores, as those rich in sulphur or in hydro-carbon, the amount of free metal in quicksilver furnaces is often much under 50%, and also when wood fuel rich in pitch is used, much soot may be expected, while the coke, as in the Neate furnaces of the St. Johns mine at Vallejo, little or no soot should be formed. This would likewise be true in furnaces using producer gas.

Leaving out of consideration any particular mines or ores, it would be more happily put to say that the bulk of the mercury of the world comes out of the condensers as free metal, but on this point the records at the Almadén mine of Spain would need to be examined. The larger part of the California production has come from the New Almaden and the New Indria mines, and it would appear that my original statement of a production of over 70% of free metal was true of these mines for a long series of years, and at the time of their heaviest production. It is also true of the most prolific of the Texas mines, the Marfa and Mariposa, during 1904-05. According to Spirek, it was also true of the Monte Amiata mines in Italy for a period of 15 years preceding 1900.

H. W. TURNER.

San Francisco, January 2.

Researches Upon Cripple Creek Telluride Ores.

The Editor:

Sir—In the letters which were published in your issue of November 20 last and of December 25, referring to the article, 'Researches Upon Cripple Creek Telluride Ores', which appeared in your issue of September 25, 1909, your correspondents appear to be unaware of the fact that the discovery of the solvent action on gold in ores of a solution of cyanogen iodide and potassium cyanide is nearly as old as the cyanide process itself. W. H. Gaze proposed the use of this solvent about the year 1888, and in 1889 the first cyanide work which I did was some tests comparing the action of a plain solution of cyanide and the iodide solution on a gold ore. If the improvement in the solvent action of the solution is due to the presence of cyanogen iodide, it is difficult to see why such an expensive method of forming it should be proposed as the use of a persulphate and an alkaline iodide. There are much cheaper methods of making cyanide iodide. The use of cyanogen bromide ('bromocyanide') was strongly advocated at one time but with the exception of a single mill in Western Australia no one does not hear of its being in use. Not only the cost of the extra chemicals is against their usefulness but to get any benefit from them great care has to be taken that the solution is neutral or slightly acid. By 'acid' is not meant acid to litmus, but that the solution contains a trace of free hydrocyanic acid. In the laboratory high extractions can be obtained by the use of extra chemicals, but it is often overlooked that the cost of these chemicals may be considerably more than the value of the larger amount of gold extracted above that extractable by plain cyanide.

BERTRAM HUNT.

San Francisco, December 29.

Estimation of Cyanide in Mill Solutions.

The Editor:

Sir—The standard silver nitrate solution used for estimation of cyanide in solution is made by dissolving a quantity of $AgNO_3$ in one litre of water. The authorities quoted recommend quantities as shown. Is it not time that this confusing variation be recognized and the discrepancy adjusted? The quantities recommended by different authorities are: Eissler, 13.05 gm. $AgNO_3$ to 1 litre water; Lodge, 13.056; Wilson, 13.07; Furman, 13.07; Berringer, 13.076; Clennell, 13.038; W. H. Leamon, 13.038; C. H. Jay, 13.04; MINING AND SCIENTIFIC PRESS, 13.07.

The values given to the atomic weights of the elements entering into the composition of silver nitrate and cyanide of potassium are responsible for the difference in the above figures. The equation

$$AgNO_3 + 2KCN = AgK(CN)_2 + KNO_3$$

represents the chemical reaction.

If the values given by the Committee on Atomic Weights (*Jour.* Am. Chem. Soc., XXI, No. 2) are used the following result is obtained:

$$\begin{array}{cccccccc} Ag & N & O_3 & + & 2K & C & N \\ 107.11 & + 13.93 & + 47.64 & & 38,82 & + 11.91 & + 13.93 \\ & 168.68 & & & & 2(64.66) & = 129.32 \end{array}$$

This gives 13.043 gm. $AgNO_3$ diluted to one litre, as the correct standard solution. If the figure given in The *Journal* of the Chemical Society (London), January 1904 be accepted as the International atomic weights, another figure is obtained, as follows:

$$\begin{array}{cccccccc} Ag & N & O_3 & + & 2K & C & N \\ 107.12 & + 13.93 & + 47.64 & & 38.86 & + 11.91 & + 13.93 \\ & 168.69 & & & & 2(64.70) & = 129.40 \end{array}$$

This gives 13.036 as the standard weight of silver nitrate. Which is the correct quantity to use in practical cyanide work?

ALGERNON DEL MAR.

Sumpter, Oregon, November 24.

Cadmium comes mainly from zinc ore, though small quantities of this comparatively rare metal are contained in some lead ores. The world's cadmium output is derived largely from Silesia, but within the last two years the metal has been produced in the United States, and the value of the annual imports of cadmium has dropped during that time from $10,500 to $2300. The zinc ore of the Joplin district contains as high a percentage of the metal as the cadmium-bearing zinc ores of Silesia.

Special Correspondence.

JOHANNESBURG, TRANSVAAL.

French Rand Closing Down.—'Modified' Blasting Gelatine. — Rapid Driving.—Neumann Mines.—Chamber of Mines and Superfluous Statistics.

The French Rand G. M. Co. is to be immediately closed down. Not even development will proceed. Although the difficulties of the mine have been well recognized by all acquainted with conditions underground since the exhaustion of the big runs of rich ore, and although little hope of profit has been held out in view of backward development and short labor-force, there has been considerable disappointment at the final decision of the Board. It was generally hoped that the money would have been found, somehow and somewhere (it is usually brought forward boldly enough by the Eckstein firm), to enable development to proceed. The closing of the mill alone, which has been losing heavily of late, would have caused no sorrow. The October returns showed a loss of £7300, the tonnage having been low. Apart from decreasing grade and a multiplication of faults, there have been factors contributing to the company's failure which can only be classified as ill-luck. For instance, in February, development and rock-hoisting operations were disorganized by floods, following the unexampled rains. As a dry mine, the French Rand was quite unprepared. Then later on, labor got scarcer, the supply falling 30% in six months. Some may be surprised to hear this outcry about the closing of a mine which will affect the Rand output to the extent of but 0.5%. But it is the 'principle of the thing'. The Rand has established such a remarkable standard of industrial stability that a complete failure of a Main Reef proposition is held to be a sorrowful disaster.

Some time ago I referred to the 'modified' blasting gelatine introduced by W. Cullen, of the B. S. A. Explosives Co., which was claimed to materially reduce the amount of carbon monoxide given off in blasting, without reducing its energy. There is now reason to question the assumption of undiminished strength. If it is less economical, it will be necessary to assure the mines that the CO is so much reduced as to appreciably influence after-blasting conditions, that the wrapper, for instance, is not still too important a factor to enable injurious effects to be removed. The opinions of practical men as to the efficiency of the modified explosive are widely divergent.

The East Rand Extension, a developing mine, lately reopened, under the control of the Consolidated Gold Fields, claims to have made a new record in driving footages. This rapid succession of development records in the East Rand is becoming monotonous, and makes one suspect that it must have been a district for the loafer in former days. However, all these recent records are dependent upon the 'point of view', for the recognition of highest achievement. There have now been declared, the following: New Modderfontein, 826 ft. in 156 consecutive shifts (two machines) in three months; New Modderfontein, 349 ft. in 62 shifts in two faces; Modderfontein B., 334 ft. in 62 shifts in a single face. The East Rand Extension now claims to set up a new record with 361 ft. in one month. But it appears that three 8-hr. shifts per 24 hours were worked, so that the footage per round must have been far less than the Modderfontein performances. The difficulties of shoveling, and the inconvenience of the gas, must be considered in the working of three shifts per day, but the advance per round is the crucial test of effective and economical progress, assuming normal conditions.

After Eckstein's, the Neumann group is probably the most efficiently controlled upon the Rand. The businesslike administration of the Anglo-French-Farrar combination leaves little to be desired, but a good deal of sound criticism could be launched at the methods of the other firms, in one department or another. Neumann's is undoubtedly one of the most progressive groups from the financial point of view, and has some important work on hand. The quarterly reports (to September 30, 1909) show that development results in the Main Reef West continue to be favorable, 1655 ft. on Main Reef Leader, averaging 7.8 dwt. over 48 in. South Reef, hitherto found comparatively unimportant in this mine, though the mainstay of properties to the west, averaged 5.5 dwt. over 36 in. The group's new producer, the Knight Central, whose equipment was only completed this year, crushed 62,490 tons for a yield of £76,681 (24s. 6d. per ton), and a profit of £18,727 (or 6s. per ton). The company of the group which merits principal notice from the general industrial standpoint (the Cloverfield Mines) is unfortunately able to give only a poor account of itself. The Cloverfield, near the Geduld, struck the reef only this year. During the quarter, 403 ft. were driven on the reef, disclosing 6.3 dwt. over 10.6 in., but hopelessly unpayable. The footage was small on account of water-troubles, but it is the poverty of the grade which occasions disappointment. There is 'room for improvement' in more senses than one; the property is large and the grade, so far, much below normal expectations, and bore-hole results were promising.

At the last meeting of the Chamber of Mines, L. Reyersbach, who is leaving Johannesburg to join Wernher-Beit's London office, made a plea for the abolition of detailed statistics, which are prepared each month by the Chamber. It may be noted that the monthly analysis of the Chamber of Mines is exceptionally full, and gives the following data for each company: (1) tons hoisted and taken from dump; (2) waste sorted out; (3) tons milled; (4) stamps erected; (5) stamps at work; (6) days milling, 24 hours; (7) duty per stamp per 24 hours, duties being always worked out over a full day of 24 hours to give a true reflex of work done; (8) number of tube-mills at work; (9) yield from milling in pounds sterling; (10) from cyanide; (11) total; (12) total fine ounces; (13) total per ton milled, in shillings and pence; (14) total per ton milled (dwt.); (15) working costs per ton milled exclusive of development; (16) amount spent per ton milled on development or development redemption; (17) total working cost per ton milled; (18) total working costs; (19) working profit; (20) working profit per ton milled; (21) sundry revenue; (22) capital of company; (23) dividends declared during month, (a) rate per cent, (b) amount; (24) dividends for year to date; (25) dividends for corresponding period of previous year; (26) remarks, with special reference to gold recovered from accumulations. Now, Mr. Reyersbach seeks to have this monument of labor abolished, and in its place, to initiate an annual analysis. He declares that this close comparison of monthly results drives managers to exert energies uneconomically in maintaining a steady grade—by distributing their workings over a wide area instead of centralizing. It is easy to understand Mr. Reyersbach's objection to useless labor, but the question arises whether the information compiled is not of sufficient practical value to outweigh the indirect influences and to justify the work involved in their compilation. The data provided would, to a large extent, have to be obtained each month for the guidance of the control, and in this case, the desire for an equalization of grade should still be manifest. The Chamber of Mines analysis, however, forms a convenient record and really saves an immense amount of compilation by others. Mr. Reyersbach is certainly right in claiming that such an analysis has some bad results, none more evident than the close comparison of costs between differently conditioned mines. On the other hand, it is probable that they are easily balanced by the good and by the spirit of confidence the publication of official details inspires in interested shareholders. Mr. Reyersbach must recollect that all mines on the Rand are not run as openly as those under his firm's control, and that the withholding of data might lead to manifold abuses, besides being a cause for endless rumors. Comparison was made with the more restricted information provided by the iron and coal industries of the States. It must be allowed, however, that the non-competitive mines of the Rand are on a different basis and there is nothing to gain by secrecy in any department. It would appear from reports of the West Australian Chamber of Mines sometimes seen over here, that

the Kalgoorlie Output is also reduced by the [illegible] Boulder. The mine is [illegible] It would be unfortunate if Mr. Hannaford would hesitate in doing the [illegible] ton per [illegible] months owing [illegible] the working [illegible] ore of the mines. It really [illegible] could [illegible] down the investing world would [illegible] readily [illegible] job to the scheme. It need be recollected however that the aim of the majority of managements during the last year or two has been a reduction of costs and with the assistance of a gold reserve the control has made the maintenance of a standard output subordinate to economy of operation.

SALT LAKE, UTAH.

Utah-Boston Merger.—Nevada Con. — W. A. Clark Opposes Copper Merger.—Ohio Copper Mill.—Daly Judge Drain Tunnel.

Upon the return of Daniel C. Jackling, general manager for the Utah Copper Co., from the conference between the officials of his company and those of the Boston Consolidated, he stated that by the end of January they would have the transfer of Boston properties to the Utah Copper household. Mr. Jackling is now in Arizona inspecting the Ray and Gila mining properties. He will return by the middle of the month to arrange his staff for the handling of both mines at Bingham, and the three mills now being operated by these companies. The principal change in the staff of the two companies has already taken place. Lafayette Hanchett, general manager of the Boston Consolidated since its inception, has resigned, and in February he will sail from San Francisco for a year's cruise around the world. Mr. Hanchett tendered his resignation some time ago, but the Boston directorate prevailed upon him to remain until the transfer of the properties to Utah Copper interests could be made. As a reward for his faithfulness to the Boston Consolidated, the directors have voted him a salary of $25,000 for the next twelve months. Overtures have been made to Louis S. Cates, mine manager, and A. J. Bettles, metallurgical engineer, of the Boston Consolidated, to remain in the employ of the Utah Copper Co., but it is understood that each of them may decide to retire. Aside from the changes in the staff of the two companies, Mr. Jackling says that the capacity of the Boston mill is to be increased from 3000 to 5000 tons. The original plans for the present Boston mill called for a capacity of 2500 tons per day, and after completion it was learned that 3000 tons of ore could be reduced in the plant. The Utah Copper mill is also to have its capacity raised from 6000 to 10,000 tons. These two plants, with the one at Copperton, will give the company a milling capacity of 17,000 tons of ore per day, while in case of a large advance in the market price of copper, the management could increase the capacity 50%, by cutting down the extraction.

On or before February 15 it is generally conceded that a majority of the shareholders of the Nevada Consolidated will surrender their stock in exchange for shares of Utah Copper at the rate of 2½ shares of Nevada for 1 of Utah. While a number of the shareholders of the Nevada Consolidated are opposed to this merger, one who is in a position to know says that the Guggenheims are the best posted on the intrinsic value of the two properties, and since the Boston Consolidated has been acquired by the Utah Copper, the latter company has one of the most valuable copper bearing estates that has ever been developed in the low-grade porphyry deposits of the West. Utah Copper and Boston Consolidated have their work several years in advance of the Nevada Consolidated, and it appears to be the impression among local mining engineers that the Nevada Consolidated has reached a point in its development which will result in its pit-work being more expensive than during the earlier stages of development. As the steam-shovels in the pit extend the opening into the mountain the overburden is becoming thicker, and the copper content at the greatest depth in the first pit is not as high as nearer the surface. Still another consideration in favor of forming the merger is said to be the fact that the Guggenheims realized that the capable management of D. C. Jackling and his efficient corps of engineers is [illegible] without equal in the country. Mr. Jackling is credited with having added many new methods to metallurgy as a result of his experience in the mining and treatment of low-grade ores. He constructed some of the largest gold-extracting mills in the West operated smelting plants in Colorado and is a practical and theoretical man in mining in all its departments.

During a recent visit of W. A. Clark to Salt Lake City, it is stated that there would be no gigantic merger of all the copper producing properties in this country. He took the position that the interests were so diversified that it would be impossible to get them to enter into an agreement for the control of the copper output, and the price of the metal in the open market. He said that the copper producers were getting along fairly well, and that he personally would oppose any movement which has a tendency to put the red metal on a speculative basis.

The Ohio Copper company has started the second section of its mill at Lark. This places the first half of the mill in operation, but owing to delays in the delivery of tables and equipment for the remaining portion of the plant, it will be several months before the management will be able to have the entire mill running. The Ohio has always been in need of money with which to complete its development and mill construction, but since the recent visit of F. Augustus Heinze, it is believed that arrangements will be made to complete the financing of the company at an early date. Incidental to starting this mill there has been a number of vexatious delays. The manager, Colin McIntosh, thinks that he will experience less trouble in future, yet the profits must come from handling more than 1000 tons of ore per day. George W. Lambourne, manager for the Daly Judge Mining Co., announces that he has closed bids for driving the long tunnel from the Snake creek side of the Park City district, to tap the Daly Judge and drain it at great depth. Repeated efforts have been made to get the Ontario drainage tunnel extended from the Daly West ground, but the Daly West owners will not consent. Thus the Daly Judge has decided to drive its own tunnel, and will get the assistance of mining property owners in that vicinity. The tunnel will be driven several thousand feet, and will drain a large area in the Bonanza Flat section of Park City district. It will take at least a year to complete this work as planned.

KALGOORLIE, WESTERN AUSTRALIA.

Strikes and Coal Output.—October Gold Production. — Perseverance Fire.—Municipal Electric Plant.

We have had another strike of firewood employees, but it has been settled to the evident satisfaction of all concerned. This time none of the mines closed, but their fuel reserves were almost depleted. A serious strike of coal miners is now in progress in all the collieries in New South Wales, the real grievances being rather obscure. The strike will not affect western Australia, excepting that it increases the production of our Collie coal mines in the southwest. These produce 175,248 tons, valued at $2 per ton in 1908, and the output is steadily increasing. The western Australian railroads use a mixture of Newcastle (N. S. W.), and Collie coals. The local coal will not stand much handling and exposure to the weather, but it appears to be improving of late. The percentage of fixed carbon runs from 45 to 50%. Our mines use very little, but steamers calling in at Fremantle take in increasing quantities; and now that the strike is on, the production is bound to rise.

The Golden Link ore reserves now stand at 71,000 tons worth $8.50 per ton. In announcing the reserves of the Kalgurli as 430,000 tons, worth $13.70 per ton, the manager states that development is somewhat behind extraction. Work at 1450 and 1550 ft. has not opened up as much as was expected, while little has been done at 1650 ft. Ordinarily, two new levels per annum are sufficient to keep well ahead of the mill, which treats 10,700 tons monthly. The orebodies in this mine are wide with little length. A new engine is being erected, capable of hoisting from about 300 ft. The Oroya-Brownhill is to further reduce its yield,

which at present is $80,000 from the mines, and $20,000 from residue treatment monthly. It is fairly certain that this mine will not operate much longer. Some years ago the monthly returns were valued at $270,000. The principal October returns were as follows:

Name.	Tonnage.	Value.	Profit.	Dividend.
Associated	11,505	$105,000	$ 30,000	.....
Associated Northern Blks	3,734	25,000	6,500	.....
Chaffers	3,310	32,000	8,500	.....
Golden Horseshoe	25,006	244,000	100,000	.....
Golden Ridge	2,235	28,000	14,000	.....
Gt. Boulder Proprietary	18,792	250,000	135,000	.....
Gt. Boulder Perseverance	19,016	135,000	21,000	.....
Great Fingall	10,863	74,000	9,000	.....
Hainault	5,600	39,000	7,500	.....
Ivanhoe	19,677	204,000	100,000	$250,000
Kalgurli	9,650*	125,000	65,000	185,000
Lake View Consols	11,328	65,000	12,500	.....
Oroya-Brownhill	11,666	104,000	40,000	110,000
Oroya-Black Range	4,591	56,000	22,000	.....
Sons of Gwalia	13,610	113,000	44,000	.....
Sons of Gwalia South	2,134	21,000	2,500‡	.....
South Kalgurli	9,040	62,000	7,500†	.....

*About 1000 tons short through accident to mill engine. Balance of the plant is motor driven. †About $5000 of usual profit spent on plant for sluicing away residue, instead of conveyor belts. ‡Shut down indefinitely. Development behind the mill.

There will be no output from the Perseverance mine for the next six months at least. On the tenth of the month, a perfectly calm day with the mercury just over 90°F., fire was discovered about 2 p. m. in the engine-room. Streams of water were playing on the fire in a couple of minutes but the flooring and woodwork being saturated with ten years' of oil, the fire got such hold that in ten minutes the whole place was a furnace. It seemed as if the entire mill were doomed to destruction and it would have gone if any wind had sprung up as it did five hours later when the temperature dropped to 57°F. Tremendous efforts were made with lines of hoses from neighboring mines, the Kalgoorlie and Boulder City, and by the fire brigades' steamer engines. There was great risk of an explosion from the 10 Heine water-tube boilers, but the fires were drawn and the steam main was broken soon after by falling timbers. By 4 p. m. the fire was under control, as when it got to the roaster shed there was not much to burn, and the part destroyed had seven streams of water playing on it. The machinery wrecked included a horizontal compound-condensing Corliss engine of 450 hp., built by the E. P. Allis Co., with cylinders 20 and 36 in. by 48 in. stroke running at 77 rev. per minute. This was used for driving 18 Griffin mills, screw-conveyors, main belt-conveyor for broken ore, and a 150 kw. continuous current generator. The engine drove a main shafting by a 3-ply leather belt 115 ft. by 42 in., weighing 1500 lb., and costing $1000, and purchased from Ludovici & Co., of Sydney. This caught fire and helped to spread the flames. A Brush compound-condensing vertical engine driving direct at 240 rev. per minute, a 200 kw. continuous current generator was also lost, as were two Wheeler condensers handling 13,500 lb. of steam per hour, a Holden & Brooks oil separator and two compound-condensing Ingersoll-Rand air-compressors, with Corliss gear, delivering air at 90 lb. pressure to the mine and mill. One engine had a load of 350 hp. and the other 200 hp. Each compressor had an inter-cooler which were also destroyed, as were three lines of shafting, belting, ore-bins, and 16 Griffin mills with their attachments. The total damage was over $250,000. This mill was erected in 1899 by Messrs. Nichols and Blakesley, of the United States, and its cost to date has been about $850,000. It embodied the dry-crushing and roasting process; the ore being milled in 16 Griffin mills, roasted in 6 Perseverance furnaces—a combination of the Holtoff-Wethey and Edwards makes—ground to slime in fourteen 8-ft. pans, agitated with KCN in 24 agitators of the ordinary type, and finally treated in 11 presses of 5-ton capacity each. In 1908, 204,406 tons were treated for $1,520,000. Dividends totaled $340,000. Costs were: mining, $1.54; treatment, $2.82; general, $0.31 per ton. Dividends to date amount to $7,000,000. The mine is opened to 1900 ft. on three lodes. Development in 1908 totaled 7699 ft. Broken ore in stopes was 85,187 tons, while the ore reserves were 391,947 tons, worth $6.60 per ton, down to 1100 ft. Employment was given to 660 men. This is the most disastrous fire that has taken place in this district. Some 12 years ago a 40-head mill, some 12 miles from here was burnt down, and three years ago the Golden link of 20 stamps was struck by lightning and totally destroyed. The insurance on the Perseverance mill was $460,000.

During the financial year of the Kalgoorlie Municipal Electric Lighting plant, 1,122,083 units were generated and 865,043 sold to private consumers for $92,500, the profit being $44,300. The average receipts per unit were 10.8c., and costs, 5.8c. The plant consists of two Parsons turbo-generators and three high-speed engines driving dynamos direct; also four Babcock boilers generating steam at 180-lb. pressure. The municipality here runs the lighting, markets, baths, theatre, recreation reserves, and the like, with good results. The Boulder City lighting plant generates some 600,000 units annually and the Power Conporation over 11,000,000 units. Adding these quantities to that generated on the mines we get a total hard to equal in any mining centre of this size.

LONDON.

Definition of Mineral.—Stream Tin. — Dolcoath Shaft. — Climate of Cornwall.—West Kitty and the National Minerals Corporation.

I have referred in this column several times during the last year or so to the numerous law suits hingeing on the meaning of the word 'mineral'. Nearly all these cases have been carried through all the courts up to the House of Lords. In the old days a 'mineral' was a substance that was 'mined', and it was, therefore, assumed that the operation of winning would not interfere with anything built or worked on the surface. Recently clay and sandstone, worked by pits or quarries, have been the subjects of contention, and various contradictory judgments have been given. A month ago the House of Lords delivered an important judgment in which they laid down the law that common surface rock and clay could not be classed as minerals. This week another judgment has been given which helps to further elucidate the views and attitude of the judiciary of the House of Lords. This was the celebrated Cornish china-clay case where the owner of the mineral rights, Lord Clifden, and the lessees, the Carpalla China Clay Co., resisted the contention of the Great Western Railway, the owner of the surface rights, that china-clay was not a mineral but only a decomposed part of the surface rock. The High Court and the Court of Appeals had held that under the Railway Act of 1845 china-clay was undoubtedly a mineral. The House of Lords unanimously supported the lower courts and added further comment. They agreed that the clay was a decomposed surface rock, but seeing that it was rare and of special value, it did not come within the scope of the decision regarding sandstone and ordinary clay. From the point of view of it not being 'mined' and therefore not a mineral, they found that it could not be advantageously worked and dressed in any way except by open-cut, so that the owners must be given the right to work it on the surface. When the Great Western Railway raised the point last year, most people hardly understood the logic of their contention, for since 1845 it has been the custom to consider china-clay a mineral in law, and custom and usage are not things to be lightly set aside.

Your readers are probably more or less familiar with the slime-tin problem in Cornwall, how so much of this tin is lost in the dressing works at the mines and discharged with the tailing into the Red river. The slime of this river is worked over and over again by various 'streamers' who, with their cheap automatic 'rag frames' or 'dead frames', all manage to pick up a decent sort of living. Dolcoath, South Crofty, Carn Brea, and others all discharge their tailing in this way, and probably from one-third to one-quarter of the contents of the ore is lost to the mines. None of the companies admit their losses and there is no

way of finding out which mine loses the most. The managers, with one exception, never make accurate assays of anything but prefer the old vanning shovel. Recently J. J. Beringer, head of Camborne Mining School, and author of the text book on assaying, has been making special efforts to introduce accurate methods of ascertaining the tin content of the ore, tailing and concentrate, and H. W. Hutchin, the assayer at South Crofty, the exception mentioned above, has conducted much experimental work on Mr. Beringer's lines. It is therefore, of particular interest to record that a tin streamer has made the novel move of treating the slime tailing at South Crofty before it is mixed with the Red river. His plant is now being erected and will be soon in operation. His work will be an excellent check on the South Crofty dressing plant and should spur Mr. Hutchin to still greater efforts. It is obvious that this new move will have an important influence on the question of tin dressing.

An important event in the history of the new main shaft that has been sunk at Dolcoath, is now to be chronicled, namely, the connection has been made at the 440 fathom level with the present workings. The atmosphere of the mine has been wonderfully improved by the ventilation afforded by the new shaft. The flowing current of air is pleasant to work in, compared with the warm, moist, stagnant atmosphere hitherto typical of the mine. By the way, the climate of Cornwall above ground is never, at the best of times, very invigorating, and in the winter time the damp and the mists are depressing and enervating. A Cornish miner is always more active abroad than at home. The indolence of the Cornishman is noticeable among the fishermen, for they prefer to let their women folk mend their nets and do the other work on shore. I have seen them at Newlyn on Sundays waiting for the public houses or saloons to open at 1 o'clock, leaning gracefully on posts or supporting the house walls. There was no dash when the clock struck one. Even the attractions of the saloon did not induce them to abandon their comfortable attitudes until another ten minutes or a quarter of an hour had elapsed. This is a reflection not on the people but on the climate. A deal is heard in the papers about the 'Cornish Riviera' as a winter resort. This is merely a dodge of the Great Western Railway to impose on the inexperienced Londoner and induce him to leave his comfortable home for the sunless, misty, muddy tracts of the west country. Of course it is rank heresy to say all this. After John Davidson's death, one of his letters was published in which he forcefully protested against the misrepresentations relating to Cornwall as a health resort; all the comment made by the local papers was that the utterance of such a sentiment was proof of the poor poet's madness.

The West Kitty mine, in the St. Agnes district of Cornwall, has gone through many vicissitudes lately, owing chiefly to disagreement among the various sets of shareholders. During the last few days it has been handed over to new control, and, as far as its prospects for actual mining work are concerned, I should fancy that the last state is worse than the first. The control is now held by a group of foreign promoters called the National Minerals Corporation. These were the first outsiders to take up Cornish mines a few years ago. Their first venture was at Clitters in East Cornwall, where modern plant and method of development were to show how things should be done. Unfortunately the plant was ahead of the development, and the mine is not a large producer. A still more unfortunate act was the declaring of an interim dividend that had not been earned, so at the end of the year additional capital had to be raised. This incident marked the end of the group's control of this mine. In the meantime they had acquired the old Wheal Jane mine, near Chacewater, and a company called the Falmouth Consolidated was formed to work it. An expensive plant was erected before any substantial development had been done. When the plant started, blame was thrown on the ball-mills, which, by the way, are working successfully enough on tin and wolfram ores elsewhere. The ball-mills were turned out and stamps are being erected instead, but so far, there has been no production of tin. The next move has been to acquire mines at St. Ives containing tin and arsenic, and the chief event so far in connection with this venture has been the erection of a laboratory in London where Sir William Ramsay is to try to extract some radium. Now comes the news that they have acquired West Kitty and that they are endeavoring to obtain other leases in St. Agnes. All these years the amount of talking in London has been prodigious and the stock market has been industriously worked. The question is, what good is all this to Cornwall or to legitimate mining?

BUTTE, MONTANA.

December Output. — Clark's Attitude Toward a Copper Combine. — Butte-Ballaklava.—Butte & Superior.—Davis-Daly.

The December copper production by the Butte companies fell below preliminary estimates, the total being but 14,340,480 lb., against 27,889,140 in November. The heavy decrease was due to the strike of railroad switchmen, which continued through the month and prevented the transportation of ore from many mines and shut off the supply of coal. The total output of ore and production of copper, in pounds, was as follows:

Companies.	Ore, Tons.	Copper, Pounds.
Anaconda	98,000	5,978,000
Washoe	5,600	336,000
Parrot	3,360	194,880
Trenton	8,400	512,400
North Butte	33,600	2,049,600
Butte Coalition	39,200	2,548,000
Original	16,800	1,108,800
East Butte (Pittsmont)	8,400	520,800
Miscellaneous	16,800	1,092,000
Totals	230,160	14,340,480

The attitude of W. A. Clark toward the proposed copper merger appears to have undergone a change. It was surmised that his apparent opposition was induced by a controversy with the Amalgamated company. If that was true, then there must have been an adjustment of the controversy, for he is now impressed with the feasibility and necessity of a combination of producers. He says the proposed merger is not a merger in the popular sense of a trust, and does not contemplate discrimination; that it will not affect the mines of Arizona, where his famous United Verde is situated, nor the mines of northern Michigan. It simply means, he says, that three or four of the larger copper interests will get together on a basis where they can handle their product better. "There is a world-wide over-production of copper that will have to be worked off," says Mr. Clark, "but new uses to which the metal is being put are increasing. It is impossible to mine copper with a fair profit under 15c. The price should not, however, go above that." The statement of Mr. Clark that there is no reasonable profit in copper under 15c. is significant, as he is the largest individual producer of that metal in the world.

The shaft of the Butte-Ballaklava Copper Co. has been completed to the surface, and is now a standard 3-compartment shaft down to the 1400-ft. level. Down to 500 the shaft was only 2-compartment, but another compartment has been raised to the surface. The foundation for the new hoisting engine has been completed and new machinery will be installed. Meanwhile the company is mining and doing extensive development. Several hundred tons of ore are being shipped daily, and when the new hoist is installed the output will be increased to at least 500 tons per day. The Butte-Ballaklava has opened four large veins and has much high-grade ore blocked.

The Butte Superior Copper Co. has begun shipments of zinc ore to the concentrator of the Basin Reduction Co. A railroad spur is also being built to the mine, and when completed shipments will be increased. However, at present the mine is not in good shape for a large production. The ore yields only zinc and silver. So far as copper is concerned results have been disappointing. The

Butte & Superior has acquired control of the Butte-Milwaukee and Butte-New York companies, owners of the Colonel Sellers group of claims, and has excellent prospects of adding a copper producer to its list of properties. It is now officially announced that the deal has been completed and that A. B. Wolvin and Theodore Hollister, of Duluth, are Butte & Superior representatives on the Butte-Milwaukee board. The Butte & Superior has started the cross-cut from the 1600-ft. level of the Black Rock mine to connect with the Colonel Sellers shaft at a depth of 1700 ft. on the latter property. The Colonel Sellers shaft is 630 ft. deep, and connection by raises will be made from the Black Rock cross-cut.

The Davis-Daly Copper company is not shipping ore at present, confining its work to development in the Colorado mine. As soon as the company can get a franchise from the city of Butte to build an electric tramway from the mine to the Great Northern railway, preparations will be made to resume shipping to the Basin concentrator. The shaft of the Colorado is now down 1850 ft. No more sinking will be done at present.

NEW YORK.

Copper Merger. — Nevada Consolidated and Ely Central. — Granby Consolidated. — Metal Market. — Guanajuato Development. — Santa Gertrudis.

While the interest in copper, both in the metal and in the share market, absorbs by far the major part of the public attention, the talk of a gigantic combination has largely died away. One of the big copper producers said today, that from data which he had recently been gathering he believed there was a heavier demand for copper now than at any previous period in history. There is no doubt that domestic consumers are beginning to buy for some months ahead much more generally than they have done at any time during the past year. A 14c. market may be counted as fairly well established, and with the export demand continuing strong and active, 15c. may be safely prophesied for both Lake and electrolytic copper. The shutdown of the mines at Butte, coupled with the curtailment which was attempted generally by the larger copper mines, is of no little aid in firmly fixing higher price-levels for copper. It seems to be generally accepted that Nevada Consolidated is not to be taken into the Utah Copper merger, but I am advised by cable today that, at the meeting of the shareholders of the Boston Consolidated, held in London, the shareholders of the latter company voted to ratify the consolidation with Utah Copper on the basis of two and one-half shares of Boston to one of Utah.

Regarding the Cole-Ryan group, it is now stated that a new plan has been arranged, contemplating the formation of a company which will buy the Cole-Ryan properties and the mines of the Amalgamated Copper Co. outright. Nothing definite has been done, further than to consider the purchase of the larger properties of the Amalgamated, which, if the deal is consummated, will be paid for in stock so far as the Amalgamated interest is concerned, thus wiping out the old companies and giving Amalgamated a controlling interest in the new organization. As outlined, the terms of the transfer will include the alternative of stock or cash in payment for the properties of the operating companies, so as to obviate the objections of any minority shareholders.

The situation at Ely seems to be somewhat complicated, and a merger of some of the larger companies with minor developing concerns is mentioned. I was told today that James Phillips, Jr., of the Nevada Consolidated, has asked for a figure to be given him on 850,000 shares of Ely Central. The trade by which Ely Central is to be acquired is part of a larger deal, which contemplates a fusion of the friends of Mr. Phillips in the Nevada Consolidated with the Cole-Ryan interests and the purchase by the new allied forces of the Guggenheim holdings in Nevada Consolidated at a price said to be $40 per share. This move, if completed, will make Ely decidedly a Cole-Ryan camp, as the International Smelting & Refining Co. would undoubtedly take over the big reduction works at Steptoe. A diplomatic denial of any such contemplated deal was issued by Mr. Phillips' office, but it is quite apparent that some such shifting of interests is contemplated. Inasmuch as Mr. Phillips and his friends seem to have been able to dominate the Nevada Consolidated to the extent of blocking the absorption by Utah Copper, it is but natural that, for the sake of harmony, the Guggenheims should prefer to get out.

The Granby Consolidated Mining & Smelting Co., Ltd., is issuing 13,500 shares of capital stock heretofore held in the treasury. Stockholders are given the right to subscribe at $85 to the extent of 10% of their present holdings. The issue is made on account of heavy expenditures on the Granby property, and the company's Crowsnest Pass Coal property. In the share market the issues in which the General Development Co. and Adolf Lewisohn and his friends have a controlling interest, have been pre-eminently the leaders. Miami, Ray Central, Keystone, British Columbia, among the coppers, and Kerr Lake among the cobalts, have all been active and have scored marked advances. Braden Copper shares and bonds have been listed upon the London stock exchange and the securities are to be distributed upon the market there.

E. G. Hothorn, of the firm of L. Vogelstein & Co., American representatives of Aaron Hirsch & Sohn of Germany, leading metal dealers and brokers, in New York City, takes an optimistic view of the metal market for 1910. The heavy export demand for copper in December and a general return to activity among domestic consumers shows that consumption is creeping up on production and that a very encouraging showing may be expected when the figures of the Copper Producer's Association appear. Viewed as a whole, Mr. Hothorn says the market is in a clean and healthful condition, and a greatly increased demand with higher prices ruling may be expected in 1910. He also says that one effect of the enforcement of the new pure food law has been greatly to increase the consumption of pure white lead, and thereby has been created an enlarged demand for lead bullion, which enjoys just at present a strong market. The American consumption of tin is much greater just now than ever before in the history of the market, and prices are higher on a steadily increasing demand. Production of spelter continues to run about 10% ahead of consumption, but the outlook is good, and the accumulated stocks have been practically all absorbed.

It is stated that the Consolidated Arizona Smelting Co., which controls the old smelter at Humboldt, Arizona, has made a contract with the United Verde to handle some of the ores from W. A. Clark's mine. It is doubted whether the report is correct, but it carried sufficient weight to cause a considerable advance in the smelting company's shares.

The Proprietary Mines Co. of America has been advised by wire from Guanajuato that a rich strike has been made in the face of the Nopal vein of the Nueva Luz mine on the 300-ft. level, the ore running 60 kilograms of silver per ton. The Guanajuato Consolidated Mining & Milling Co. reports a gross production for the month of November of ₱115,500, less working expenses, ₱80,900; net ₱34,600, of which ₱10,100 was expended in development.

Among the metals lead and zinc ores have been ruling slightly lower, zinc sulphides averaging $47 to $49 per ton for 60% ores; zinc silicates averaging 40% zinc, bringing $26 to $28 per ton. Average price for lead last week was about $56 for 80% ores.

The shareholders of the Camp Bird, Ltd., have voted unanimously to accept the proposition to take over the Santa Gertrúdis y Guadalupe. The resolution adopted by the shareholders is, that the company authorize the formation of a separate company to acquire the option over the Santa Gertrúdis, and that the capital of the company be increased to £1,350,000 by the creation of 250,000 additional shares of £1 each. Camp Bird's present capital stock is 1,100,000 shares, of which 820,000 have been issued. This gives the company a present treasury reserve of 280,000 shares, which, with the authorized increase, will make available 530,000 shares of treasury stock, which will presumably be offered to the shareholders at something better than par, and a little under the present market.

General Mining News.

ARIZONA.

COCHISE COUNTY.

The hoist at the Peacock Copper Co.'s mine at Johnson has been installed. A carload of lumber for the mine buildings has been shipped to the company and two carloads of ore are on the dump for shipment to the smelter.——Operations are to be resumed at the old Peabody mine which has been idle for the past two years owing to litigation. The property is credited with a production of over $2,000,000 from the upper levels.——The Johnson Copper Development Co. is installing a 10 hp. Fairbanks-Morse gasoline engine and a 10 by 12 in. compressor.

GILA COUNTY.

(Special Correspondence.) As soon as a double-drum hoist can be installed at the No. 4 shaft of the Miami Copper Co.'s property, sinking will be resumed to increase the depth of the shaft from 450 to 700 ft. When production begins all the ore for the concentrator will be hoisted through the No. 4.——The Star churn drills being used on the Inspiration Copper Co.'s property have put down 23 holes since last spring. This drilling has been done to prospect the ground between the Scorpion and Joe Bush shafts, a distance of 2400 ft.——Sinking will be resumed at once on the McGaw shaft of the Superior & Boston property. This shaft is now at the sixth level and will be the main working shaft of the mine. A 1000-gal. Prescott pump is being installed on the sixth level. The Superior & Boston mine is in a position to ship 100 tons of ore daily were it deemed advisable to begin production immediately.——The Star churn-drill to be used for prospecting the Cordova Copper property has arrived and will be set up for drilling the first hole at the Jennie shaft. The drill will continue the prospecting of this ground from the present depth of 125 ft. at which shaft-sinking has been discontinued. At this depth, the assays were 2% copper. Granite-porphyry is the formation thus far opened by this shaft.——The Duquesne Mining Co. has placed a block of its stock on the local exchange. John F. Shaw, the president, has selected the position for a double-compartment shaft and expects to begin this work as soon as the necessary arrangements can be made. Several shipments of gold ore have been made from this property since development work was started last August. The average gold content was $32 per ton. Indications are favorable for the development of a copper mine at depth.——The churn-drill prospecting on the Boston-Miami property of 42 claims is giving satisfactory results. F. W. Hoar, the superintendent, has 35 men employed.

Globe, January 7.

YAVAPAI COUNTY.

Operations are to be resumed at the old Comet mine in the Walker district, re-christened the Snow Flake. The mine has a good record for ore produced from the upper levels before the sulphide zone was reached. New equipment has been purchased and new buildings are being erected by the Snow Flake Mining Co.——A test shipment of 15 tons of ore and 2 tons of concentrate from the Black Diamond property, in the same district, netted the owner, David Booker, $57 for the ore and $60 for the concentrate. The shaft is down 90 ft. on the vein and the mine is to be equipped with a hoist in the near future.——John Duke purchased the Alta group in the Bradshaw mountains for $10,000.——The shaft at the Money Metals in the Black hills has been unwatered and a cross-cut started from the 200-ft. station.——The claims against the Standard Exploration Co., operating the Treadwell property in the Big Bug district, have been settled, and it is probable that the Treadwell smelter at Mayer will be re-built this spring. David Miller is president of the company.——An 18-in. vein has been opened on the Arizona Copper Belt property at Constellation, and the company is to resume work on the mill next month.

CALIFORNIA.

AMADOR COUNTY.

(Special Correspondence.) The South Eureka is disbursing monthly dividends at the rate of 2c. per share, making a total of $8000. Twenty stamps are in operation treating the ten leased from the Central Eureka. The vein on the 2700-ft. level is said to be 10 ft. wide and is good milling ore.——The hanging wall vein has been cut on the 2300-ft. level of the Kennedy. It is 5 to 6 ft. wide. The 150-ft. west drift is expected to intersect the foot wall vein within 150 ft. In the mill 100 stamps are dropping steadily.

It is reported that the Bunker Hill expects to add ten stamps to its mill in the spring.——The Garibaldi placers are being operated during the winter.——George Hamblet and associates have purchased the Ghiocchio claim and have commenced shaft sinking. George Hamblet is manager.

Operations have been resumed at the Mitchell. Several men are employed.——The Argonaut, Bunker Hill, Kennedy, and South Eureka are declaring regularly monthly dividends.

Jackson, January 10.

O'Donnel, Weiss & Kristovich who purchased the Dane & Mitchell mine at Pine Grove recently, have taken over the Blakely place of 160 acres. Ten stamps and a cyanide annex are to be added to the mill.

BUTTE COUNTY.

The Butte Magalia Consolidated Mining Co. has purchased the Cohn property near Magalia and is driving an adit to tap the channel. The company now has about 1000 acres along the trend of the channel which will be worked as a drift mine.——The Cohn & Gooday shaft has cut the gravel at a depth of 500 ft. on the incline and will now be sunk on the rim till the bottom of the channel has been reached.——The Mammoth Channel Mining Co. has installed new machinery and is sinking.——The adit at the Magalia Consolidated is now in about 200 ft. and is expected to open the channel within the next fifty.

CALAVERAS COUNTY.

The Boston mine, three miles from Mokelumne Hill has been bonded to Eastern capitalists and will probably be reopened.——Operations have been suspended at the Easy Bird mine.——The Washington mine, near Murphys, is being unwatered by John Campbell.

INYO COUNTY.

The main adit at the Casa Diablo mine cut the Granite Mountain vein recently when in 850 ft. opening a good body of ore which is now being put through the mill. On the level 100 ft. below the adit the drift has cut the shoot on the Dry Bone vein, two assays from samples taken across the face for a width of 10 ft. running $29 and $38 per ton. The drift 100 ft. below this is expected to intersect the ore shortly.——The New Coso Mining Co. has installed a 70-hp. gasoline hoist and is shipping 90 tons of ore per week to the smelters.——The drift on the lowest level of the Four Metals company, operating on Cerro Gordo hill, has opened a good body of galena ore.

KERN COUNTY.

Two new 7-ton engines and twenty-one 3-ton cars have been added to the equipment at the Yellow Aster mine at Randsburg. In the mill 130 stamps are kept dropping, the cost per ton for treatment averaging less than $1.50.

MARIPOSA COUNTY.

A 2-stamp mill is being erected by Joseph Kolbach at his property on Saxon creek.——Operations have been resumed at the Santa Rosa property.——A 100-ft. shaft is to be sunk on the Santa Clara group in the Mariposa district.——J. C. Horsley and James Leonard have secured a bond on the San Jose mine at McCabe's Flat. Considerable rich ore has been taken out of pockets on the property.——J. W. Graham is installing 350 ft. of pipe at the King Solomon mine, near Briceburg, to furnish water power for the 4-stamp mill erected several years ago. Mr. Graham and M. G. Wilson are contemplating the erection of a power-plant on Bear creek to furnish power for the Santa Rita mine and mill.

NEVADA COUNTY.

A drift has been started on the vein at the Sunshine property in the Washington district that, when completed, will give from 500 to 700 ft. of backs. The vein is on a contact between slate and serpentine; the ore averages $10 per ton. Frank Dillon is manager.——At the Red Point mine below Washington the old adit has been cleaned out and some high-grade quartz found.——A new shoot has been opened 300 ft. from the cross-cut adit in the Fairview mine assaying $30 per ton. The ore at this point is 10 ft. wide and cut at a vertical depth of about 500 feet.

PLACER COUNTY.

There are 40 men working at the Crater mine and the management expects to start the mill this month. Both mill and hoist are to be operated by electricity.——At the Orpheum 15 men are working and five stamps kept in constant operation.

SHASTA COUNTY.

(Special Correspondence).—Approximately 7000 acres of dredging lands on Clear creek, six miles south of Redding, have been bonded by Lewis Aubury, State Mineralogist, W. P. Hammon, and associates. The bond runs for a year and operations will be commenced at once.——The Mammoth Copper Co. is producing at the rate of over 3,000,000 lb. of blister copper per month. All five furnaces are in operation at Kennett and 1000 men are employed at the mines and plant. The bag-house is expected to be ready for service early in the spring.

Redding, January 10.

The contract for 250 ft. of sinking at the Reid mine is to be finished in a short time and cross-cutting will be started on the new levels. The bottom of the shaft will be 375 ft. below the present workings. An aerial tram to carry the ore across the Sacramento river and an electric hoist is to be erected by James Salee, the owner of the property. ——Another payment amounting to $45,000 has been made on the purchase price of the Milkmaid mine at French Gulch by Erik O. Lindblom, and the French Gulch Mining Co., incorporated by Lindblom & Soderberg. A 12 by 12 Gardiner air-compressor and 10-stamp mill are to be installed at once. The vein in the present workings is 5 ft. wide, and the ore plated $62.50 per ton on the last 20 days' run. J. J. Sheey is now superintendent of the property. ——G. W. Garwood and T. B. Straven have secured a one-year bond on the Sybil mine at French Gulch for $100,000. The bond stipulates that 50% of the value of the ore extracted is to be applied on the purchase price of the mine. ——The Silver Falls Mining Co., operating near Igo, shipped 45 tons of silver ore to the Mammoth smelter at Kennett.

SIERRA COUNTY.

The Ireland group of three claims near the Plumbago mine have been bonded to Fred Clark and the first payment made on the property. The mine has been closed on account of litigation for several years but is credited with a production of $200,000 from the upper levels. There are several veins on the group, one of which has been cut by an 800-ft. adit.——A shipment of 2800 lb. of concentrate to the Selby smelter from the Standard mine netted the operators, Bevins, Frye & Winrod, $2000.——The raise at the White Bear mine opened the channel on the rim and a cross-cut will be driven to tap the bottom of the gravel. A good prospect was obtained from the ground. John Costa is manager.

TRINITY COUNTY.

Reed & Chapman have opened a 12-in. ore-shoot on the lower level of their Lily of the Valley claim on Coffee creek that contains $60 free-milling gold and $400 gold and silver per ton in concentrate.

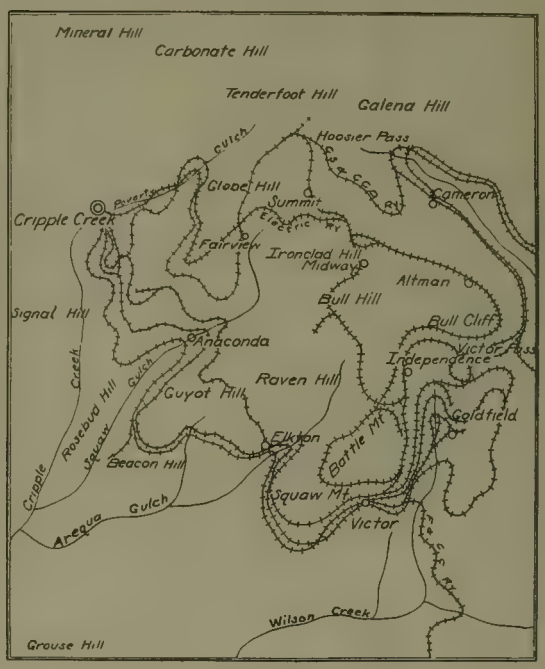
COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—Enlarged work is to be put under way next week at the Capital mine. During the past month over 4000 tons of mill-ore have been broken. This was during the time the concentrating plant was undergoing repairs. During 1910 on an average of 250 tons of ore per day will be treated. Shipments of smelting ore are also to be started.——The Boston Mining, Milling & Tunnel Co. will put work under way within a couple of weeks at the Kelly adit. The bore is to be driven for 5000 additional feet, making a total of 7800. F. R. Bromley will serve as manager.——The Centennial mine, situated on Leavenworth mountain, is being unwatered. Shipments of smelting ore have been started, the product netting from 2 to 3 oz. gold and from 15 to 20 oz. silver per ton. Work on the new 50-ton mill is to start March 1. D. Kennedy is manager.

Georgetown, January 8.

(Special Correspondence).—The mine of the Tanquay Mining Co. has been taken under lease by H. M. McGrew and the mill is being remodeled.——The Big Horn vein has been intersected by the Cymric adit at a distance of 1300 ft. from the portal, a body of smelting ore having been found that is from 7 to 10 in. wide.——During 1909 there



Cripple Creek District.

was purchased at the Chamberlain-Dillingham sampler 25,080 tons of ore for which $752,400 was paid.

Idaho Springs, January 8.

GARFIELD COUNTY.

(Special Correspondence).—Late reports indicate that the new camp of Goldstone in this county is proving as rich as was indicated by the rich float that was first found. Considerable work has been done on the Gray Eagle property, operated by the Western Investment Co., showing the vein to be over 2 ft. wide and to average $30 gold per ton. All the work on this property has been in granite and schist which are the predominating rocks in the district.

Denver, January 10.

GILPIN COUNTY.

(Special Correspondence).—E. Visintine & Co., leasing on the 150-ft. level of the Puzzle mine, shipped a lot of ore last week that milled 6.34 oz. gold and 6.34 oz. silver per ton, with 6.75% in copper. Stoping is in progress on a 3-ft. orebody.——An important discovery was made at the Topeka mine, in Russell district, a body of high-grade ore being found 100 ft. above the seventh level that is from 6 to 10 in. wide. H. P. Lowe is manager.——The Pine Comb property, in the Wide Awake district, has been secured under bond and lease by Eugene Shoush, representing Missouri capitalists.

Central City, January 7.

JEFFERSON COUNTY.

The North American Smelter & Mines Co. has secured the services of George G. Vivian, formerly manager of the Knight smelters, to manage the plant at Golden. Additional machinery has been ordered and a furnace of Mr. Vivian's design will be installed.

TELLER COUNTY.

S. H. Guyot and associates, of Boston, have secured a lease on the property of the Chesapeake Mining Co., on Battle mountain, and will install new machinery at the mine. Two shafts have been sunk to a depth of 100 and 210 ft., respectively, on the property and it is the intention of the lessees to deepen these at once and commence shipping ore, a commercial grade having already been opened.——The December dividend of Stratton's Independence amounted to $62,000.——The Dante Gold Mining Co. has determined to work the upper levels of its property by the leasing system, and has granted leases on several blocks.——The Portland and Strong Gold Mining companies have come to an agreement over the apex rights on the Black Diamond claim, thereby avoiding costly litigation. By a previous agreement, formed in 1906, the Portland company was to receive the right to work all veins dipping north and the Strong company all veins dipping south of the compromise line, while the last agreement provides that the Portland operators take all veins dipping east and the Strong people all dipping west of the north and south line dividing the Strong property from the Black Diamond claim. It also established a division of the ore already taken out.——Three companies, operating in the Cripple Creek district, have declared dividends for January: Portland, $60,000, Victor Consolidated, $45,000, and Pharmacist, $7500.

IDAHO.

BLAINE COUNTY.

(Special Correspondence).—The Eureka Development Co., Ltd., operating at Bullion, seven miles west from Hailey, will install new boilers, air-compressor, and hoisting engine, retimber the shaft, and overhaul the concentrating mill, all of which will require the expenditure of $50,000. In 1909 about 300 tons of ore was shipped that sampled 45% lead and 55 oz. silver per ton. W. A. Wilson, of Salt Lake, is manager.——The Red Elephant, belonging to the Quincy Mining Co., underwent some development during the past year, with J. G. Sawyer in charge. It is equipped with an air-compressor and has attained considerable depth by adits.——The Croesus is under lease to Riggs & Scobel.——The Nayaug, which is a zinc-lead property, has a shoot of pay-ore on its lower levels, and will be operated this year, with John Thomas in charge.——The Idaho Consolidated at Bellevue operated the old Minnie Moore and adjoining properties part of last year, treating the ore by both the wet and dry concentrating processes in the two mills. The lower workings in these mines have been unwatered and production on a larger scale will be accomplished in 1910. Under the management of I. E. Rockwell this property has been well equipped, the latest addition consisting of a hydro-electric power-plant on Wood river, from which power is derived for operating hoists, air-compressors, pumps, and the two mills.

Hailey, January 10.

LEMHI COUNTY.

(Special Correspondence).—The Kittie Burton mine at Ulysses, managed by R. L. Edwards, produced between $90,000 and $100,000 in 1909 in gold bullion besides considerable concentrate which will not be shipped until the Salmon River railroad is finished to that district. The 15-stamp mill is equipped with plates and tables.——The Musgrove mine, on Musgrove creek, 30 miles from Salmon, will be equipped with a mill and cyanide plant this year. The fissure vein in a slate formation is opened by adit-levels on the vein, the ore being a gold-bearing quartz. The driving of a 900-ft. cross-cut that will give 1000-ft. depth on the vein is planned for 1910. Brown & Edwards, of Salt Lake, are directing operations.

Ulysses, January 8.

KANSAS

CHEROKEE COUNTY.

(Special Correspondence).—A large underground channel about 25 ft. high and 300 ft. long has been penetrated again on the Hubbard land at Badger. In it is found a floor of soft limestone and dolomite sand, where large chunks of zinc ore, weighing several hundred pounds, have been discovered. Drifts are being driven in different directions from this open channel. The mill shaft has been supplying ore from the more shallow levels, but the lower runs are being opened in other shafts. The mill has recently been improved with new machinery.——Ore has been found on the Foster land at Galena at the depth of 60 ft. Drill prospecting will be continued though development will also be pushed.——The old Cyclone tract, once a famous galena producer, is again the scene of a discovery at 75 ft. The find in every respect resembles the old workings, the ore consisting of very large chunks of free high-grade zinc blende. The find was made in an old shaft which was retimbered and sunk deeper.——A discovery has been made on the Smith land at Cave Springs by Bob Sloan and associates at a depth of 75 ft. Both lead and zinc are found. Hand jigs have been installed and the ore will be treated on these until it is learned whether the extent of ore will warrant the building of a mill.——The Nymo company, formerly the Waterhouse, is now operating the new mill, supplying it with ore from three shafts. The shafts are 60, 70, and 80 ft. deep respectively, but the shallower two will be sunk deeper. Underlying the pocket-ore there has been found a run of disseminated mineral similar to other properties in the camp.

Galena, January 8.

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—Among the recent good discoveries, one in the Billy Sunday mine, northeast of Joplin, may be mentioned where a good body of zinc blende was found in several holes from 69 to 83 ft.——A large face of ore is being developed on the Gregg land in Tanyard Hollow where ore was found in three holes at 65 ft.——A Joplin company is developing the Rob Roy land where ore was cut at intervals from 50 to 110 ft., the ore in places running as high as 17%. Zinc blende predominates.——A new discovery on the Gussie K. lease, at Duenweg, has opened both galena and blende at 144 ft.——The owners of the Yellow Dog mine have started operations in half of the 1000-ton mill after a shut-down lasting since the beginning of the panic. W. O. Coats, former superintendent, is manager. The Little Pearl company has started its mill on the Continental ground west of Joplin, the ore being furnished from three shafts.——The Second National mine, at Alba, is ready for work again after being drained. This mine has a 150-ton mill which has recently been overhauled.——Among the important deals closed the past fortnight, the largest, perhaps, is the sale of a lease on the Taylor & Glover land, west of Joplin, to Nixon & Burlingame, of Ohio, the land bringing $50,000. A shaft is in ore and a general deposit found in 15 drill-holes. Work will begin immediately on a 300-ton mill, to be fitted throughout with electrical equipment. During its erection the ground will be thoroughly opened.

NEWTON COUNTY.

(Special Correspondence).—In the Granby camp the Lady Bird Co. has taken over leases on the Bill Miller and Old Timer leases and will develop them at once. A shaft is being sunk on the Miller ground and a mill will be started shortly.——In the vicinity south of Scotland in the northern part of the county, two tracts of land which have hitherto been unprospected, are being found to be well mineralized. The Shifferdecker 400-acre farm is being developed and a shaft is going down upon a drill-hole which drilled into ore at 100 ft. continuing more than 20 ft. A number of holes cut similar runs.——On the Granby land, near by, Crossman & Bucher have found ore in a drill-hole from 88 to 99 ft. Other holes will be sunk before a shaft is started.——In the Spring City camp Frank Malang and others are developing a tract of the Allen land in the north-

ern part of the camp and are now sinking the fifth shaft, having four in ore at 100 ft. The ore is mainly zinc blende though good lead is being penetrated at shallower levels in the fifth shaft. There are several large dump-piles awaiting treatment but no ore has been cleaned as the company is to erect a large mill. The best part of the ore shows a 14-ft. face.

Granby, January 8.

NEVADA.

CLARK COUNTY.

The quarterly report of the Quartette Mining Co., at Searchlight, shows that the company has been producing at the approximate rate of $1000 per day.——A lot of 46 tons of ore from the Chief of the Hills lease at Searchlight was put through the Cyrus Noble mill resulting in a $2500 gold bar. The lessees have about 75 tons now ready for the mill and will start an adit farther down the hill to open the ore at greater depth.——The east drift on the 50-ft. level of the Sunday group opened a shoot of $50 ore. The vein is about 4 ft. wide, but the ore is only 1 ft. in width. ——A whim has been set up at the Duplex Extension shaft and sinking resumed at the depth of 90 ft.——The drift on the third level of the New Year's Gift lease opened 30 in. of ore that assays $40 gold, with a small amount of copper. A stope will be started and the ore shipped to the smelter.

ESMERALDA COUNTY.

The new Chilean mills and concentrators recently installed in the Consolidated mill are in operation, and the management hopes to break all records with this month's production. The Clermont vein is supplying a large amount of ore for the mill, and it is expected that this source will be increased shortly when the west cross-cut on the 1000-ft. level opens this vein.——The shaft of the Goldfield Annex on the Polverde claim cut a body of low-grade quartz at a depth of 750 ft. The management hopes to open the Clermont vein at about the 900-ft. level.——Lessees on the Gold Bar have cleaned out the old workings and succeeded in opening a new shoot, the ore from which is being shipped to the Nevada Goldfield Reduction Works.——The Grizzly Bear shaft is down 800 ft., the Big Florence lease, on Atlanta 730, the shaft of the Merger Mines Co., is being unwatered to continue sinking to the 600-ft. level, and the tendancy of the whole district is to explore the ground at greater depth.

LANDER COUNTY.

(Special Correspondence).—The Austin Manhattan Co. is arranging to install a 60-hp. gasoline hoist at the Ophir shaft and will sink to greater depth.——Driving on the Panamint vein from the 800-ft. level of the Lander Hill shaft is opening good ore and the drifts on the 200-ft. level of Jackpot have cut a shoot assaying $60 per ton gold, with a high silver content. On the Patriot good ore is being stoped in the recently unwatered levels. The Maricopa Leasing Co. is developing the Patriot under lease from the Austin Manhattan. New machinery will be installed shortly. ——The cross-cut adit at the Austin Nevada has been reopened for 550 ft. and exposes five distinct veins.——The Peerless lessees report the uncovering of a 12-in. shoot of $500 ore on the foot-wall of the main 4-ft. vein.——The Shoshone Quicksilver Co. is opening several veins of high-grade cinnabar. A furnace will be installed this spring.—— C. J. Kinchel and associates of Oakland, California, have bonded a group of claims adjoining the King Midas. Drifts will be driven to cut the main vein.——The Murray lease on the Valley View claim of the Nevada-Omaha estate, has opened 18 in. of ore assaying $70 gold per ton.——The Hanks lease on the Buzzard reports 12 in. of ore assaying $250 gold per ton.——The Bannock Mining & Leasing Co. has opened a new vein from 4 to 6 ft. wide. The small vein of high-grade ore in the shaft is holding out with increasing depth.

Austin, January 6.

LYON COUNTY.

The first train over the Mason Valley railroad reached Yerington January 14, and is expected to be in Mason City before the end of the month.

NYE COUNTY.

The east drift on the 1100-ft. level of the Tonopah Belmont has been extended for 60 ft. along the shoot proving it to be 8 ft. wide and have an average assay of $60 per ton.——The record for development work at the Tonopah Mining Co. was broken the first week of the year with a total of 618 ft.——The cross-cut in the hanging wall on the 390-ft. level of the Montana Tonopah mine opened 3 ft. of good milling quartz.——The December production of the Round Mountain Mining Co. amounted to $35,000. The threatened litigation between the Round Mountain company and the Round Mountain Red Top has been avoided by the former company taking over the latter's property and issuing the stockholders 60,000 shares of Round Mountain stock.

General View of Goldfield.

WHITE PINE COUNTY.

The Steptoe Valley Smelting & Mining Co. is installing a new Nordberg blower in the new unit of the plant as a reserve in case of damage to the present air supply. The new machinery will be erected at a cost of approximately $75,000.——At the Ely Central the Clipper shaft is in ore and the Eureka shaft is expected to enter the copper-bearing porphyry within the next 40 or 50 ft.——The Emma shaft of the Boston Ely is now down 1110 ft., and has been in ore assaying from 1 to 3% copper with 60c. to $2 gold per ton for the last 45 ft. A drift will be run on the 1150-ft. level to the jasperoid at which point the management expects to open good commercial ore.——The raise at the Giroux broke through to the surface January 6, after six months' continuous work. The shaft is the largest in the district, being of five compartments, and sinking will be started at once to reach the 1200-ft. level.

OREGON.

BAKER COUNTY.

(Special Correspondence.—The one-furnace copper smelting plant situated at Sumpter, which was sold at receiver's

sale some time ago and bought in by interested parties probably will be in operation again in the next few months.

The E & E mine at Bonanza is being put in condition to operate again under the superintendency of John Thomas.

The Highland situated two miles from the old Baisley-Elkhorn, is operating with a force of about 30 men with P. J. Greene in charge. Since August 20, the property has shipped 257 tons of ore which brought $18,430 net, at the Tacoma smelter. Work has commenced on a projected 3000 ft. cross-cut that will open the vein 600 ft. below the present working adit level. An electric-power line is close by and a 6 drill air compressor may be installed.— The Iron Dike mine, at Homestead, close to the Snake river, has been purchased by the Lewisohns, who have had a force of men at work for some time under direction of W. B. Fisher, of Salt Lake, developing and exploring. This is reputed to be an important property, fairly well developed by adit levels, showing a body of copper pyrite 95 ft. wide in places, containing 3½ to 4% copper, with some gold and silver in a porphyritic lava gangue. A branch of the Oregon Short Line railroad has been built from Huntington down the Snake river on the Oregon side to Homestead, over which train service has been commenced as far as Copperfield, which is four miles from Homestead. This line passes close to the Ox Bow electric power plant, to be finished within a year, and which will be a useful factor in mining operations in this part of Oregon and in Mineral and Seven Devils districts, Idaho.— The Oregon-Idaho Investment Co., of Baker City, which is operating the Humboldt mine and mill in Mormon Basin, Oregon, is also developing the Arkansas mine at Landore, in the Seven Devils district, Idaho, where 200 tons of 20% copper ore were sacked and shipped in the earlier stages of work.

Baker City, January 6.

UTAH.

UTAH COUNTY.

(Special Correspondence).—The Miller mine, situated in American Fork canyon, 24 miles from the railroad, has been re-leased for the year to four miners who have been doing development work the last few months. It is an old property which has produced about $1,000,000 since it was located. It yields a silver-lead ore, with some gold. It contains 20 to 25% iron, 2 to 3% silica, and 10 to 25% lime, and is desirable at the smelting plants for flux. The Dutchman and Pittsburg, in the same locality, have been shipping ore, and the Mountain Dell has done considerable development.

American Fork, January 7.

WASHINGTON.

FERRY COUNTY.

J. L. Harper has paid $11,500 upon the Pearl Consolidated property which he is working on a $225,000 bond.

KING COUNTY.

Unusual interest attaches to the twelfth annual session of the Special Course for Mining Men at the School of Mines of the University of Washington, Seattle, from January 5 to April 5. The United States Government has just established a station at the school for instructing miners in the use of the Draeger oxygen apparatus for mine rescue work. The Government expert in charge of the station, Hugh M. Wolflin, and the State Coal Mine Inspector, David C. Botting, will give instruction to the special students on the subject of mine rescue work, mine gases, prospecting for coal, and the development of coal mines. Placer mining and the handling of water in pipes and flumes will be dealt with in a detailed manner to meet the demands of Alaskans who are adopting hydraulic or dredging methods. No examinations are required for admission to any of the studies, the object being to make them open to all persons who are engaged in mining or interested in that business. The university laboratories, assay furnaces, stamp-milling, concentrating, and mining machinery are used for making the various tests of ores and minerals. Special instruction will be given by the following well known men, in addition to the two already mentioned and the regular members of the University staff: Harvey Glenn, assayer, United States assay office Seattle; Roger S. Taylor, superintendent of copper plant Tacoma Smelting Co.; George Jamme, coal mine operator; Henry Landes, State Geologist. Eleven studies are given, but each student may select those he wishes to follow, up to the limit of four or five studies. The registration fee is $5. There are no other charges except the deposits in the laboratory courses to cover the materials actually used. Books may be purchased or not as desired. For detailed information, address Milnor Roberts, University of Washington, Seattle.

CANADA.

BRITISH COLUMBIA.

(Special Correspondence.) The advent of the new year has not made any great change in Canadian mining, the companies carrying the work steadily forward and having as a rule good ore reserves to start with. The shipments from the various mining districts for 1909 were as follows: Rossland, 235,090 tons, Phoenix, 1,613,039, and Nelson, 331,455 tons. It is estimated that the total value of the provincial mineral output will be about $24,425,000, being an

A Portion of British Columbia.

increase of approximately $673,700 over that of 1908. The following is a statement showing the tonnages of ore smelted by the Consolidated Mining & Smelting Co. of Canada, Ltd., at Trail, since 1899. This gives a fair illustration of the expansion of both the lead and silver business at Trail:

	Copper.	Lead.	Total Tons.
1899	.....	.....	55,702
1900	91,194	13,615	104,809
1901	122,035	21,736	143,771
1902	56,793	15,539	72,332
1903	152,914	16,892	169,806
1904	139,760	18,197	157,957
1905	214,969	25,347	240,316
1906	238,983	18,102	257,085
1907	263,910	35,021	298,931
1908	266,579	51,895	318,474
1909	374,069	55,507	429,676

Rossland, January 7.

ONTARIO.

The first carload of ore from the Blackburn mine, near Elk lake, was shipped January 4. It consisted of 10 tons of ore worth about $1400 per ton, and 10 worth $700 per ton. The ore was hauled to the railroad on sleds and it is understood that the company has about $100,000 blocked out which will be shipped in the spring.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

LEON DOMINIAN is in Mexico.

G. G. VIVIAN is at Denver, Colorado.

W. A. SCOTT has gone to Los Angeles.

A. E. FIREBRACE is visiting Ouro, Bolivia.

C. C. LEHMAN is at Los Angeles, California.

W. H. GARLICK is at Los Angeles, California.

F. J. H. MERRILL is now at Nogales, Arizona.

H. F. COLLINS is at Valdelmusa, Huelva, Spain.

ALGERNON DEL MAR is at Philipsburg, Montana.

ROBERT LINTON is at Ocampo, Chihuahua, Mexico.

H. W. GARTRELL has gone to Adelaide, South Australia.

A. R. EICHLER has arrived in San Francisco from Sitka, Alaska.

WILLIAM OLIVER is at the Cinco Minas, Hostotipaquillo, Mexico.

HOWARD W. DUBOIS has returned to Philadelphia from Canada.

LESTER W. STRAUSS has returned to Lima, Peru, from Tecopilla, Chile.

JUAN FELIX BRANDES has gone to New York for a three months' sojourn.

H. W. TURNER has been inspecting a mining property at Copperopolis, California.

G. H. DOWELL is superintendent for the Old Dominion Copper M. & S. Co., at Globe, Arizona.

LEO VON ROSENBERG, of New York, has gone on an examination trip to Peru, South America.

R. B. MCCONNEY, general manager for the F. M. Davis Iron Works, Denver, Colorado, was at Salt Lake.

NED J. CHURCHILL, formerly with the Mammoth mine, is now with the Needles Mining & Smelting Co., Kingman, Arizona.

WALTER HARVEY WEED has disposed of his interest in the C. L. Constant Co. to CHARLES S. HERZIG, and has left New York for Ely, Nevada.

HENRY KRUMB, of Salt Lake, is consulting engineer for the Ray Consolidated at Kelvin, and the Inspiration Copper Co. at Globe, Arizona.

M. E. MACDONALD has left New York for Zacatecas, Mexico, to superintend the erection of a 150-ton mill and cyanide plant for the Zacatecas Mining & Metallurgical Company.

Obituary.

HARVEY A. SHIPMAN, who died January 3 at St. Luke's hospital, Denver, was born at Waukan, Wisconsin, in 1854. He was a graduate of Lawrence University in that State, and early devoted his attention to mining. His work on the Pacific Coast will be remembered especially in connection with his management of the Searles properties. In 1899 he was called to Colorado to take charge of the Stratton's Independence. He stayed there three years and then went to Australia. After three years he returned to Denver and took up general consulting work. A year ago he went to West Africa and it was then he contracted the fever which eventually led to his death. Mr. Shipman's career was not only long, but honorable, and was marked especially by ability displayed in management and reduction of costs.

Dividends.

The Rio Plata Mining Co., with offices at 175 Fifth avenue, New York, paid its initial quarterly dividend of 1½% on December 29.

On Wednesday, January 5, the Bunker Hill & Sullivan M. & C. Co. paid dividend No. 148 of $45,000. This makes the amount of dividends paid to date $11,331,000.

Market Reports.

LOCAL METAL PRICES.

San Francisco, January 13.

Antimony	12—12¾c	Quicksilver (flask)	50½—51
Electrolytic Copper	15¼—16½c	Spelter	7¼—8¼c
Pig Lead	4.95—5.00c	Tin	36—37½c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver per oz.
Jan. 6	13.68	4.70	6.18	52⅛
" 7	13.68	4.70	6.18	52¼
" 8	13.68	4.70	6.18	52⅜
" 9	Sunday.	No market.		
" 10	13.68	4.70	6.17	52½
" 11	13.68	4.70	6.17	52½
" 12	13.68	4.70	6.17	52⅜

ANGLO-AMERICAN SHARES.

Cabled from London.

	Jan. 6. £ s d.	Jan. 13. £ s. d.	
Camp Bird	1 8 0	1 9 0	
El Oro	1 7 6	1 7 6	ex div.
Esperanza	2 18 9	2 18 0	ex div.
Dolores	1 8 9	1 8 9	
Oroville Dredging	0 10 6	0 9 9	ex div.
Mexico Mines	6 0 3½	6 12 6	ex div.
Tomboy	0 18 0 ex div.	0 18 0	

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

SOUTHERN NEVADA STOCKS.

San Francisco, January 13.

Atlanta	$ 11	Mayflower	$ 4
Belmont	97	Midway	18
Booth	9	Montana Tonopah	88
Columbia Mtn	5	Nevada Hills	70
Combination Fraction	43	Pittsburg Silver Peak	85
Daisy	9	Rawhide Coalition	20
Fairview Eagle	14	Rawhide Queen	22
Florence	2.65	Round Mountain	58
Goldfield Con	7.75	Sandstorm	3
Gold Kewenas	6	Silver Pick	8
Great Bend	4	St. Ives	8
Jim Butler	10	Tonopah Extension	70
Jumbo Extension	14	Tonopah of Nevada	6.62
MacNamara	27	West End	24

(By courtesy of the San Francisco Stock & Exchange Board.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices. January 13.		Closing prices. January 13.
Amalgamated Copper	85⅞	Miami Copper	26
A. S. & R. Co.	97⅛	Mines Co. of America	½
Boston Copper	20⅜	Montgomery-Shoshone	1⅛
B. C. Copper Co.	7⅞	Nevada Con.	26¼
Butte Coalition	27¼	Nevada Utah	1⅝
Cumberland-Ely	8½	Newhouse	3¾
Davis-Daly	3⅞	Nipissing	10⅛
Dolores	7¾	Ohio Copper	5
El Rayo	2⅞	Ray Central	3¾
Ely Central	2	Ray Con.	25⅞
First National	5¾	Superior & Pittsburg	16
Giroux	11⅞	Tenn. Copper	38¼
Guanajuato Con	1⅝	Trinity	10⅛
Inspiration	9⅝	Tuolumne Copper	3⅛
Kerr Lake	9¼	United Copper	8⅛
La Rose	4⅞	Utah Copper	56⅝
Mason Valley	3½	Yukon Gold	4⅞

COPPER SHARES—BOSTON.

	Closing Prices. January 13.		Closing Prices. January 13.
Adventure	8¼	Mohawk	69¼
Allouez	52	North Butte	41¾
Atlantic	11¼	Old Dominion	51¼
Calumet & Arizona	97	Osceola	162
Calumet & Hecla	670	Parrot	20
Centennial	35½	Santa Fe	2⅝
Copper Range	83¼	Shannon	16¾
Daly West	8½	Superior & Pittsburg	15¾
Franklin	17½	Tamarack	67
Granby	109½	Trinity	10
Greene-Cananea, ctf.	10¾	Utah Con	43½
Isle Royale	27	Victoria	5
La Salle	18½	Winona	14⅛
Mass Copper	7½	Wolverine	149

(By courtesy of J. C. Wilson, Mills Building.)

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EDITORIAL.

LAS DOS ESTRELLAS, one of the banner mines of Mexico, paid dividends during 1909 of $1,500,000 gold, making a total distribution to date of $5,280,000. The company was organized in October 1902. The original capital stock, amounting to $150,000, has also been repaid.

GUSHERS continue to be found occasionally in the Pennsylvania oilfields even after a half century of development. Early last month at Shumiston a 7000-bbl. well was brought in, the first of this size in this field since 1900. The high grade of Eastern oil makes a well of this size especially important.

REVISION of the mining law and enactment of adequate conservation measures as recommended in the President's message, ought not to await completion of the investigation of the Department of the Interior and of the Forest Service. The two matters have no such intimate relations as require delay in what after all is the more important.

BEGINNING with the New Year the *Electrochemical and Metallurgical Industry* assumes as its future title, *Metallurgical and Chemical Engineering*. This indicates a broadening of scope, and incidentally betrays a conviction that the invasion of electricity into the metallurgical field does not mean the exclusion of the old tried and trusted methods. Electricity is one of the new giants being trained to do the work of the world, but it is still on probation in many departments where dominance was rashly promised a few years ago. Our contemporary gains by its change of name.

ATTENTION should be drawn again to the efforts making in Germany to control the output of potassium salts. A bill was recently laid before the Federal Council of Prussia designed to create a trust of all the potash mines of that country, under the auspices of the Imperial Government. Its supporters advance Rooseveltian arguments for conservation of national resources in its defense. This calls to mind the proposal in this country to prohibit the exportation of phosphate. Reprisals are possible, it seems, and Germany will evidently make the first move in the game. A special investigation by the United States Geological Survey of the available resources of potash in this country would appear to be in order. For agricultural needs a supply can be obtained on a pinch by using pulverized granite rich in orthoclase. This is now being utilized in a small way. The potash is slowly liberated by decomposition in the soil. Many granites yield as much as 6 per cent K_2O. It would be difficult absolutely to starve out the farmer, so far as a supply of potash is concerned,

but potash is an essential article in many arts, and curtailment of the German exportations, which is now threatened, makes it imperative that we take account of stock, and also investigate and put an end to the waste of this substance that is now unrestrained.

INFORMATION from credible sources confirms the rumor that work on the 'Ely Route', so-called, from Goldfield to Ely, Nevada, will begin within the next sixty days, money having been provided by Mr. F. M. Smith of borax fame, and Bernheimer & Company of New York, to complete the initial 100 miles from Cuprite, by way of Golden Arrow, to a point from which branch lines will be built north and south respectively to Tybo and Reveille. A warrant for the immediate construction of the road exists in those districts, where Bernheimer & Company expended more than a million dollars in the development of lead-silver and copper ores. Large reserves are blocked which are claimed to average above $20 per ton. A smelter at Tybo some years ago produced over three million dollars' worth of doré bars. The construction of the projected railway will greatly enlarge the area for profitable prospecting in the sage-brush State.

The Humphrey Ship Subsidy Bill.

Our calcitrant correspondent writing upon ship subsidies in another column of this issue, calls attention to the deficient earnings of the Japanese subsidized lines, and points out that only a third of the tonnage carried is of Japanese origin. This we believe to be true; and we also understand that the Chinese have long maintained a boycott against the Toyo Kisen Kaisha, which cuts out the bulk of the possible east-bound traffic, while the Pacific Mail gets the lion's share of west-bound business from San Francisco by methods that need no explaining. We have given reasons why we believe an American merchant marine would benefit the miner, without attempting in a broad way to defend the principle of subsidies. It is a form of protection analogous to the tariff, but it tends also to lead a nation to desire at least a rational tariff, if not an open market. It lies counter to the imagined interests of the steel trust and other industries which high protection serves. Hence we find the representatives of these industries persistently opposed to a ship subsidy that shall be free for all, that specially favors no transportation companies, nor restricts the use of foreign-built craft. This fact is quite enough to cause those who oppose ship subsidies as a matter of political conscience, to inquire how it happens that they so readily, though unwittingly, turn up on the side of the protected trust-barons. It is also worth while to inquire why the railroad interests are not opposing the Humphrey bill now before Congress. In some respects it appears to have merit. It has eliminated most of the perils of legislation for special interests, but it limits payment of subsidy to American-built vessels—and few can be built and operated in competition with the foreigner. It provides for ships built according to plans approved by the Secretary of the Navy, and the contemplated mail contracts could not apply to any vessels now in commission. In short, it is a pretense at encouragement, a sop to make people believe that aid has been rendered to American shipping, when in fact nothing effective has been done. The steel trust dares not reveal how cheaply steel ships can be built abroad out of American-made steel. After so many 'steels' we might be tempted to utter a pun, but the humor of the situation is obvious without crude witticism. The Humphreys bill would create a sponge to absorb the foreign mail profits of the Post Office Department, and indirectly shield the protected steel makers. We join our correspondent in condemnation of present efforts to subsidize a merchant marine, but we fancy that no one could object to encouragement of shipping that would help to build up trade for our surplus manufactures and metallic products. To do this is to help restore the equilibrium between the agricultural and metal output of the country, the disproportion between which is one of the leading causes of the present high cost of living.

Mining Legislation in Illinois.

The report of the Illinois Mine Investigation Commission, made public last week, is definite and practical. Three principal recommendations are made: (1) provision for adequate fire protection in and around mines, (2) establishment of three mine-rescue stations, (3) founding and maintenance of 'Miners' and Mechanics' Institutes' under direction of the State University. The first of these is of greatest immediate importance, the second is admittedly palliative, but the third is likely to give the largest ultimate returns.

The necessity for better fire protection in and around coal mines especially, is now generally recognized. The Cherry disaster at least served the purpose of making clear to the public the imperative need of immediate change. The detailed plans proposed by the Commission are too long to be given here. In brief they include the provision of an adequate supply of water under suitable head, delivered by permanent pipes to the bottom of the shaft and for 300 feet along the entries, automatic sprinklers in the stables and at certain other points of danger, fire hose, buckets, fire extinguishers, and other standard apparatus, telephones and gongs throughout the mine, and a rigid system of alarms, of graded authority among mine officers at times of fire and accident, semi-monthly fire drills, and frequent inspection. In addition, all mines opened in the future are to be made fire-proof from the surface to a distance of 300 feet down the main entries. It cannot be doubted that if the recommendations be enacted into law, as seems altogether likely, Illinois will have the safest mines, from the point of view of fire risk, in America.

The recommendation for the establishment and maintenance of three mine-rescue stations in the northern, central, and southern parts of the State, follows naturally from the recognition of the value of the work done by the Urbana corps and the prohibitive expense involved in adopting the foreign requirement of a supply of rescue apparatus at each

colliery. It is proposed that the State stations shall in the main, take over the work of training men for rescue work, leaving the Federal station at the University to carry out its primary function of investigation. These general measures, having to do with present conditions, are supplemented by a recommendation that the University of Illinois be required to take up the general work of providing better educational facilities for the men in the mines by institutes, lectures, correspondence courses, or any other means likely to be helpful. It is pointed out that the State sets certain educational standards for inspectors, mine managers, and other officers, and yet provides no means by which the men, who have usually left school at an early age, may attain them. The difficulties and dangers, too, incident to the rapid introduction of uneducated foreigners in the mines are indicated, and the need of special educational facilities urged.

The proposed law has been elaborated with great care by a mixed commission, including representatives of the operators, the miners, the University, the public, and the Technologic Branch of the United States Geological Survey. Officers of the Chicago Fire Department and of the Underwriters' Laboratories have co-operated in its framing, and it may fairly be said that few bills have been written after as careful a study from scientific, practical, and commercial standpoints. The report as a whole evidences intelligent and paintstaking care in its preparation, and is a credit to the members of the Commission. The Governor, Mr. C. S. Deneen, has transmitted it to the General Assembly with his endorsement, and there is strong probability that the laws asked for will be promptly passed.

Internationalization of Manchurian Railways.

In our review of Far Eastern conditions at the beginning of the year, we pointed out that interest was for the present centered largely in the railway situation. At other times we have shown that the whole problem of export trade and of a merchant marine is inextricably tangled with railway rates, foreign and domestic. Both these facts lend interest to the note recently sent to the Powers by the Secretary of State, in which he has suggested the internationalization of the Manchurian railways. For the development of China many miles of trunk and branch lines are needed, and while the Chinese have shown exceptional ability in the management of railway lines, and while the final resources of the Empire are adequate to provide what they need, it is undeniable that prompt development calls for outside capital. Not every nation is willing to take the attitude of the Australians who sacrifice the present development of the northern part of the Commonwealth rather than imperil the future by decrease in the rigor with which they maintain a 'white man's country'. China has had unfortunate experiences with foreign loans; experiences which abundantly warrant caution and reinforce the natural desire of a proud people to provide for their own development. At the same time China is awake, and her public officials realize as never before the importance of promptness if the true interests of their country are to be served. The people of the United States in a similar situation, borrowed freely to build railways and make other improvements. Canada uses large amounts of British capital. Mexico is making good use of dollars wherever they can be obtained, and there is really no reason why the Chinese should not similarly benefit from the use of foreign money, particularly since the density of their population makes railways unusually profitable, and would enable the payment of the lower rate of interest which money demands in Europe and New York, without serious burden on the properties. The difficulty lies in the fact that he who borrows is to some extent and degree the servant of him who lends. In Manchuria both Russia and Japan now have strong footholds as a result of foreign money invested in local railway lines, and there have been many political entanglements. Not long since, when China suggested taking over the South Manchuria lines, the Japanese professed willingness to accept the offer, provided China should obtain the capital at home. The Japanese naturally objected to an arrangement which would result in their being merely supplanted by some other foreign nation which might provide money for the new securities. So long as any foreign nation dominates the railways of a particular part of the Empire and controls the railway rates, the situation will be full of danger, and the 'open door' be as much a stage property as though the custom houses were in the hands of one importer. Mr. Knox has suggested, as a means of meeting the situation, that both the Japanese and Russian lines in Manchuria be sold to an international syndicate, which furthermore shall provide funds for extensions and new lines. China is believed to be willing, and surprisingly general support has been enlisted. Russia, at first believed to be willing, now objects. Japan has not answered, but it is reported to be unfavorably impressed. If, however, the other nations agree, and that constitutes a large 'if', it is difficult to believe that the Japanese would find more advantage in refusing than in joining the new concert. It is intimated that strong American interests are ready at once to subscribe the part of the loan which might be allotted to this country, and it is also said that just prior to his death Mr. E. H. Harriman had been engaged in direct negotiations with Japan for the purchase of a large, if not controlling, interest in the Manchurian lines. The Southern Pacific, Pacific Mail, and South Manchuria, would have formed a highly effective transportation group, and would doubtless have proved a strong influence in developing American trade in China. That Mr. Harriman should have proposed such a combination is strong evidence of its value, and lends support to the belief that Americans will have part in the future development of the Empire. We believe it is purely a matter of time when the Chinese will decide to welcome rather than repel foreign help. When that time does come, an international syndicate will be better for them than the 'zones of influence' involved in the present plan. Provided that the syndicate include a sufficient number of nations, Chinese diplomacy may well be relied upon to prevent such complete harmony as might threaten native interests.

GEOLOGICAL DISTRIBUTION OF THE PRECIOUS METALS IN COLORADO.—II.

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

The Carboniferous limestone has proved a marvellous treasure-vault to the miners of Colorado, especially as regards silver. The discovery of the chief mining districts—Leadville, Aspen, and Rico—where this geological horizon has been exploited, has played an important part in the history of the State.[1] Leadville is situated on a terrace terminating one of the spurs reaching westward from the Mosquito range, near the headwaters of the Arkansas. The Mosquito range is a faulted mountain mass of Paleozoic beds, resting on pre-Cambrian granites and gneiss. The main fault reaches into the Leadville district, but there the displacement is "distributed on no less than six approximately parallel faults, making as many fault-blocks between the Arkansas valley and the crest."[2] In ascertaining the structure of the underlying rock masses, the miner has received incalculably valuable aid from the geologist.[3] Ore has been found at successive geological horizons, represented by pre-Cambrian granite, Cambrian quartzite (53),[4] Silurian limestone (50), Devonian quartzite (48), Lower Carboniferous limestone (46), as well as igneous rocks that have penetrated the whole series and covered them. Two porphyries are distinguishable, one is a white rhyolite and the other a gray monzonite. Both are of pre-Cretaceous age, and both occur in sheets, forming 'contacts' with the limestone formations. It is along these contacts and reaching downward from them that the greatest orebodies have been found. A typical cross-section on Carbonate hill gives the following thicknesses of formations, according to Emmons:

Local name.	Geological age.	Character of rocks.	Thickness in feet.
White porphyry	Pre-Cretaceous	White rhyolite porphyry	800
Blue limestone	Lower Carboniferous	Blue-gray dolomite	200
Gray porphyry	Pre-Cretaceous	Gray monzonite porphyry	50
Parting quartzite	Devonian	Coarse quartzite	30
White limestone	Silurian	Drab silicious dolomitic limestone	160
Lower quartzite	Cambrian	Mostly white quartzite	160
Granite	Basement complex or pre-Cambrian	Granite and gneiss	.....

The White porphyry and Blue limestone of the Carboniferous gave the celebrated 'first contact', and the Gray porphyry, when covering either the Parting quartzite (Devonian) or the White limestone (Silurian), made the 'second contact', equally famous in local mining history. Favorable positions for the deposition of ore were afforded near the under surfaces of the porphyry sheets, in the vicinity of dikes, and near sharp bends in the limestone, where a fold has passed into a small fault. The ore was deposited after the porphyry sheets were consolidated, but before the great structural faulting began, for the ore measures have been dislocated, and it is in finding the broken ends of the orebodies that geological study has proved of such economic value. At first it was supposed that the Blue limestone was especially favorable to ore, and particularly under the contact with the overlying White porphyry, but as exploration progressed it was proved that valuable orebodies existed within the mass of the Blue limestone at places away from the contact, also in the Gray porphyry, and within the White limestone. Finally, ore was found within the Parting quartzite and in the upper part of the Cambrian quartzite. No important discoveries of ore have been made in the lower part of the Cambrian nor in the Archean of the basement complex, although both are ore-bearing in neighboring districts (61 and 65).

In the text accompanying the foregoing table Mr. Emmons states that the porphyries *may* have been intruded during pre-Cretaceous time. If this were so, then my idea as to the post-Cretaceous age of the eruptives associated with the gold and silver deposits of Colorado would be destroyed and one more generalization would be thrown to the scrap-heap. But if it be true that all the eruptives associated with the occurrence of the precious metal within a region so large and important as Colorado, belong to a late period of geological time, then we have a striking coincidence, which might possibly prove to be a salient fact in ascertaining the origin or mode of formation of such ore deposits. Any dictum of Mr. Emmons is authoritative, so I noted his statement with regret. On writing to him, however, he shows that the evidence is not at all conclusive and, in fact, that he himself is willing to concede the probable post-Cretaceous age of the Leadville porphyry. In a letter to me he says:

"There are two points of view, that of the petrographer and that of the structural geologist. The former, reasoning from many facts similar to that which you mention, namely, that at Breckenridge the porphyries cut Cretaceous beds, say, that the Leadville porphyries must be of post-Cretaceous age. From the point of view of the structural geologist, on the other hand, since these particular intrusive sheets at Leadville were cut by faults, they must necessarily have been older than these faults. Now the principal one—the Mosquito fault—can be traced northward and westward fifty-odd miles beyond the Leadville map, but the latest sedimentary beds displaced by it, as far as I have observed, are the red Triassic sandstones. Where the fault ends, at the northwest end of the Gore mountains, as represented in the Hayden atlas, the Dakota Cretaceous color

[1] T. A. Rickard. 'The Historical Development of Colorado Viewed from a Geological Standpoint'. MINING AND SCIENTIFIC PRESS, February 29, 1908.

[2] S. F. Emmons. 'The Downtown District of Leadville, Colorado'. U. S. Geol. Surv. Bull. 320.

[3] S. F. Emmons. 'The Geology and Mining Industry of Leadville'. U. S. Geol. Surv. Monograph No. XII.

[4] These numbers refer to the table accompanying the first article of this series. MINING AND SCIENTIFIC PRESS, January 1, 1910.

Telescope Mtn. Dolores Mtn.

Rico, Colorado.

Aspen and West Aspen Mountain.

(which includes Jurassic) laps over across the line of the fault. This means that the fault already existed at the time these beds were deposited, and it must have been pre-Cretaceous. Unfortunately, there is no descriptive text of this portion of the Hayden maps, as Marvin, who did the field-work, died before he had time to write it up and no one has edited his material. I have planned over and over again to visit the place where this occurs, but in every case something has prevented, so that I am not able to verify this silent statement of the Hayden map, and until I do that I can have no absolute certainty. Cross considers the porphyries as post-Cretaceous, and Spurr distinctly states that they are of Tertiary age."

The ores of Rico (40) are found in lodes traversing a thinly bedded series of shale, limestone, and sandstone dipping into Newman hill. This series is a part of the Hermosa formation, as recognized by the U. S. Geological Survey.[5] The evidence of fossils has led A. C. Spencer to correlate this formation with the coal-beds[6] of the Pennsylvania division of the Carboniferous. The best ore is found under black shale and among thin lime-shales underlaid by sandstone-grits, forming a succession that presents a lithological likeness to the Weber series of the Middle Carboniferous as observed elsewhere in Colorado.

The sedimentary rocks are penetrated by porphyrite (the monzonite porphyry of the Survey), which was followed by movements that disrupted the ore-bearing veins. In the mine this porphyrite is not often visible (See Fig. 5), but it was undoubtedly the precursor of the thermal activity that was the prime agent in the deposition of ore.

The ore deposits are characterized by the occurrence of flat bodies of gold and silver-bearing zinc-lead sulphides lying at a definite horizon, which is marked by a zone of crushed rock; this zone is termed, by the miners, the 'contact'; it is disturbed and faulted by two distinct series of veins, which come up through the underlying beds. The relation between these two vein-systems and the 'contact', which is above them, presents a striking example of the manner in which the occurrence of ore is affected by geological structure.[7] Of the two series of veins, one (the Enterprise, Songbird, and Hiawatha) has a northeast strike and a nearly vertical dip. These are known as 'verticals'. They are crossed and faulted by a later system, which has nearly a northwest trend and a flat dip. These are termed 'cross-veins'. The 'verticals' are ore-bearing, the 'cross-veins' are not. Neither series reaches the present surface nor the surface of the Carboniferous formation, which is overlaid by Quaternary drift. The veins, therefore, have none of the usual outcrops: on the contrary, they break and fan out into stringers just below that zone of crushed rock which has been referred to as the 'contact'. See Fig. 1 and 2. The stringers or small branches, into which the veins scatter, are found to be connected with the ore-bearing horizon, which derived its name from a supposed resemblance to the 'contact' at Leadville. At Rico, however, while the 'contact' represents an ore-bearing zone, it does not form a continuous blanket deposit nor a wide-spreading ore-measure between an eruptive and a sedimentary rock; on the contrary, the ore occurs in narrow bands ramifying through the crushed sedimentaries in directions that correspond exactly to the *strike* of the veins underneath. I ascertained this relation in the course of actual mining, in 1894, when manager of the Enterprise mine. Moreover, it is a remarkable fact, that while the cross-veins are barren in themselves, they are, nevertheless, related to orebodies at the contact fully as rich as those connected with the ore-bearing series of veins.

The facts just summarized are illustrated in the accompanying drawings (Fig. 1 and 2), which represent a portion of the workings of the Enterprise mine, from surveys and observations made in 1894 and 1895. The plan shows how the ore-bearing veins are explored by the workings. The cross-veins are not followed by any workings save on the contact, because they become productive only at that horizon. The section illustrates how the cross-veins branch out at a certain level and are capped with the ore that follows the strike of the particular vein to which it is related. The 'verticals', or ore-bearing veins, act in just the same manner. Note, for instance, on the plan, how the ore above the Enterprise vein is projected to the west of the line of the vein by reason of the joint effects of an easterly dip and a difference of level. The irregular orebodies of the contact are indicated on the plan so as to show their connection with the vein-system. It must be borne in mind that the plane of the contact averages from 50 ft. (at the left or southern end of the drawing) to 115 ft. (at the other end) above the level of the workings shown on the map. The formation as a whole dips 15° southeast. The section will elucidate this point. On the plan it is easy to see how the orebodies are related to the different veins. The ore on the contact is indicated by stippling, and it spreads in bands and cross-bands, corresponding to veins underneath. Thus the contact blankets the whole system of veins and cross-veins, as well as the mine workings made in exploiting them. The reader should get this relation clearly in his mind. For example, the cross-veins A B, C D, and E F, are responsible for the biggest orebody in the mine; in the plan this body is seen to the south of the cross-veins that appear on the level, 48 ft. below. This orebody (W V to X Y) was first found by David Swickhimer, the original discoverer of the mine, who was searching for the Enterprise vein and thought at first that he had encountered a flattened portion of it. The ore had a thickness of three or four feet and a width of as much as 50 ft. It extended for 700 ft. in length across and above the ground traversed by the Enterprise, Songbird, and Hiawatha veins, connecting with other orebodies on the contact that corresponded to these veins, as the drawing illustrates. The next two

[5]Whitman Cross and Arthur Coe Spencer. 'Geology of the Rico Mountains, Colorado'. U. S. Geol. Surv. Twenty-first Ann. Rept., pt. 2, pp. 15-165, 1900.

[6]The coal measures of Colorado are chiefly in the Laramie beds, belonging to a transitional Cretaceous-Tertiary formation.

[7]T. A. Rickard. 'The Enterprise Mine'. Trans. A. I. M. E., Vol. XXVI.

Fig. 1.

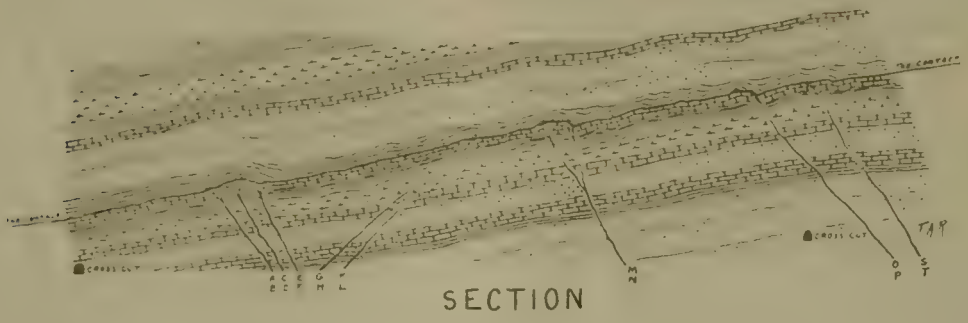


Fig. 2.

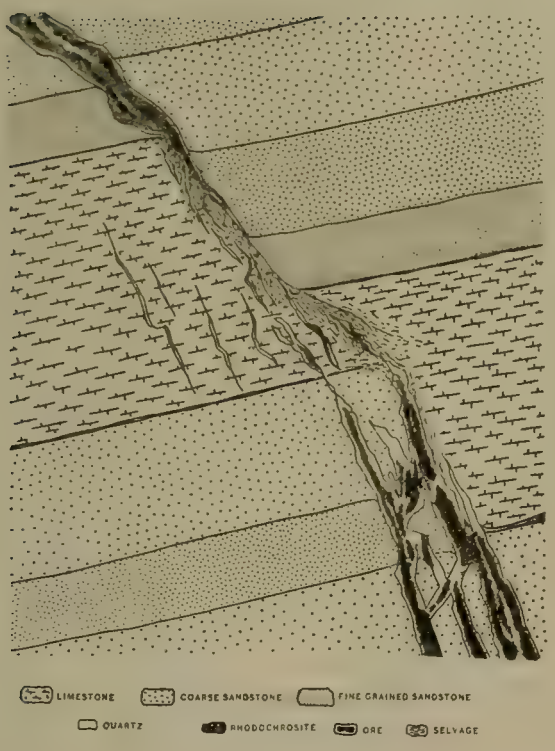


Fig. 3. A Vertical.

Fig. 4. A Cross-vein.

cross-veins, G H and K L, dip in the opposite direction to A B, C D, and E F, so that the ore corresponding to them is thrown 70 ft. northward, at K' L' (See plan and section). The other cross-veins can be traced in a similar way to the various orebodies on the contact having a NW-SE strike, as distinguished from the contact orebodies having a NE-SW strike, which are connected with corresponding members of the other or 'vertical' series of veins.

The dislocation of the ore-bearing veins by the cross-veins is a marked feature of the workings. As the plan shows, the faults are numerous but exceedingly variable in the amount of throw, ranging from a mere deflection to 20 or 30 ft. The direction of the throw was found, in each case, to be in accord with recognized rules of faulting and this feature did not seriously impede mining. It is interesting to note that the cross-veins O R and S T throw the Hiawatha and Songbird veins in opposite directions and toward one another by reason of the contrary dip of these two ore-bearing veins. Another result is to cause a junction of ore on the contact above these veins going north. Note also how the change in the dip of the Songbird vein, between U and Z, causes the transfer of the corresponding ore on the contact, related to that vein, from one side to the other.

The ore obtained from the contact was rich, averaging 3 to 4 oz. gold and 200 to 500 oz. silver per ton. It was essentially a mixture of sulphides, chiefly zinc blende, galena, and iron pyrite. The blende was of that straw-colored variety to which the name 'resin zinc' is often given. The gold was discernible occasionally. The silver occurred as sulphide, argentite, and to a less extent as stephanite, an antimonial sulphide. Of the 4½ to 5 million dollars yielded by this mine, about one quarter has been in gold and three quarters in silver.

In the 'vertical' veins, as distinguished from the contact, the mineralization differs. The preponderance of zinc is less marked, the pyrites of iron and copper are relatively more important, but the chief difference lies in the fact that the gangue is less metallic, that is, the sulphides form a small percentage of the ore, which is composed of a matrix of quartz and the carbonate of manganese, rhodochrosite. The last, on account of its marked color, is a beautiful feature of the workings, occurring in streaks, which alternate with quartz and cross the black beds of shale and limestone like pink ribbons. Comb structure is frequently observable.

The horizon at which the veins cease in their upward course, where also the flat bodies of ore are found, has been referred to as the 'contact' because that is the term used by the miners. At the time of my study of the vein-structure I recognized this 'contact' as a zone of crushed rock, characterized by three principal features, namely, brecciation, pulverulent lime, and gypsum. Since then the Government survey of the surrounding region has demonstrated the existence in the Hermosa formation of a persistent bed of gypsum situated at a horizon corresponding to that of the ore-bearing zone of Newman hill; therefore A. C. Spencer, to whom the recognition is due, has made the ingenious suggestion that the pulverulent lime, which is so characteristic of the contact, represents the remains of gypsum that has undergone incomplete dissolution.[8] This idea harmonizes many of the seemingly contradictory features of the ore-occurrences as described in the earlier papers by John B. Farish[9] and myself.[10] The pitted and cavernous condition of the gypsum bed to be seen in the eastern part of the Enterprise mine, the juxtaposition of the powdery remnant, and the choice of this horizon as the place of ore deposition are all explained by the existence of this soluble layer of calcium sulphate.

Above the 'contact' there comes finely laminated black shale, succeeded upward by shattered layers of sandstone and limestone. This ground has suffered from lateral shifting, which, more than actual vertical rupturing, represents the dying out of the faulting associated with the formation of the vein-fractures, much in the manner illustrated on a smaller scale in the occurrence presented in Fig. 7. Under the contact comes a layer of blocky limestone, below which succeeds a series of thin beds in which black shale predominates; these give place in depth to a succession of limestones, shales, and sandstones, of which sandstone becomes more and more frequent.

In this description, only the vicinity of the contact, which includes the uppermost portion of the two vein-systems, has been considered. It remains to state that the cross-veins are usually barren save where they include fragments of vein-stuff torn off the edges of the ore-bearing veins, at the places of intersection and faulting. The ore-bearing veins themselves become unproductive at a depth varying from 75 to 150 ft. below the horizon of the contact. They are intercepted by an adit called the Lexington Tunnel, at a level 400 ft. below the Enterprise workings, and at this depth they appear as barren veins of white quartz, traversing beds of light-gray coarse sandstone. Thus the impoverishment coincides with a change in the enclosing country. Black shale, which predominates in the productive zone, gives place to a light-colored sandstone in the unproductive. Moreover, the rhodochrosite that characterizes the veins higher up, disappears entirely in depth. The valuable sulphides also become conspicuously absent and a scattering of iron pyrite is all that remains to remind one of the lavish mineralization to be seen in the ore-bearing horizon. While rich ore is not found in any marked relation to the porphyrite penetrating the ore-horizon, there is good reason for associating the deposition of the ore with the thermal activity following upon irruptive movement. The Rico porphyrite penetrates beds of Cretaceous age, so the ore deposition was probably early Tertiary.

I have thought it well to reproduce these drawings, because they illustrate the practical application of geology to mining. The fact that the enclosing formation is Carboniferous and the porphyry post-Cre-

[8]Op. Cit., pp. 49 and 52. The material which I called "pulverulent lime" is described by Mr. Spencer as "peculiar gray marly material."

[9]John B. Farish. 'The Ore Deposits of Newman Hill'. Proc. Colo. Sci. Soc., Vol. IV.

[10]T. A. Rickard. 'The Enterprise Mine'. Trans. A. I. M. E., Vol. XXVI.

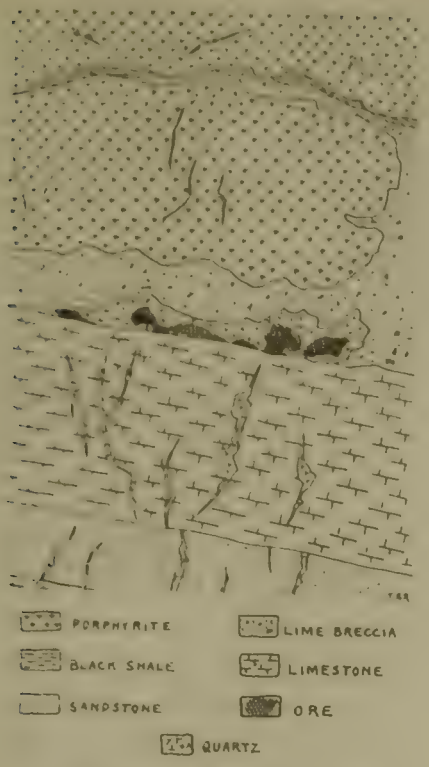


Fig. 5. Porphyrite tongue at the contact.

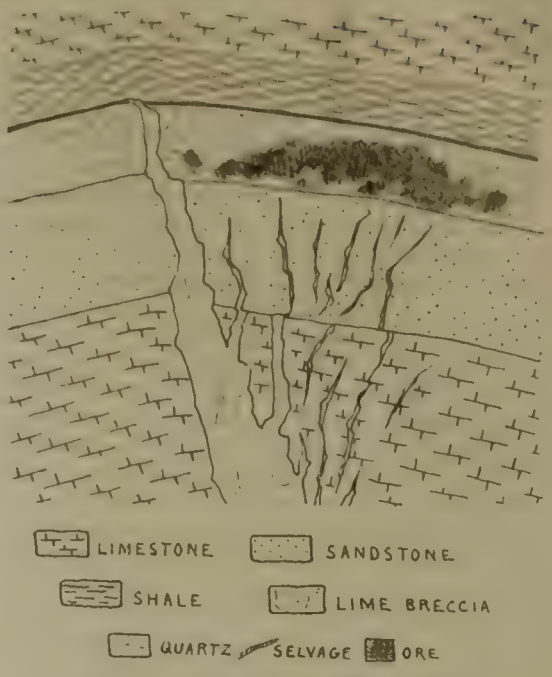


Fig. 6. Ore at the contact above a 'vertical'.

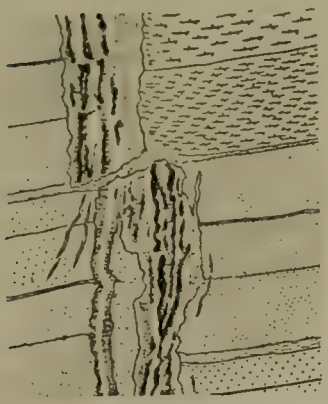


Fig. 8. A dislocation of a vein, itself following a fault-plane.

taceous is not without interest, even to the miner, but the ascertainment of the true relation between the systems of veins and the ore-bearing horizon named the 'contact' was undoubtedly of more direct benefit to those engaged in searching for ore. Yet this most important feature is not sufficiently emphasized in the Survey reports, although Tower, Spencer, and Ransome successively investigated the ore deposits.

The deciphering of the structural geology of a mining region is more immediately useful to the miner than theories concerning the origin of ore deposits, and the latter have the greatest economic value when they furnish light to the ascertainment of the facts pertinent to actual exploration underground.

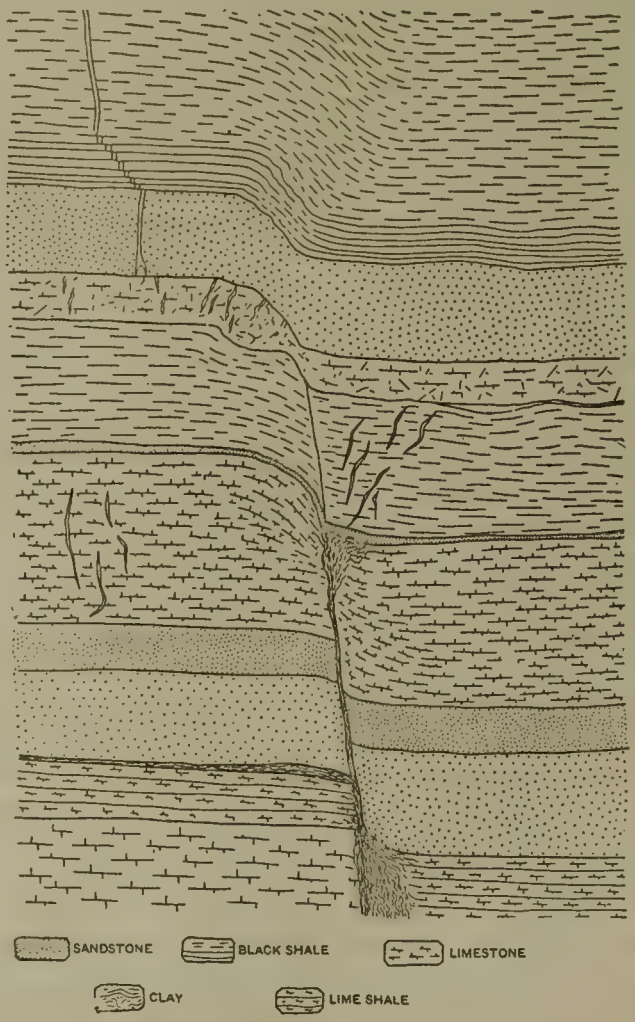


Fig. 7. A dying fault.

SIBERIAN DREDGING STATISTICS FOR 1908.

Written for the MINING AND SCIENTIFIC PRESS
By JEROME B. LANDFIELD.

Interesting statistics of gold and platinum dredging in Siberia for the year 1908 have been gathered by the Gold & Platinum Miners' Association of Russia. Question-forms were sent to all the mine-owners, with requests for accurate and detailed information. A large number of the companies responded and gave the desired details, but several failed to do so. Out of some 64 dredges known to have been in existence in the Ural region and in Siberia, statistics of 49 were furnished. This information is not all that an American enginer could desire, but it is helpful in giving something of an idea as to conditions existing there. In giving a resumé of these statistics I will endeavor, as far as possible, to transform the Russian information into terms of our own practice.

Administratively, the Ural region is not a part of Siberia, but of European Russia. For purposes of mining statistics, however, it must be included with the former, although there are some interesting points of difference. Practically all of the quartz-gold of Russia comes from the mines of the Ural, amounting to about 40% of the output, whereas 95% of the gold produced in Siberia proper is alluvial. Furthermore, almost the whole of the world's supply of platinum comes from the Ural region, and the development of the platinum industry has had an important influence on the introduction of dredges. Quite a proportion of the dredges has been installed especially for the winning of platinum. The question of length of season is the first point that naturally occurs to the foreigner in regard to mining in Siberia, and it is interesting to note that in the case of the 49 dredges reporting, the average operation was 149½ working days, and the average number of hours that each dredge was operated was 2502. The record number of working days for any one dredge was 194, made by one of the dredges of the Neviansk company, working on the Nikolaievsk mine. Two of the dredges in the platinum region of the Ural began operations on April 2 and 3, respectively, but most of the dredges opened their season late in April, and those in the Yenesei region, for the most part, did not begin work until the middle of May.

Several of the dredges were obliged to cease operation for the season as early as October, but the majority were able to continue until nearly the end of October, and some well into November. Two dredges in the Nizhni Tagil region of the Ural, on the placers of the Demidov estate, are reported as working up to December 11. Only about two-thirds of the dredges reporting give the dates of the beginning and ending of the season's operation.

No statistics are published in the report concerning the kind of dredges used or their place of manufacture. They varied a good deal in capacity and size of bucket. Twenty had 7-ft. buckets, and there were one 6-ft., two 5½, ten 5, nine 4½, five 4, one 3½, and one 3-ft. buckets. The average amount of gravel handled per dredge during the season was 166,400 cu. yd. A comparison with the figures for 1906 and 1907 shows that whereas in 1906 the statistics for 32 dredges showed an average of 174 days of operation, with 2837 working hours, the average amount of gravel handled per dredge for the season was 159,600 cu. yd. In the season of 1907 reports were received from 46 dredges, and they showed an average season of 137¾ days of operation, with 2259 working hours, but the average amount of gravel handled per dredge was only 139,300 cubic yards.

According to the statistics available of the 49 dredges that reported their operations for 1908, the total product was 70,288 oz. gold and platinum unrefined, which the Bureau estimates, for the purpose of figuring profit and loss, at approximately $17.75 per ounce. This gives an average of 1430 oz. as the amount won by each dredge, or about $25,380 for the season. These figures are, of course, of little value, as the conditions of working are so varied as to prevent a satisfactory basis of comparison.

Perhaps the most surprising feature of the report is that which has to deal with the tenor of the ground worked. According to the figures given, the average tenor of the gravel on all the operations in which the 49 dredges were engaged was a trifle under 15c. per cubic yard. It seems almost incredible to think of working such gravel at a profit under Siberian conditions, and perhaps the best explanation is that in all probability many of these operations were carried on at a loss. The highest tenor noted was a little over 31c. per cubic yard. In this latter case a 7-ft. dredge worked 170 days, an average of 14¾ hours per day, and cleaned up 2945 oz. of gold dust and platinum, yielding in the neighborhood of $42,300. The figures on the amount of gravel handled and the tenor of the gravel cannot be considered as accurate, since many of the dredges worked under conditions that required rough approximations to determine the quantity of material lifted.

From the data available, the Bureau estimates that the average cost of dredging operations in the Ural region was about $15,000 per dredge, exclusive of amortization charges on dredge and mine equipment, while $19,000 must be allowed as the expense per dredge for operating in the Yenesei region, where conditions are less favorable. Taking $5000 as the average amount to be set aside annually to extinguish the cost of the dredge and equipment, the Bureau points out that the operations in the Ural show an average profit of $5000 per dredge, while in the Yenesei region they barely pay expenses. A comparison of the figures of production shows that four dredges yielded less than $9500 each during the season, while, on the other hand, four dredges yielded from $45,000 to $50,000 each.

Soldering aluminum and copper may be done successfully and easily by the following method: First tin the aluminum and the copper, or brass, using stearine as a flux: wipe clean, then use zinc chloride as flux, with solder composed of tin 67 and lead 33 per cent.

Vanadium has been used in cast iron with good effect, and experiments with brass and bronze show that it may be used with advantage in these alloys.

SONORA, MEXICO, IN 1909.

Written for the Mining and Scientific Press
By F. L. H. Morgan

The closing year has been one of renewed activity for the mining industry in Sonora, after temporarily being paralyzed by the panic of 1907. It was scarcely convalescent during 1908. The financial crisis resulted in a suspension of operations in many of the mines which had not yet become productive and were dependent for running expenses on money derived from stock-sales or from stockholders' subscriptions. The great copper camp of Nacozari continued in operation, and the Creston-Colorado gold mines near Minas Prietas kept up production under the control of Charles Butters. At Cananea, however, in October 1907, the time seemed ripe for closing the mines and renewing the smelting plant, in order to effect economies. At the same time the discharge of several thousand miners from this great camp paved the way for a material reduction of wages, which, from the operator's standpoint was of far-reaching importance, since it would result in reducing the average rate of wages all over the State of Sonora. Under the presidency of W. C. Greene the scale of wages at Cananea had been advanced until ordinary miners were paid ₱3 per day. This raised the rate throughout Sonora and proved a hardship to miners of small capital, who found themselves obliged to pay an advance of nearly 200% over the wages prevailing in the past. With the re-opening of Cananea in 1908 the scale for ordinary miners has dropped to ₱2.50 per diem.

The marked feature of the past two years is the stimulus to mining offered by the opening of new lines of railway, which give access to areas previously difficult and expensive to reach. Chief among these were the extension of the Sonora railway into Alamos; the opening of the road from Nogales to Cananea, and the rapid extension of the line up the Yaqui valley, that will give access to the rich Sahuaripa district. Work is now actively progressing on the line from Nacozari southward along the Moctezuma River valley to eventually effect connection with the Yaqui River branch.

The mineral resources of Sonora may be classified under four heads, namely, copper, placer-gold, vein-gold, and silver. The importance of the copper deposits needs no comment. The placer-gold deposits, chiefly in the Altar district, are of great importance, but have not hitherto been made productive on a large scale owing to the scarcity of water. Vein-gold appears in two classes of deposits; first, veins sufficiently large and rich to be continuously worked on a company basis; and second, myriads of small veins, often of high surface value, but too limited in extent to justify operation on a large scale. Of the first class, comparatively few have been opened. Of the older properties, those at La Colorada have been the most productive. Of the newer, Cerro Prieto or Black Mountain is striving for commercial recognition with a large mill in which no expense has been spared to supply perfect equipment and economy. El Tigre, northeast of Nacozari, is a large gold and silver property which promises to have a brilliant future. There are also many abandoned or inactive gold mines which within the last half century have been productive or which have records of great productivity during the colonial days. Some of these owe their records to zones of enrichment carrying high grade, free-milling ore now largely worked out. In other cases, no doubt, a thorough examination would show large orebodies which might be profitably worked by modern methods of cyanidation, and, as transportation becomes cheaper, these mines will be unwatered and prepared for examination.

In silver production Sonora has not a high rank compared with the great silver districts of the interior plateau. Among the older mines La Quintera near Alamos is historic as a rich producer, but, having been worked to a depth of 1500 ft., changes in the ore have been encountered which involve new methods of treatment. At Lampazos, in the south of the Moctezuma district, is a silver mine which has been productive for many years, the ore having been treated lately by lixiviation. The richest silver mine in Sonora today is that of Las Chispas in the upper Sonora River valley near Bavicanora.

The copper production of Sonora is chiefly confined to the great camps of Nacozari and Cananea, a limited amount coming from the Transvaal Copper Co. with its small smelter near Cumpas in the Moctezuma district. Sonora, however, exhibits in all directions, at frequent intervals, outcrops of copper deposits, both large and small, which in the future will contribute to the copper production of the Southwest. During the past year a large deposit near San Antonio de la Huerta was taken over by the Cole-Ryan interests after a fruitful campaign of development. Active exploration is reported at many other points. One of the necessities for the greater development of the copper industry in Sonora is cheaper transportation of ore by rail, for there are many properties, both small and large, which would produce rich surface ores if they could be cheaply shipped to a custom smelter.

Several attempts at building up a local smelting business have been made in Sonora, but with little success, owing to lack of foresight in the original plan and to high transportation rates for ore. About five years ago a smelting plant was built at Toledo on the Yaqui river by Ohio capitalists, in the hope of securing business from the mines in that vicinity, but the high cost of fuel hauled in wagons from the railway at La Colorada had not been provided for, and the business has remained in suspense pending the extension of the Yaqui River valley branch of the Southern Pacific railway to that point. Another smelter was built at Fundición in the Guaymas district, but did not secure favorable transportation rates or succeed in making its contracts attractive to mine operators. Near Guaymas a small smelter was erected some time ago by W. C. Greene and his associates, but mainly for the purpose of holding a concession until this should become saleable. The Guaymas smelter has, therefore, never been in commercial operation.

In the Altar district, attention has been newly attracted to the operation of the cement gravel pla-

cers, by the development of a machine for breaking up this cemented material. This consists essentially of a rotating barrel having iron staves with narrow interstices between. Within the barrel and rotating in the opposite direction is a shaft to which are connected short lengths of heavy chain. These act like flails and break apart the pebbles which are united by a calcareous cement. By the beating of the chains, and the grinding action of the released pebbles within the barrel, the calcareous cement which encloses the gold is pulverized and escapes between the staves, the gold being afterward separated by a Hungarian dry-concentrator, or 'dry washer'. The principles of this disintegrator were worked out by a miner named Quenner, and it is now manufactured by Roy & Titcomb, of Nogales, Arizona.

The finely equipped 50-stamp mill of the Llanos de Oro Mining Co., which has been idle for some

Map of Northern Sonora.

time through lack of success in treating the cemented gravel in a stamp-mill, has recently been put into operation by the erection of a wire-rope tramway from the Martha mine of the Reina del Oro Co., at El Tiro, a distance of some six miles. The plan is to mine the El Tiro ore and treat it in the mill at Llanos de Oro, the lack of water at El Tiro having rendered the mill at the mine inoperative. Among the mines of Altar, the Juarez is reported as in successful operation. The Campana and La Libertad properties north of Caborca have attained successful results in development, and good orebodies are reported at the 600-ft. level. At the present time there are more Americans prospecting in this country than have been seen there for several years. It may be said that the mining enterprises begun in Sonora during the past five years have not shown a large average of success, because, as a rule, they have been started with insufficient capital and under inexperienced management. Added to these weaknesses was often the insurmountable difficulty that in the beginning the property chosen was only a one-man mine and could not stand the expenses of operation on a corporation-basis. At times, indeed, so little judgment has been shown in selection, that money was spent on a property which had no claim to consideration on any basis. There is a common tendency for people with little or no capital, who hope to make some money out of a mining scheme, to take up for flotation a property of almost no promise simply because it is cheap and within their reach. The disastrous results of such finance discredit legitimate mining and deter investors from taking up substantial propositions. Every new country must, however, pass through vicissitudes of delay in obtaining recognition, and Sonora will not lose in the end. There are few areas of its size in America which are so extensively mineralized, and in the slopes of the Sierra Madre which are now being made accessible by extensions of the Southern Pacific railway system, many rich deposits will make important contributions to the metal production of the Mexican Republic.

Barite deposits occur about two miles north of Five Islands, Nova Scotia, a village 12 miles east of Parsboro, on the north shore of Minas basin. They were recently described before the Geological Society of America by C. H. Warran. The principal outcrops are on the steep banks of the bars and east river, and at isolated points between, for some two miles. The barite is coarsely crystalline and remarkably pure. It occurs in the form of large irregular vein-like masses, usually with steep dip, associated stringers, and smaller isolated masses in an ancient fault-breccia; also as a filling for fissures sometimes several feet wide in the massive ledge-rock. The fault breccia is part of an extended zone of faulting, frequently marked by brecciation and fissuring, which lies in a narrow east-west band of much-folded Devonian slates and quartzites on the southern side of the Cobequid hills. The fault-zone follows rather closely the contact with intrusive syenites which form the core of the hills. Near the eastern end of the fault-zone, north of Londonderry, barite also occurs associated with much ankerite and iron ore, also in a fault-breccia. The barite is believed to have resulted from a leaching and concentration process which took place through the agency of water percolating downward along a zone of faulted and broken rock. The adjoining ledge-rocks contain about 0.2% BaO. A comparison with deposits elsewhere leads to the conclusion that many barite occurrences are the result of a concentrating of the barium content of limestones, sandstones, and quartzites, wherever faulting or crushing has made an easy channel for percolating waters.

More than 500 producer-gas power-plants, ranging in size from 15 to 6000 hp., are now in operation in the United States. About 88% of these plants are running on anthracite coal, a few on anthracite or coke, and the remainder on bituminous coal and lignite. In a bulletin on the recent development of the gas-producer power-plant in the United States (Bulletin 416), just issued by the United States Geological Survey, R. H. Fernald, consulting engineer, states that the internal-combustion engine has already become a serious rival of the steam-engine in many of its applications, and that the development of the large gas-engine within the last few years has been extremely rapid. Only nine years ago a 600-hp. engine exhibited at the Paris Exposition was regarded as a wonder, but today four-cycle, twin-tandem, double-acting engines of 2000 to 3500 hp. can be found in nearly all well equipped steel plants, and some plants in this country contain several units rated at 5400 hp. each.

HYDRAULICKING PIPE-CLAY GRAVELS

Written for the Mining and Scientific Press
By Dennis H. Stocker

In the vernacular of the California and southern Oregon hydraulic miner the 'pipe-clays' consist of those portions of the gravel banks carrying 'pay' that is they constitute a false bedrock on which gold lies concentrated. As a usual thing, they are found in the middle and lower strata of the Pacific Coast old channels. The breaking up of these clays causes some difficulty at times. Placer mines which failed

Here claim-owning interests him not at all. One such channel extends all the way from Humboldt county, California to Douglas county, Oregon. This one no doubt, is the largest of them all as it shows a width at several places of a half to a full mile. This ancient river was in existence before the present chains of the Siskiyou and Coast mountains were upheaved. The filling of the old bed, the gravel, boulders and debris, comprise the 'working grounds' of the hydraulic mines. How the gold came there is a matter for the geologists to explain. It is a question of erosion and concentration by the washing of floods

Old Channel Gravel Mine With Pipe Clay

under one management are often highly profitable under another, with the same equipment. The difference was in the manager himself; one could not recognize 'pipe-clays', the other could, and knew how to deal with them.

The identification of these 'pipe-clays', these 'working grounds', as some surface miners call them, is a simple matter. Practically all the old channels which form the basis of the California and Oregon placer mines, are the beds of ancient rivers and streams. The geology of the property is of little or no interest to the average placer miner. Interesting as its story may be, he throws aside the ancient mortars, pestles, and other relics that his giants uncover, and occupies his mind with the getting of gold. The fact that he might be uncovering relics older than Today patches of the old river channels are found on the very tops of mountains. The distribution of the gold through the gravel is in many cases a matter of its being held there by these false bedrocks of 'pipe-clay'. If the 'pipe-clays' lie in strata so thin that a mountain of débris must be removed to uncover them, then it were better to shut off the water and 'hang up'. It costs money to move mountains, even by the hydraulic method, and the wise miner will make sure of the returns before he begins. There is no branch of mining that offers better opportunity for making sure than hydraulicking. If the miner will, he can estimate the worth of his ground closely before a dollar is expended in equipping for actual operation.

The accompanying photographic illustration gives

a general idea of the character and formation of some of these Pacific Coast old channels, and of the general nature of the 'pipe-clays'. The picture shows an 80-ft. bank comprising the 'fill' of an ancient river channel. Bedrock is slate, in some places serpentine, and at others granite. Above the bedrock, and forming the lower strata, are the boulders and heavier rocks. These usually carry coarse gold. The 'pipe-clays' are easily distinguished. The strata lie in horizontal and parallel streaks of blue and gray, blending into the darker brown of the upper capping. The bank shown in the picture has only a thin capping on the surface, fully three-fourths being 'pay gravel'.

The gravel with the 'pipe-clays' is small. There are some boulders, but they are never so large that the giant's stream cannot easily tear them from the parent bed, hurling them down the sluices. There is usually an entire absence of 'cement'. The 'pipe-clay' gravels yield readily, 'melting' like an ash heap when the streams strike them. Blasting may be required for the lower strata. The depth of the 'pipe-clay' banks ranges from 10 to 250 ft., with an average of from 60 to 80. In Galice district, southern Oregon, the banks are extremely high. One mine in that camp has a working bank over 1000 ft. long, with a height of 265. The 'pipe-clays' and the lower strata of this enormous gravel-pile consist of three-fourths the entire content. On account of their great height, however, it is necessary to work the banks from a distance of 400 ft., with a battery of giants operating under 500-ft. head of water.

A feature connected with a thick surface capping is its 'flour gold'. This frequently occurs in considerable quantity. It is so light and fine that it can only be saved by a system of undercurrents attached to the regular sluices. As long as the water of the sluices is in agitation, the 'flour gold' will not settle. The undercurrents are arranged to draw off, or rather 'draw down', the water through apertures in the bottom of the sluices, spreading it over broad riffle-tables covered with burlap, into which the fine gold settles. To clean the undercurrents the burlap is lifted carefully and rinsed in vats of still water in which the fine gold particles settle. The 'pipe-clays' of the western channels often carry gold at the rate of from 8 to 20c. per cubic yard. If the upper capping is not too thick, the miner can move the ground at a cost of 4 to 5c. per cubic yard.

Cadmium melts at a low temperature, and, like bismuth, lowers the melting point of alloys in which it is used. Bismuth, however, forms brittle alloys, but many alloys of cadmium are ductile and malleable, yet hard. The melting points of these alloys are lower than the melting points of any of the metals composing them. Several of them liquefy at temperatures considerably below that of boiling water, and a silvery-looking 'trick' teaspoon made of one of these compounds melts in a cup of tea, to the great astonishment of the tea-drinker. An alloy of cadmium is used in making automatic fire extinguishers, in which water under pressure is released in a jet or spray by the melting of cadmium under the heat of the fire.

The Prospector.

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

F. G. C., Lordsburg, New Mexico: Rounded quartzite pebbles.

A. H. C., Pyeng Yang, Korea: Specular hematite and pyrite in chloritic schist.

B. L. H., Oasis, California: No. 1 and 2, galena with a little pyrite in thin veins.

C. M. & S. Co., Viesca, Coahuila, Mexico: No. 1, andesite; No. 2, feldspathic rock; No. 3, diabase.

E. T., Hostotipaquillo, Jalisco, Mexico: No. 1, rock apparently altered by fumarole action; No. 2, altered feldspathic rock; No. 3, black basalt; No. 4, feldspar-porphyry; No. 5, trachyte.

VOLUMETRIC ESTIMATION OF URANIUM AND VANADIUM.

A review of the methods previously published was given at the Fortieth General Meeting of the American Chemical Society by Edward DeMille Campbell and Charles E. Griffin. Experiments show that vanadium may be satisfactorily determined by reduction with sulphur dioxide and titration with permanganate, and vanadium and uranium together may be reduced by boiling with a spiral of heavy aluminum wire and titration with permanganate after the removal of the aluminum wire spiral and the addition of an excess of ferric sulphate. In the analysis of carnotite ore, after solution of the ore in nitric acid and evaporation with sulphuric acid, the vanadium and uranium are separated from iron by double precipitation of the latter with sodium carbonate in the presence of a little hydrogen peroxide. In the acidified solution the vanadium is first determined by reduction with sulphur dioxide to V_2O_4 and titration with standard permanganate, after which the vanadium is reduced by boiling with aluminum to V_2O_2 and the uranium to UO_2. After complete reduction of the uranium and vanadium, acidified ferric sulphate is added, and the solution is titrated with standard permanganate.

Severe earthquakes were felt in Alaska in September 1899. They were accompanied by faulting, tilting, and warping in the Yakutat Bay region. There were shocks for 27 days, including five or six world-shaking disturbances and hundreds of minor shocks. On one day there were over fifty minor shocks and two world-shaking disturbances. These were recorded by seismographs throughout the world. In Alaska, Yukon Territory, and British Columbia the shocks of September 3 and 10 were felt throughout an area of at least 217,000 sq. mi. on the land, and perhaps as much as a million and a half square miles. Only 20,000 persons were in the area affected, 250 close to the earthquake origin, and 8 men right on one of the faults, but there was no loss of life and insignificant damage to property.

CALIFORNIA PETROLEUM IN 1909

Written for the MINING AND SCIENTIFIC PRESS
By An Occasional Correspondent

It is too early to give exact figures of the petroleum output of California for 1909 since the returns for the month of December have not yet been received from the producers. It is known, however, that California led all other States in the production of mineral oil in the year just closed, exceeding Oklahoma materially, not only in number of barrels, but in total value. In 1908, according to the United States Geological Survey figures, Oklahoma produced more barrels of oil than California, although the California oil was valued at $5,735,659 more than the total output of Oklahoma. For 1909 this State exceeds Oklahoma both in number of barrels produced, and also in total value. It is apparent that California has increased its output in 1909 over the previous year by as much as ten to twelve million barrels, and also that prices were much better than during the previous year.

A review of the conditions existing in the different oilfields of California in 1909 has already appeared in these columns. This was in a condensed form, it being virtually impossible in a limited space to go into close detail of the developments which have occurred during the year in the various producing fields. When the year 1909 opened it is estimated there was a daily production of about 6000 bbl. more than the consumption warranted, and this was being stored. In the beginning of 1910, however, nearly that much is being drawn from stocks, so that consumption is rapidly reaching the amount of daily production. The demand for oil is on the increase, but the California wells are increasing their yield far beyond the expectations of a few years past. A year ago the daily production was about 142,000 bbl., and now it is nearer 158,000.

The following table, based on actual returns for 11 months, and a conservative estimate for December, shows the output of petroleum in barrels in the different oilfields of the State in 1909.

CALIFORNIA OIL, 1909.

Field.	Barrels.
Coalinga	15,161,570
Coyote	85,500
Fullerton	4,334,730
Kern River	15,090,050
Los Angeles City	554,745
McKittrick	5,071,736
Midway	2,389,230
Newhall	125,649
Salt Lake Field	3,490,225
Santa Maria	7,995,085
Sunset	1,918,575
Ventura	407,040
Whittier	861,591
Summerland	65,997
Total for 1909	57,551,723

This estimate is conservative and will be found close to the truth when all returns are in. There are now upward of 4000 producing wells in the State. The aggregate yield of these in December was the largest in the history of the State, being considerably above 5,000,000 bbl. When all the wells are considered, the daily average runs from 41 to 45 bbl per well per day. As may be noted the field making the largest production for the year is Coalinga in Fresno county. The Kern River field does not run far behind, and with all its fields Kern county far exceeds in oil production the other counties of the State. The Santa Maria field continues to make a satisfactory record and has exceptional shipping facilities to tide water.

Average price per barrel in 1908 was determined by the United States Geological Survey at 52.25c. In 1909 it had materially increased, but it is difficult as yet to fix an exact average. In some fields the price is higher than in others, and, moreover, large quantities of oil are still being sold under old contracts at low prices. It is probable that 56c may be considered a fair average price for the output of 1909, and it is expected that 1910 will see an average price of 60c. per barrel. The oil industry of the State is in a flourishing condition, with its increasing yield and the increasing consumption. The value of the oil produced in the State now greatly exceeds that of both gold and silver, a condition which could hardly have been predicted a decade since.

SOME PHYSICAL PROPERTIES OF SULPHUR TRIOXIDE.

Sulphur trioxide, according to D. M. Lichty, purified by repeated distillation of the commercial article over pure phosphorus pentoxide in a vessel exhausted to 50 mm. or less, melts sharply at 16.8° (Weber 14.8°), boils at a temperature not exceeding 44.8° under 760 mm. pressure, and seems to be purer than that prepared by Weber. If kept from contact with moisture, it retains its sharp melting point, and at the room temperature is in appearance a transparent mobile liquid which really consists of a liquid variety, containing, dissolved in it, and presumably in equilibrium with it, a considerable quantity of a solid variety. The depression of the freezing point of phosphorus oxychloride, caused by this mixture, leads to the formula SO_3. The coefficient of expansion is very high, agreeing essentially with that found by Schulz-Sellak and by Schenck. If exposed to a relatively small amount of moist air, the liquid solidifies quite completely at room temperature. The depression of the freezing point of phosphorus oxychloride, produced by a completely solidified sample, also leads to the formula SO_3. The ordinary asbestos-like needles seem to be a polymer having the formula S_2O_6.—*Jour.* Amer. Chem. Soc.

The Soo Canal is the only internal waterway which has had its capacity increased faster than that of the railroads serving and served by the Great Lakes which it links. The Soo Canal opened to commerce a little over 100,000 tons in 1855 with a depth of 11½ ft. on its mitre-sills, when there was a scant 8 ft. of water on the St. Clair flats. Successive enlargements of the locks and deepening of the restricted Lake channels now give an available depth of about 20 ft. In 1907, 58,217,214 tons of freight were carried through the locks of the Soo. The freight was slightly over 20% of our railroad tonmileage. The cost of service fell from 1.5 mills in 1888 to 0.69 in 1908, 9% of railroad rates.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Ship Subsidies.

The Editor:

Sir—You have recently had a good deal to say about the encouragement of an American merchant marine without, as I think, achieving your usual convincing result. Perhaps the letters of Mr. Newlands (November 20) and Mr. Van Wagenen (December 25) have sufficiently brought out the objections to the proposal, but there are still a few arguments which may properly be urged. Doubtless all of us would be glad to see 'the American flag in all ports of the world'—who doesn't like to hark back to the Golden Age?—but that is hardly a valid reason for embarking on a course of expenditure which would be a serious burden on an already deficient treasury. So, too, we have all been chagrined at the spectacle of our Navy dependent on foreign colliers and supply ships. As to the latter, Mr. Newlands' suggestion is excellent. Let the Navy build or buy such vessels as it needs, just as it builds and buys battleships and cruisers. The merchant vessels can, if not needed in time of peace, be leased for use in trade. A few might be used to advantage in giving the Pacific ports the same connection with Panama that the Atlantic cities have with Colon. For a general merchant service, however, other means must be devised or we must continue to allow the foreigner to carry our goods for us. Personally, at least for the present, I favor the latter. If other people are willing to tax themselves either in the form of lower wages and interest returns, or of direct subsidy, in order to perform for us a service cheaper than we can do it for ourselves, why not let them do it? It has recently been shown that the Japanese lines, despite the subsidy they are receiving, are not making money, and also that approximately one-third only of the freight which they carry is Japanese in origin or destination. In other words, the Japanese pay taxes for the privilege of carrying American goods to China cheaper than we can do it ourselves. So long as they are content to do so, why should we compete with them?

As to the argument that shipping lines stimulate development of business and, specifically that additional lines to the Orient would secure us a much larger share in that trade, I can only say that this argument is much overworked. Trade involves buying as well as selling, and must be conducted at a profit, or it cannot survive. What, may I ask, are we prepared to buy from China and Japan in such enormous quantities as the case supposes? Also, is it proposed that we shall grant a subsidy large enough to overcome for the importer the disadvantage he labors under in the matter of our tariff? If so, why the double payment? How, too, about the goods we sell? It is admitted that we manufacture at higher cost than our competitors—else why the tariff—and it follows that our subsidy must then be large enough to offset this increased cost of production. It looks suspiciously as though Peter would again have to submit to a smaller income in order that Paul be the richer. Now, as a matter of fact, there are a considerable number of ships going out annually from Pacific ports which sail with insignificant cargoes—because the trade does not, under present conditions, exist. Furthermore, there are regular lines from the Gulf and Atlantic ports to Central and South America (someway it is so easy to overlook these boats) and these carry very little freight outward. If, however, the argument that steamship lines will build up trade against these disadvantages be held valid, still another difficulty remains.

It is but an inexperienced traffic director who has not learned that through lines alone stimulate little traffic. It is the feeders and distributors which count, and to our proposed lines to the Orient we must add control of warehouses and railway lines in the foreign countries. The system to be complete would need to include an alliance of American railways to gather goods, American steamers to carry them over the ocean, and at least some American-controlled foreign railroad lines or other equally efficient distributing system. Mexico has shown that control of railways can be utilized quite as effectively as control of customs to stimulate native industries, and our own people have protested against Japanese discriminating railway rates and supposed rebates in Manchuria as violations of the 'open door', rather than of customs discrimination. It will do little good to carry our manufactures to foreign ports and leave their sale and distribution in the hands of our competitors. So long as our exports consist largely of raw materials which foreign countries must have, we need have no fear that they will fail to reach their markets. Such foreign trade in manufactures as we now have has been largely built up by the railways, including our own Great Northern and Southern Pacific, by the United States Steel Corporation, the Standard Oil, and similar agencies. Is it proposed to subsidize them?

KICKER.

San Francisco, January 7.

Outcrop of Orebodies.

The Editor:

Sir—Your editorial criticism on 'Outcrop of Orebodies' is most appropriate and suggestive, but your statement, "When gold veins contain appreciable amounts of manganese, accompanying placer deposits need not be looked for," is much stronger than my premises warranted, and as it stands I hasten to disclaim such responsibility. The wise prospector will look for placer gold at appropriate places in any mineralized area, but I wish to make the point that he should not abandon a highly manganiferous outcrop of a quartz lode after merely superficial prospecting, especially in a region where the gold is finely divided. Your suggestion that this problem should be investigated experimentally is timely. Still, not a little work has already been done, and this, it seems to me, shows that gold is

not dissolved to any great extent at the low temperatures and pressures which prevail near the outcrops by the chemical compounds which are commonly contained in mine-waters except on the presence of oxidizing agents of which manganese oxide is probably the most important because it gives up its oxygen readily to form chlorine in the presence of sulphuric acid and salt both of which are generally present in vadose mine waters. In the laboratory free chlorine is usually prepared after one or the other of the following reactions:

$$MnO_2 + 2NaCl + 3H_2SO_4 = 2H_2O + 2NaHSO_4 + MnSO_4 + 2Cl.$$

$$MnO_2 + 4HCl = 2H_2O + MnCl_2 + 2Cl.$$

The analyses of mine-waters show that salt and these acids, or their ions, are generally present, but of course the solutions are dilute compared with those used in the laboratory. Above 100°C. gold is dissolved by many compounds, but such reactions are certainly not applicable to the problem in hand. It should be remembered in this connection that a small amount of manganese makes a big showing in the oxidized outcrop, and that coarse gold dissolves slowly, even in rather concentrated solvents. As already stated, there are certain mining districts where the lodes are manganiferous and where placer gold is won, but the placers are small compared to those which form below the lodes which carry coarse gold and which do not carry appreciable quantities of manganese.

I agree with you that the economic geologist should apply his principles with great caution to each particular deposit, and should endeavor as far as possible to master all the facts pertaining to it, and to properly weigh each one in the diagnosis of each outcrop or deposit, and that he should frankly disclaim the gift of prophecy. Still if his opinion regarding what is not fully exposed be valueless, why should anyone employ him? The statement that of two rocks or ores, the one which resists erosion longest tends to monopolize the outcrop, is almost axiomatic, although you intimate in your editorial that the deductions drawn may suggest to the untrained a too optimistic conclusion. To me it is unthinkable that one should buy a claim on the strength of an exposure of a narrow outcropping lode because the lode is more easily eroded than the rock, yet this fact may warrant him in sinking a pit below the outcrop in order to ascertain whether the lode becomes wider down the dip. My statement is that "not all, but a majority of such lodes, will increase in depth," which is another way of saying that an easily eroded rock will be removed more rapidly than one which is more resistant, a statement which should not be difficult to comprehend. On the other hand, he should be particularly cautious when he is called upon to appraise the possibilities of a large promising outcrop which is much more resistant to the processes of weathering than the enclosing rock. I have in mind a deposit in Nevada, the outcrop of which consists of a large mass of nearly pure quartz. The country rock is limestone, and is eroded at a much more rapid rate than the orebody, so that the latter forms the crest of a good sized hill. Some 40 years ago an engineer examined it, and on the basis of his report his clients paid three million dollars for the property. It proved to be a chambered vein, but its depth was not much greater than its width, and the profits which it yielded hardly equalled the purchase price. Many other examples could be cited where siliceous bedding plane deposits or siliceous saddle reefs in limestone show outcrops out of all proportion to their width below.

WILLIAM H. EMMONS.

Chicago, December 12.

Insurance and Mine Accidents.

The Editor:

Sir—Noting the article by G. W. Traer in your issue of November 27, on 'Insurance and Mine Accidents', I have thought a brief account of the plan of the Federal Mining & Smelting Co. might be of interest. The Federal company is operating four mines in the Coeur d'Alene, employing from 1200 to 1400 men. The company at one time carried accident insurance as a protection to itself in case of recovery of damages by an injured employee, but this plan proved unsatisfactory, as in many cases where an equitable settlement could be promptly made with an employee the mining company was absolutely prohibited by the terms of insurance from proposing or making settlement, and the insurance company would refuse to do anything until suit was instituted, and then a reasonable settlement was generally impossible because there were attorneys to be taken care of as well as the injured employee. It is true that the company was fairly successful in the litigation, and in most cases was able to show to the satisfaction of the jury that the company had not been guilty of negligence, but the litigation cost something, and, worse than that, the company was prohibited from treating with its employees in a friendly and considerate manner.

Under these circumstances the management, in 1904, concluded to do away with the casualty insurance, and evolved a plan of mutual insurance as follows: An association called the Federal Provident & Accident Insurance Association was formed, consisting of the mining company and its employees. A monthly due of $1 was collected from each employee, and the company contributed an amount equal to 50% of the amount contributed by the employees for an insurance fund. The association is governed by a board of trustees composed of a representative from each mine elected by the employees, an equal number appointed by the general manager of the company from the company's staff, and, in case of a tie, the general manager casts the deciding vote. This board passes on all claims against the Association and conducts its entire business. The members of the board serve without pay, except the secretary, who receives $15 per month, and the members get their actual expense incurred in attending the meetings, as the mines are situated in different towns.

The following benefits are provided for: In the event of the death of a member as a result of injuries received while on duty, the widow and minor children, if there be any, shall receive $1500; if there be none, then the parent, sisters, or brothers dependent upon and actually receiving support from

the deceased, shall be entitled to receive $1500. In cases where there are no dependent heirs there is no payment, as the theory of the insurance is to recompense one for the injury resulting from the loss of support, and not to enhance the value of the deceased's estate. In the event of the total disability of a member he shall receive the sum of $1500; the loss of the sight of one eye, or the use of one limb shall entitle the injured to receive $750. In the event of a member being injured so as to necessitate the loss of time and the care of a physician, he shall be entitled to receive $10 per week benefit for every week he is unable to work, not to exceed ten weeks, after the first five days.

Considerable latitude in the matter of granting relief is allowed the board of directors; they being able to take up any case and grant such relief as, in their judgment, the circumstances warrant. Thus the board has at times arranged to take care of the funeral expenses of deceased members, where the deceased's estate was not sufficient to look after it; also relief has been granted in cases not covered by the by-laws.

The plan was put in operation in January 1904. Three Coeur d'Alene operators, the Federal company, Larson & Greenough (afterward absorbed by the Federal), and the Hecla company, all agreeing to adopt it at the same time. These companies put it in force without submitting to a vote of the men, as it was considered that less contention and ill feeling among the body of the men would result than would follow if it were put to a vote and a lot of agitators were given an opportunity to stir up strife. Out of the entire crews less than ten refused to become members, and since the working of the plan has become familiar to the men it is doubtful if any one would be willing to forego its benefits for the cost. The employees at once selected their representatives from the different mines, who proved to be level-headed men and highly appreciative of the trust imposed on them. They exhibited courage and firmness in resisting demands for relief that did not seem warranted, and painstaking care in looking into the merits of all claims, with the result that the Association gained the confidence of all its members.

The Association has distributed nearly $20,000 annually in payment of benefits and claims, and litigation between the company and its employees has been largely done away with as a result of its existence. Every six months the board of directors examines and verifies the amounts collected from the men and the amounts paid in by the company, and renders to the members a full detail statement of all amounts received, and of all claims allowed, giving the name, injury, and amount allowed each claimant.

W. H. North.

Albion, Idaho, December 7.

Modern Quicksilver Reduction.

The Editor:

Sir—I was greatly amused when I read an article written by Clifford G. Dennis 'on the train', November 20, published in the Mining and Scientific Press, December 4 last, on 'Modern Quicksilver Reduction', saying that a well built furnace of the Scott type properly conducted was all right, but that the brick condensers connected with this same plant are about as poor as it is possible to have, and that they are accountable for most of the loss in the reduction of mercury ore. The basis for his claim I do not know, but I will say that my experience covers a period of 24 years at the quicksilver mines of New Almaden. I have a few facts to adduce in defense of the quicksilver condensing plants as a result of my long service in New Almaden. We experimented with many different kinds of condensers, wood, glass, iron, and water, but obtained unfavorable results. While I was in New Almaden, I invented what is known as the Scott furnace, having erected a number of this type at the Almaden mines, all with brick condensers connected. This mine for many years produced an average of 2000 flasks per month paying to the stockholders in New York several millions of dollars in dividends. I have also erected several plants with brick condensers at nearly every great producing and dividend-paying quicksilver mine on the Pacific Coast; such as Oat Hill, New Idria, Mirabel, Oceanic, Great Eastern, and the Helen mine in Lake county, owned and operated by Andrew Rocca, one of the best known quicksilver men on the Coast. I also erected many plants in Texas. At the Marfa & Mariposa my first 10-ton furnace produced from 300 to 400 flasks per month for over two years, the largest yield for one month being 432 flasks. Also the Chisos of Texas is a good producer. All of these plants have brick condensers built by myself.

I would like to add that over 97% of all the quicksilver produced on the Pacific Coast was condensed in brick condensers. I am now erecting one of my new improved furnaces for the Santa Rosa Quicksilver Mining Co., S. A., with brick condensers, near Cuernavaca, in the State of Morelos, Mexico, protected by patent obtained in the Republic of Mexico through the Dewey-Strong patent agency.

Robert Scott.

San Jose, California, January 11.

The use for titanium which gives promise of greatest expansion, is in steel and cast iron, according to F. L. Hess, of the United States Geological Survey. In steel it is ordinarily added in the form of ferro-titanium (containing preferably from 10 to 20% of titanium) in quantity sufficient to form about 0.1% of the steel. Rails treated with titanium and laid in places on railroads where the wear was especially hard are said to have shown much greater resistance than untreated rails. Gray cast iron also is said to show beneficial effects from such treatment. Cupro-titanium is manufactured for use in bronze and other castings containing copper. The titanium acts as a deoxidizer, much like phosphor-tin, and makes very tough castings. Another use of titanium which promises to assume considerable proportions is the manufacture of electrodes for arc lights. Titanium ore in the form of rutile, which is titanium dioxide, has been mined in Nelson county, Virginia, where a plant has been erected to extract the metal from the ore. Titaniferous iron ores are mined in New York, Minnesota, and Wyoming.

Special Correspondence.

GUADALAJARA, MEXICO.

Cinco Minas.—Daly-Estate Projects.—Bramador Mines.

The Marcus Daly estate, represented by H. E. Crawford, has closed the deal for the famous old Cinco Minas in the Hostotipaquillo district of Jalisco. A check for a little less than ₱500,000 was turned over to Jose Martinez and Jose G. Montero, the Guadalajara owners of the mines, by Mr. Crawford. The deal is one of the most important in the mining history of Jalisco. The Cinco Minas have been under option to the Daly estate for the last year. At the time the option was arranged by Mr. Crawford ₱50,000 was paid, and later a payment of ₱20,000 was made. The price originally agreed upon was ₱530,000, but later certain rights held by the Mexican owners were included in the deal, and the total investment is about ₱570,000. During the year the mines were examined by Ernest A. Wiltsee, John R. Farish, and Frederick A. Ross. The report of Mr. Wiltsee was unfavorable, but Mr. Farish, who followed him, refused to sustain his findings, and in November last Mr. Ross recommended the purchase of the mines. According to estimates made by Messrs. Crawford and Ross, the ore now in sight in the mines has a value of fully $3,000,000. During the last few months a shaft has been put down 200 ft. below the old tunnel-level, and much driving has been done. The average of the ore so far opened below the tunnel-level exceeds $11 per ton. The Cinco Minas are Spanish *antiguas* that have been worked at intervals during the last 200 years. The interests that sold them to the Daly estate have owned them for the last 30 years, and in that time several bonanzas have been taken out. The total production runs high into the millions. It is now the intention to sink the shaft from the tunnel-level to a depth of 2000 ft. The tunnel is the deepest of the old workings, and is but 500 ft. below the outcrop. Much additional drilling, hoisting, and pumping machinery will be installed, a modern reduction plant with an initial capacity of 250 tons per day will be erected, and $25,000 will be spent in building a wagon-road from the mines to the new Southern Pacific line. Electric power will be transmitted to the Hostotipaquilla district by the Chapala Hydro Electric & Irrigation Co. of Guadalajara in April or May of this year, and a contract for current up to 1000 hp. will be made.

Paul de Vilaine, a French capitalist, who some time ago acquired the old Refugio mine in the Bramador district of Jalisco, has taken an option on the other principal old mines of Bramador, which were under option to John Hays Hammond and the Guggenheims about three years ago for ₱300,000. The price specified in the new option is ₱100,000 less. Mr. de Vilaine is re-opening the Refugio, and expects to interest associates in the purchase of the other old mines. He is interested in the Franco-British Syndicate formed recently to build the Guadalajara-Chamela railroad. The promise of activity in the old Bramador district recalls the fact that four brothers of the noted Dr. Robert Koch, of Berlin, Albert, Adolph, William, and Ernest Koch, were prominently identified with the district in its bonanza days. They came to Mexico early in the seventies, and the stories of the Bramador riches caused them to settle there. They were graduate chemists, and were the first to introduce the modern system of assaying in that portion of Mexico. The brothers became interested in mines and erected custom reduction works, and their knowledge of chemistry and metallurgy enabled them to get better results in the treatment of the Bramador ores. While the operation of the mines continued their earnings were large. Albert, Adolph, and William Koch died in Jalisco. Ernest Koch, now old and in poverty, was recently given a place at the Refugio mine by Mr. de Vilaine. Water and fires forced the abandonment of the Bramador mines before a depth of more than 350 ft. was reached. In the bonanza days 15 *haciendas de beneficio* were in operation in the district. Some of the ore taken out contained 50% silver. The Hammond-Guggenheim option was dropped during the financial depression.

JOHANNESBURG, TRANSVAAL.

Titanic Iron.—Crucible Experiments.—Waste Sorting.—Geological Survey and the Rand.—Government Leases.—A Contrast in Headgears.

The possibility of founding a commercially successful iron industry in the Transvaal is a question again receiving attention. The hopes of Natal have been practically blasted by the unfavorable report just issued by F. H. Hatch upon the Colony's mineral resources. In the Transvaal doubt still lingers. The ore found in sufficient quantities to support an industry contains a high percentage of titanium dioxide (15%), the ore of suitable quality is in deposits of inadequate bulk. A heated controversy is waging as to the practicability of utilizing the titaniferous ore successfully. For the first time, the matter is being studied with scientific thoroughness. The Government has proved keenly interested in the problem and has engaged the services of F. W. Harbord, who is now investigating the resources. G. H. Stanley, a professor of the Transvaal University College, has been conducting crucible experiments, and is now continuing tests in a small blast furnace. The early results have been described in a paper before the Chemical, Metallurgical & Mining Society. Mr. Stanley's early results suggest that by combining the Transvaal's siliceous and titaniferous iron ores, a mixed ore could be obtained which is not far from being self fluxing. "Approximately one half ton of a 30% silica iron ore would furnish all the silica required by a ton of the 15% titaniferous ore, and this one and a half ton of mixed ore would only require about two or three hundred weight of non-siliceous dolomite." The moot point of the action of titanium in the slag was dealt with in the following words: "The titanium, in all probability, exists in the slags wholly or partly as Ti_2O_3, which acts as a base, at any rate when sufficient silica is also present. It is conceivable that, like alumina, it may act as an acid in very basic slags. * * * With regard to the iron, this, in most cases, was white, and when gray was obtained, it seemed to be as often a consequence of extra high temperature as of extra silica in the slag." Mr. Stanley's investigations have been scientific, while Mr. Harbord's will be largely industrial. The latter expert has by no means inspired the public with large hope of success. At the same time, feelings of high optimism have been expressed by sound authorities. W. Bettel keenly opposes the sanguine view, and protests against the assertion that an iron industry can now, or at any period in the near future, be established in the Transvaal to work successfully against over-sea competition.

The scarcity of ore for the mills, experienced at many mines owing to the labor shortage, is likely to be followed by a drop in the percentage of waste rock sorted on the belts, tables, or floors. The Rand's average, however, remains at about 13%. Examining the returns for a recent month, the sorting done by the different groups appears as follows:

	Per cent.
Robinson Group	10.2
General Mining (Albu's)	10.3
Consol Gold Fields	10.6
Wernher-Beit Eckstein	11.8
Farrar	13.3
Barnato	14.8
Newmann's	15.1
Goerz	19.4

The Robinson Group's sorting is the lowest, although the Randfontein Leader (narrow and worked by hand-labor) presents good opportunities for close sorting. The highest percentage is recorded by the Goerz group (largely owing to the fact that two out of its four mines lie in the Roodepoort district), which, so far as sorting appliances go, is the worst equipped. For efficient sorting, there is nothing to surpass the old-fashioned floors, upon which all the coarse must be handled, but the higher efficiency is heavily paid for even with the 1s. and 1s. 6d. labor employed for the work.

The Transvaal Geological Survey Department has issued

its report for 1908, which is well up to the high scientific standard of previous productions. From the economic standpoint, the most valuable portions of the Report are those dealing with (1) the tin deposits of the Rooiberg, and (2) the gold, galena, and zinc blende occurrences of the Marico district, West Transvaal. It is believed that the Survey will shortly turn its attention, after a long appeal by those who have not fully appreciated the greater demands for the investigation of the unknown districts, to the Witwatersrand. The work will be of immense value. It is often argued that the Rand, being so well known, does not call for such Government examination and report. Let this delusion be dispelled. In the first place, there exists no monograph upon the geology of the Rand worthy of mention: this in itself is a statement of fact which may astonish many. Secondly, the very few geologists who are intimately acquainted with the several thousands of square miles represented by the Witwatersrand formation have been signally timorous of expressing their opinions as to the solution of the Rand geological problems, though never loath to propound theories as to the character or origin of some comparatively valueless occurrence in more distant places. The origin of the gold in the 'banket' is one question that has certainly received a good share of attention from qualified petrologists. But even in this connection, one can see wide scope for underground and field work. The recent investigations of Young and Weber, pointing to

Worcester Shaft, Johannesburg. Vertical Depth, 150 Feet. Sunk in 1889.

an association between acid intrusives and the gold, do not appear to have been associated with the necessary field-work, which should involve a long period of mine examination. Still more glaring is the need of a thorough weighing of evidence on other questions. We may ask for some conclusions as to (1) the conformability of the Upper and Lower Divisions of the Witwatersrand, (2) the identity of the Rietfontein series, (3) the nature of the disturbances that affect the formation at the South Randfontein Deep and cut off the 'reef', (4) the puzzle of the Steyn Estate Reef, (5) the identity of the 'reef' cut in the Pullinger bore-holes, and many other points, studiously avoided by sound geologists, and the common theme for ambiguous discussion by scribbling cranks and pretentious 'experts' employed by syndicate promoters. It is to be hoped that the Survey will receive a sincere welcome. Genuine mining interests have nothing to fear and a great deal to gain by a proper elucidation of problems on the Rand. Yet it is possible that a little snarling may be heard. Once before, the Survey approached the Rand in its examination of the district to the north of Krugersdorp, and most unfortunately it blundered in its determination of what is probably an outlying fragment of Lower Witwatersrand formation (on Zwartkop), classifying it erroneously as the old Swaziland system. The criticism in opposition was scientifically strong enough without abuse. The spirit of the attack told its tale. The Geological Survey will have to proceed with tact in exercising influence and pursuing investigations in the mines.

The Government appears to have made good headway in the disposal of its assets in mining rights under water-rights and unpegged ground. The firm of Barnato Bros. has been successful in its tender for working the two Government leases (each over 100 claims) on Modderfontein, which will mean, labor permitting, that two great mines will be started in the East Rand, in the profits of which the Government will share on the basis of a sliding scale. The terms have not yet been fully disclosed. In addition, it is announced that the Mining Houses and the Government have also come to terms in regard to the basis of settlement in the water-right and 'bewaarplaatsen' negotiations. The value of the ground being agreed upon, the company receives 2s. 6d. per ton and 25% of the distributable profit for working the ground, the rest going to the Government 'for disposal'. It is rumored that the just claims of the freehold owners for a share of this interest have been favorably considered by the Commission.

The two photographs published herewith provide an interesting graphical contrast between the new order and the old in the construction of headgears over Rand vertical shafts. One represents the old wooden structure over the Worcester shaft of the Ferreira, one of the first to be erected on the Rand. The Worcester shaft, 12 by 5 ft., is of three compartments and cuts the reef at 150 ft. vertically. In the early days, ore was drawn from here and sent down to a 20-stamp mill at Turffontein Spruit. That

Turf Shaft, Johannesburg, 4066 Feet Deep. Cut the Vein in 1909.

was the time when the ore was taken to the water instead of the water to the mill. The Worcester shaft is no longer used for hoisting. The other headgear depicted is that over the Turf shaft of the Village Deep, Ltd. This shaft is 44 by 9 ft. in the clear, and is now 4066 ft. deep, with development proceeding on three levels. Like all modern Rand vertical shafts, its longer axis is at right angles to the strike of the formation. The steel headgear is over 100 ft. high.

GOLDFIELD, NEVADA.

Production for 1909.—Consolidated Report. — Florence Goldfield.—Reduction Plants.

The gold production of the Goldfield district in 1909 was probably in the neighborhood of $11,000,000. The list of the State bullion tax agent, in which the figures for the last quarter are estimated, shows that taxes were paid upon a production of $9,621,900, but the agent admits that a large portion of the product has escaped taxation, and while the entire State paid bullion taxes upon less than $25,000,000 he appraises the year's output at $35,000,000. Dividends were paid within the calendar year 1909 by four Goldfield mining companies amounting to $5,303,483, distributed as follows: Consolidated Mines Co., $4,981,283; Florence Goldfield Co., $210,000; Combination Fraction Co., $92,200, and Consolidated Red Top Lease Co., $20,000. The ore reduction plants in operation have been the 100-stamp mill of the Consolidated, the capacity of which has recently

been increased to 900 tons daily. The Florence 40-stamp mill, enlarged by the addition of tube-mills and other equipment and now treating 360 tons daily; the 20-stamp mill and sampler of the Nevada Goldfield Reduction Co., the milling department of which is under lease to the Combination Fraction Co., and the large crushing and sampling plant of the Western Ore Purchasing Co. Net profits of approximately $7,000,000 have been made from mining in the Goldfield district during the past year. A statement of the production of the Consolidated shows that the company mined 229,142 tons during the calendar year, of which 227,620 tons were milled, the balance being shipped to smelters. The recovery was $7,996,612 with total operating expenses amounting to $2,140,092, and net profits $5,901,519. In these figures the returns for December are estimated. For that month 20,260 tons were treated containing about $649,000.

The gross assay value of the ore produced during the year 1908-09, according to the company's report just issued, amounted to $7,386,450, from which was realized a recovery of 92.5%, or a total of $6,832,652. This was the return from 194,479 tons of ore, which therefore averaged $37.98 per ton gross. The total operating expense was at the rate of $6.77 per ton, making gross expenses of $1,572,251. The net profits were $5,026,619, out of which was made a dividend distribution of $5,000,000, or $1.40 per share. The Combination mill was injured by the cave of the Hampton stope and ceased operating September 25. The new Consolidated 100-stamp mill was placed in commission on December 26, 1908. Additions and betterments throughout the year gradually increased the tonnage treated until, by October, a steady average capacity of 649 tons per diem was attained, with a milling cost of $1.915 per ton, and an extraction of 94.49% of the gold content. The average assay value of the ore sent to mill was $33.45, and the average extraction for the year was 92.66%. The concentrate-treatment plant took care of 7005 tons, yielding a return of $2,728,185. The cost of treatment was $6.50 per ton. The concentrate is passed over amalgamating plates on its way to the cyanide treatment plant. J. H. Mackenzie announces improvements, as a result of his own experiments in the refining of the cyanide precipitate, which will enable the company to produce bullion 990 fine, at a decrease in cost. The concentrate-treatment plant has been in operation since March, and is saving $25 per ton over the previous costs. Stoping costs per ton were $2.38, transportation 10c., milling $2.30, and development $1.56. The high ratio of development to stoping bespeaks the earnest effort of the management to procure reserves giving demonstrable longevity to the operation of the mine. The ore reserves are estimated at 800,000 tons. This accordingly represents nearly four years' supply. The distribution of the total costs is:

	Per ton.	Total.
Labor	$2.81	$533,776.81
Supplies	2.15	407,060.03
Power	0.41	76,271.74
Department	0.55	106,097.08
Construction	0.10	19,095.24
General Expense	0.32	57,769.77
	$6.34	$1,200,071.27

In the matter of ore production the following credits to the several mines of the group are given:

	Tons.	Average per ton.	Gross value.
Combination	64,537	$52.24	$3,371,613
Mohawk	78,520	30.22	2,373,182
Red Top	48,894	28.46	1,391,756
Clermont	2,529	98.82	249,899
Totals	194,480	$37.98	$7,386,451

In the Mohawk much ore is still left in the old lease-blocks, and stopes of large size have been opened between the 450 and 600-ft. levels, the ore being richer than in any other portion of the Mohawk workings. The glory hole of the Combination is being extended in length, and rich ore has been revealed on the 230 and 280-ft. levels. The Hampton stope has a maximum width exceeding 50 ft. and in addition to the high grade milling ore it produced 1193 tons of shipping ore having a gross assay value of $684.18 per ton. Further development indicates that the Combination vein at a depth of about 300 ft. joins the Mohawk vein and dips rapidly away from the Combination shaft. Hence it is not anticipated that the known orebodies extend downward in the vicinity of this shaft below 850 ft., the present deepest level. The Red Top shows a large increase of ore reserves. The Clermont shaft in the Jumbo has reached a depth of 1050 ft. On the 750 and 900 ft. levels the downward extension of the Mohawk ore-shoot is being successfully developed for a length of 300 ft. On the 750-ft. level for 100 ft. the ore has averaged $450 per ton, and the average ore outside of this richer zone assays about $30. Within the year changes have been made in the organization, whereby the Goldfield Consolidated Mines Co., from being a mere stockholder, succeeds to actual ownership of the Goldfield Mohawk, Red Top, Jumbo, Laguna, and Goldfield Mining companies. The details of the financial arrangements are given in the report. The mining, milling, and transportation branches have been segregated by the organization under the laws of Wyoming of the Goldfield Consolidated Milling & Transportation Co., putting the railroad, water, and milling departments under management distinct from the mines. This admits of making a depreciation charge, effecting a reduction in the amount of bullion tax that would otherwise be collected. The new company has a nominal capital of $400,000, divided into $100 shares. Commencing the year with a cash balance of $786,188, the parent company has completed its mill, extended development work, perfected its general plant, purchased proprietorship in the subsidiary mines, paid dividends, and begins the new year with a cash balance of $1,365,324. It has, furthermore, bullion and concentrate in transit amounting to $479,341.

J. R. Finlay has arrived here from New York and has assumed the management of the Consolidated mines, succeeding J. H. Mackenzie. The new equipment of Chilean mills, concentrators, etc., in the Consolidated mill is now in operation and running smoothly, and it is believed that the capacity of 900 tons will be exceeded.

The Florence Goldfield mine is credited with a production during last year of 37,087 tons with a recovery of $730,610 and net profits aggregating $269,752, the figures for the last quarter being estimated. The average value of ore treated was $19.75, and total costs of production $12.49 per ton. This heavy cost is explained by the fact that a large sum for mill construction and enlargement was charged against production as well as the extensive development carried on. For a large part of the time only 20 stamps were in operation and the mill treated only low-grade ore, chiefly from the old lease dumps. No official estimates of the value of ore reserves can be obtained but they are thought to be worth $10,000,000. Connections have been made from the main shaft with the Little Florence, Gem, Baby Florence, Engineers' and Rogers-Syndicate workings, and the north drift at the 350-ft. level has exposed good ore for 500 ft. Rich orebodies are being developed down to the 500-ft. level, and the main shaft will later be sunk to the 1000-ft. level.

BUTTE, MONTANA.

Labor Situation. — Ophir Mine. — Davis-Daly. — Butte-Ballaklava Hoist.—Copper Merger Talk.

The Montana labor situation, in its relation to the mining industry in Butte, seems to be slowly righting itself, and the mines that had been closed for six or seven weeks are gradually being re-opened. In fact a normal condition would already prevail but for the shortage of coal and electric power at the mines. Extremely cold weather has prevailed throughout the State and the Northwest for nearly two months; railroads have been tied up by snow blockades, and the coal shortage at the mines and for domestic use in Butte has been a seriaus problem. It is now believed that the strike situation on the railroads will be ignored by the miners, which seems to be the easiest way

out of a critical situation. An unusual and tense situation was created when John D. Ryan, president of the Amalgamated Copper Co., announced that all the Amalgamated mines and smelters would be closed unless the miners' union receded from its position of sympathy for the striking switchmen, and if that union did not support the union of smeltermen in an effort to end the strike and resume work with the aid of non-union switchmen if necessary. With a complete suspension of mining operations held before them as a threat, idleness without credit in the midst of the coldest winter ever known in Montana, the miners reiterated their sympathy for the striking switchmen and refused to support the attitude of the Great Falls smeltermen. However, it was later understood, from leaders of the miners' union, that while the union declined to stultify itself by bowing to a threat, the miners would not actively oppose a resumption of railroad switching under strike-breaking crews. The railroads therefore put strike-breakers to work and the transportation of ore to the smelters was resumed. Since then the mines and smelters have been gradually resuming operations.

The Butte Central Copper Co., owner of the Ophir mine, has been heavily financed and will resume operations with $200,000 available for the treasury. Capitalists of Montreal and Boston are in the company. The Ophir mine has been a good producer for a number of years, but no attention has been paid to a large copper-bearing vein which has been cut on one of the upper levels, although assays of 7 to 13% copper have been taken from it. The mine has been opened to a depth of 500 ft., and the old silver vein has shown some good copper assays, indicating that the rule prevailing in all mines of the Butte district is true for the Ophir. In the opinion of W. L. Creden, the company's engineer, the cost of the concentrator and preliminary work will be about $100,000, while Mr. O'Connell says he can put the mine on a paying basis with $25,000 to $30,000. The Ophir mine has an interesting situation and an interesting theory regarding it. The theory is that the veins in the Ophir will be found to unite at a depth of 1500 to 2000 ft., and because of the fact that the cross-fissures have for ages served as a drain and waterway for the copper solutions from the enormous veins of the Anaconda hill, it will be found that where the veins unite, and where there has been a re-deposit of the copper in solution the greatest copper deposit in the world will be found. Many mining men hold to that theory and belief.

It seems likely now that the Davis-Daly Copper company will be granted a franchise by the city of Butte to build a tramway from the Colorado mine to the old Hesperus shaft in the southern part of the city, in order to connect with the Great Northern railway and ship ore to the concentrator owned by F. A. Heinze at Basin. The management of the Davis-Daly says that as soon as the tramway and ore-bins are built the Colorado mine will resume ore shipments. The Davis-Daly had shipped a considerable quantity to the Washoe smelter, most of it mined from the 1500-ft. level of the Colorado. The report is again current, and coming from more authoritative sources than usual, that the Davis-Daly company will soon be in need of additional funds and that some scheme for borrowing, or another assessment on the stock, will have to be resorted to. In Butte it has been a firm conviction since the last assessment was levied that further assessments would have to be made before the company could hope to make a producing mine of the Colorado.

There has been delay in the shipment of the new electric hoisting engine for the Butte-Ballaklava Copper company, but it is expected that it will be shipped about January 20. In the meantime the Butte-Ballaklava will continue operations with the smaller hoist now in use, with which the mine has been developed to a depth of 1400 ft. The new hoist will be able to work to a depth of 2000 ft. The new steel head-frame, 100 ft. high, has also been completed, and the concrete foundation for the new engine laid. The new hoist will be provided with automatic controlling devices for safety. The old steam-hoist will be kept as an auxiliary plant. While the shaft was being enlarged a great deal of development was done on the lower levels, and large bodies of ore blocked.

If there is anything in the renewed reports that, as a preliminary to the big copper merger, the Cole-Ryan and Amalgamated companies of Butte will be combined, nothing of an authentic nature is known in Butte. John D. Ryan, on his recent visit here, disappointed the public by failure to make any important announcement.

Strangely enough, there are many mining men in Butte and the West who now believe that a great deal of the copper merger talk that found its way into print was in aid of an Amalgamated pool, and that with the practical failure of the pool the merger talk gradually subsided.

TORONTO, CANADA.

Porcupine Lake Goldfields. — Cobalt Shipments. — Gowganda. — Electric Power at Cobalt.—Coal from the Arctic.

The Porcupine Lake rush is the feature of the mining situation at present, quite overshadowing Cobalt and the other silver fields. The frequent reports of big discoveries appearing from time to time were naturally received with a good deal of skepticism, owing to the unfortunate experiences at Larder Lake, but official corroboration as to the richness of the district leaves no room for doubt. J. F. Whitson, assistant chief of the Surveys branch of the Ontario Department of Mines, has just returned from a ten days' trip to the Porcupine Lake goldfields, and is thoroughly impressed with the importance of the district as a gold-producing country. He declares that, with the exception of Cobalt, it is more promising than any other part of Ontario. There have been so far 2000 claims staked. The entire townships of Whitney and Tisdale have been taken up, with the exception of some locations reserved for veteran soldiers before the discoveries, and in addition about two-thirds of the two adjoining townships to the south are staked out. The new arrivals number about 50 daily, and hundreds of prospectors are doing development work on their claims. The O'Brien Mining Co., and the New York Syndicate, have each 25 men at work on properties near the southwest corner of Tisdale. On one of these, under the management of Mr. Timmins of the La Rose, a quartz vein has been stripped for 1300 ft., and in many places it shows a width of 20 ft., with free-milling gold visible throughout its extent in many places. The road from Milepost 222, on the Temiskaming & Northern Ontario railway, about 30 miles long, has been finished. It is an all-land route through a level country, and affords easy access to the goldfields. A number of road-houses have been built, and at Porcupine lake about 50 stores and stopping places are being erected. The existence of fine water-powers within easy distance will be an important factor in the economical development of the mines. A large number of men who have figured prominently in Cobalt have gone to Porcupine lake, including Robert Bryce, Robert G. Leckie, M. C. Culvert of the O'Brien mine, Burr Layton, and George Turnbull.

Shipments of Cobalt ore during December amounted to 2971 tons, bringing the total for the year up to 30,098 tons, as compared with 25,463 tons in 1908. The largest shipper was La Rose with an output of 6384 tons, Nipissing following slightly behind, with 6253 tons. The discouraging feature is the slow increase in the number of shipping mines. There were 27 on the shipping list in 1907, 29 in 1908, and only 30 last year, the increase in tonnage being due only to the augmented output of a few large mines. Under these circumstances it is hardly to be wondered that the cheaper Cobalt issues remain stagnant. The dullness of the market has lately only been broken by a spurt in Kerr Lake, which, however, has not affected the general list. Out of 25 Cobalt stocks only five sold higher at the close of 1909 than at the end of 1908, the great majority of the others being much lower. As for Elk Lake and Gowganda they have so far failed to realize the brilliant expectations of a year ago, but considerable allowance must be made for transportation difficulties. The first shipment has just been made from the Gowganda district, the Blackburn mine, Miller Lake, having forwarded 36 tons of high-grade ore to the smelter at Copper Cliff. The mine is operated by a close corporation, the controlling interest being held by the

International Nickel Co. Fifty men are employed and there has been considerable development at a depth of 100 ft. Further shipments are expected shortly. The much-advertised Hartlett mine, in the Gowganda district, has closed for want of funds.

The delay in furnishing electric power has been a considerable drawback to development at Cobalt, but this appears likely to be overcome early in the season. The Mines Power Co. is developing power at the Matabinchonawa river, where there is a fall of 310 ft., for the supply of electricity and compressed air to Cobalt, and is reported to have made good progress so that the power will shortly be available. The Cobalt Lake company has shipped 35 tons of ore for treatment by the Dominion Metal & Refining Co. at Toronto, being the first shipment to this point. The ore will be treated by the Oxford process.

John E. Wilkinson, of Toronto, and many others charged with illegally receiving or selling Cobalt ore, were brought before the police magistrate here on January 6, and committed for trial by a jury. The evidence submitted showed the receipt of money by returned checks of the Wilkinson firm. Samples of coal brought back by Captain Bernier from his last cruise in the arctic regions are being analyzed at Ottawa, and the tests so far made show it to be a good class of fuel.

NEW YORK.

Copper Stocks. — Copper Merger Talk. — Combination at Ely. — Pioche.—Santa Gertrudis Promoter's Profits.—Cortez Associated Mines.—Cornelia Copper.

While the general market conditions have been such as to nullify a good part of its influence, the January report of the Copper Producers' Association was in reality one of the best prophetic indications of a better copper market. The decrease in accumulated stocks of copper during the month of December was a comparatively negligible quantity, being only a little more than half a million pounds. Prior to that time there had been no decrease registered since the month of August, when there was a decrease of 32,261,454 lb. The consumption ran ahead of production during December, with the result that there was a decrease of 11,237,416 lb. One of the interesting utterances recently on the copper situation, somewhat in line with the interview of J. Parke Channing, is an interview with Daniel Guggenheim, endorsing Mr. Channing's position as to the possibility of the comparatively early exhaustion of known copper ore reserves, and expressly calling attention to the fact that a guiding hand is needed to correct existing conditions in the copper market. Many of the larger producers are among those known as high-cost coppers, and many are today, Mr. Guggenheim says, mining their ores without reasonable commercial profit. He says, further, that what is a reasonable return on commercial investments is by no means adequate to compensate those who develop large mining enterprises.

The outlook for a copper merger seems to be doubtful, and plans are much awry. There has been considerable interest evinced in affairs at Ely, where the Ely Central is being examined by Charles S. Herzig on behalf of interests within the company, and by other engineers for outside New Yorkers. It is said that there is a movement on foot to acquire the Guggenheim interests in the Nevada Consolidated on behalf of a consolidation to include the Nevada Consolidated, the Giroux, and possibly the Ely Central. The commission paid to John Hays Hammond and his syndicate, which secured the option on the Santa Gertrúdis for the Camp Bird people amounts to 119,000 full paid shares of the new company, the Santa Gertrúdis, Ltd. The examinations for the Camp Bird company were made by R. J. Frecheville and Rowland Cox, of the firm of Spurr & Cox. The Proprietary Mines Co. of America has ordered Sweetland filter presses for its Tajo de Dolores mine at Guanajuato, also 20 Westinghouse electric motors for the power-plant. New York interests have secured an option on the Prince Consolidated at Pioche, Nevada. It is claimed by the vendors that the property now makes a large showing, having ore to the value of $8,000,000 net blocked out. There is evidently to be a rejuvenation at Pioche. Development work on the joint properties of the Nevada Utah and the Ohio Kentucky at that camp has been encouraging and plans for a smelter and additional transportation facilities are to be pushed. The Cortez Associated Mines, an organization which is to work along the lines of the General Development Co., has been organized among Boston and Michigan copper interests. The stock subscription books were placed in the hands of Wrenn Bros. of Boston and New York, and the shares offered were subscribed several times over. The activities of the new concern are to be largely in the State of Hidalgo, Mexico.

I am informed today that the General Development Co. which controls the Miami, Ray Central, the New Keystone, and other copper properties, has secured an option on a large block of the stock of the Cornelia Copper Co. The Cornelia is owned by a group of St. Louis, Missouri, capitalists, the property being in Mariposa county, Arizona.

SALT LAKE, UTAH.

Park City Merger. — International Smelter Delayed. — Utah Consolidated Aerial Tramway.

A conference has been held in New York for perfecting a merger of a larger portion of the mineral-bearing area of Park City. David Keith, president, and Thomas Kearns, general manager, of the Silver King Coalition Mines Co., have been in attendance at the conference, which was held at the invitation of Hayden, Stone & Co. The purpose of the meeting was to get the consent of the controlling interests in the Silver King to a merger of properties, which would include a number that are now in litigation over titles. Hayden, Stone & Co. agreed to finance the proposed company, and give the controlling interests in Silver King a cash consideration for their stock. The return of Keith and Kearns has thrown no light upon the situation, but it is understood that they have practically agreed to accept certain terms for their holdings, and that the proposal is acceptable to Hayden, Stone & Co., provided the Silver King mine proves up under an examination. The big mine has been a steady producer since 1890. During that period it has yielded upward of $25,000,000, and dividends to date have amounted to almost $12,000,000, while a million has been expended in surface improvements, including a mill of 300 tons daily capacity. Its ores are silver-lead with some copper and gold. There is said to be ore in sight to make it a paying mine for more than ten years to come, the ore averaging about $45 per ton. The mine has never been troubled with a heavy flow of water. It is opened by a shaft 1300 ft. deep and a tunnel over two miles long. It has been the principal producer in Park City for 15 years, and is paying quarterly dividends of $187,500. The proposed merger does not include any of the regular producing mines of the camp except the Silver King.

E. P. Mathewson, general manager of the International Smelting plant in Pine canyon, has just made an inspection of the works in course of construction. The structural steel material has been delayed in transit, and the extremely cold weather put a check on concrete construction. The mammoth stack is about 40% completed, and the force of 600 men employed is pushing work as fast as conditions will permit. Some disappointment is felt over the delays which will prevent starting the plant by April 1, the date on which ores are to be received from the Utah Consolidated mine at Bingham. The officials cannot give the date on which the furnaces will be blown in. For a time it was feared that the Utah Consolidated mine would have to close for a few months until the new smelter was completed, but it is understood that shipments will be continued to the Garfield smelter under the old contract for a reasonable length of time.

The Utah Consolidated has all of its towers in place for the aerial tramway, except two in Pine canyon. Almost all the machinery on the east side of the mountain is in place, and the controlling station on the summit will soon be completed. The terminal station at the International Smelting plant has the concrete work in, and the steel structure is now being placed.

General Mining News.

ARIZONA.

COCHISE COUNTY.

A recent report to the stockholders of the Heffern Mining & Development Co., operating at Douglas, stated that the shaft was down 500 ft., two cross-cuts run on the 400-ft. level, and ore opened that assays 2½% copper with several dollars per ton in gold and silver.——The ore recently found on the 400-ft. level of the Holbrook shaft of the Copper Queen company has been cross-cut for 65 ft. without reaching the limit of the orebody. The ore was found in territory that was previously thought barren of commercial bodies.——Sinking is to be resumed at a depth of 620 ft. in the shaft of the Bisbee Extension company, operating west of Bisbee, and a heavier hoist installed. George W. Long is superintendent.——The Germania and April Fool shafts of the Calumet & Arizona company, at Courtland, have been connected on the 500-ft. level and preparations are being made to ship the ore to the smelter at Douglas. A double-drum hoist is being installed at the Germania shaft and sinking will be continued to a depth of 1000 ft. ——Ore assaying $1792 per ton has been found on the Eagle claim in the same district.

GILA COUNTY.

(Special Correspondence).—The work of clearing away the wreckage resulting from the accidental destruction of the large hoist at the A shaft of the Old Dominion mine, December 31, 1909, is in progress. A small hoist is now being moved from the C shaft for temporary work at the A, where 373 tons per day is being hoisted. A small compressor and a 750-kw. electric generator are being added to the equipment at the power-house of the Old Dominion smelter.——Sinking has been resumed at the No. 4 shaft of the Miami property. This shaft is now slightly over 450 ft. deep, and will be put down to the 700-ft. point. The Miami Copper Co. is employing about 600 men in mining and construction work. The foundation of the concentrator is over two-thirds completed. The building of a large warehouse, a 65 by 75-ft., two-story office building, 5 cottages, and 4 bunk-houses is nearing completion. One Star churn-drill is being operated on the northwest part of the Miami property. Two more churn-drills will soon begin prospect work. Eventually, all the Miami land will probably be drilled. B. Britton Gottsberger is resident manager, N. O. Lawton, mine superintendent, and H. Kenyon Burch in charge of the concentrator construction.——The McGaw shaft, through which all ore will be raised from the Superior & Boston mine, has been sunk 35 ft. below the 600-ft. level. Sinking will be continued indefinitely to open the orebody at greater depth. The piers for the 200-ton ore-bin being erected at the McGaw shaft have been completed, and all the timbers for use in constructing the bin have been framed. There remains 85 ft. of cross-cutting to complete the connection between the McGaw shaft and the Great Eastern workings.

Globe, January 14.

MARICOPA COUNTY.

A meeting of the stockholders of the La Coronada Mining Co. was held at Phoenix and S. J. Tribolet re-elected president. The company is operating the La Coronada mine near Florence and has cut the ore on three levels from the 255-ft. shaft. The board decided to sink to the 300-ft. level, cross-cut to the ore, and commence stoping as soon as heavier machinery can be installed.

MOHAVE COUNTY.

L. McKesson has opened a 30-ft. vein on the east side of the range between Goldroad and Union pass that assays $11.50 per ton. This is important on account of its accessibility to power and transportation.——The new shaft at the Sunnyside mine, at Oatman, opened two ore-shoots that were each about a foot wide, and averaged about $35 per ton.——At the Carter mine, in the same district, the shaft is down 250 ft., and is expected to cut the vein within a short distance.——A pump is to be installed at the Ruth mine, near Goldroad, as there is too much water in the shaft to be handled with the bucket. A sample taken across the face of the 100-ft. drift assayed $84.76 per ton.——M. D. Thomas has taken charge of the Tennessee mine, one of the properties recently acquired by the United States Smelting, Refining & Mining Co.——The Golconda mine, at Cerbat, which was forced to stop shipping a short time ago on account of the heavy roads has resumed and is sending out 1000 tons per month.

PIMA COUNTY.

A new whim was installed at the shaft on the Tellurium claim of the Gold Bullion Mines Co., operating in the Baboquivari mountains, and a steam-hoist will be placed on the Last Chance claim in a short time. On the 180-ft. level both east and west drifts are in ore. A meeting of the stockholders was held at Tucson recently and the same board of directors re-elected.——The shaft at the La Mexicana mine, south of Tucson, is down 100 ft., and has been in ore assaying from 8 to 15% copper with a small amount of silver from a depth of 18 feet.

CALIFORNIA.

EL DORADO COUNTY.

(Special Correspondence).—The Invincible Mines Co. has been formed with a capitalization of $500,000 to operate the Invincible group. John A. Britton, P. M. Reeves, E. V. T. Lee, H. Bostwick, and C. W. Conlisk, all of San Francisco, are directors.——The 10-stamp mill at the Mount Pleasant is running 10 hours per day. The December clean-up approximated $6000. With the return of warm weather the mill will be operated continuously. Excellent ore is being opened at the 400-ft. point.——Henry Odlum has been awarded a contract to drive a new adit at the Eagle. The orebody is 4 ft. wide and averages $12.50 per ton. The mine is opened to a depth of 330 ft., and has a productive record of $1,000,000. L. J. Kendrick, of Berkeley, is managing owner.——The Encinal is reported to be producing excellent gravel.——The Ensley, at Fairplay, reports progress in development with considerable gravel in sight.—— The working force at the Douglas has been increased and work is being pushed on the adit and other underground workings. Good ore is being produced.——Several owners of small properties in the Mud Springs district are preparing to operate extensively with the advent of spring.

Placerville, January 14.

INYO COUNTY.

The Beckdolt property, at Panamint, has been bonded to Denver people and work resumed on the group.——An 8-ft. vein has been opened on the 300-ft. level of the Queen Ann mine, 2 ft. of which is high-grade ore. A 40-hp. hoist is to be installed at the property.——The Mecham & Keys Co. has sunk a 75-ft. shaft on its property south of the Old Coso mine and cut a vein, samples from which assay as high as $60 per ton.——At the old Cyty property the 5-stamp mill which was erected over a year ago is to be started next month.——The Columbia Mines Co. is to lay seven miles of pipe to bring water from the Crystal spring to its property near Darwin.

NEVADA COUNTY.

The shaft at the Nassau mine, formerly the Dana, is down 350 ft., and is opening good milling ore. Electric power has been installed to operate the hoist and compressor.——Operations have been resumed at the German mine, four miles above Washington, and the adit is being cleaned out and re-timbered. The mine has a good production record, though it has been idle for a number of years. ——Lessees working on the 800-ft. level of the Champion mine, near Nevada City, have opened a 4-ft. vein and are keeping 10 stamps dropping on the ore which averages $30 per ton. As this vein has never been opened before, its discovery will mean much to the Champion properties. The sale of the group which was supposed to have taken place some time ago, has apparently fallen through, the mine now being operated largely by lessees.——The vein has been cut on the 600-ft. level of the Union Hill mine, varying from 16 to 22 in. wide, and averaging $18 per ton. ——The work at the Central Consolidated, on Banner

mountain continues to open good ore. The old Remington Hill channel crosses this property and development is being carried forward here as well as on the quartz vein. George H. Hewitt has secured a bond on the old Ben Franklin mine, in the Grass Valley district, and will install new machinery.

PLACER COUNTY.

(Special Correspondence).—A 5-stamp mill has been installed at the Davenport within the city limits of Auburn, and excellent ore is being treated. Several shoots of rich ore have been opened, and the property has been leased under a working bond to several parties. N. E. Davenport is owner.—M. Savage and associates are arranging to resume operations at the Three Queens.—It is reported that operations on the Gold Blossom will be resumed in the spring.—The 10-stamp mill at the Crater has been practically completed, and wires are being strung to conduct electricity to the plant.—The Roseville Mine, Mill & Lease Co. has been incorporated with a capital stock of $500,000 to operate in this county and $250,000 subscribed.

Zenda Mill, Amalie District.

The directors are: R. E. Nobel, T. J. Walsh, R. R. Moore, A. D. Williams, and H. G. Smith.

Auburn, January 15.

SHASTA COUNTY.

The oil-burning experimental reverberatory furnace at the Mammoth has been completed and will be started on the fine ore in a short time. The furnace is 12 ft. wide by 30 long, and is designed to make a low-grade matte and effect a better saving on ore rich in gold and silver.

SIERRA COUNTY.

The suit which has tied up the work at the Sixteen-to-One mine, at Alleghany, has been settled out of court and a new company incorporated to operate the property. At present the inclemency of the weather will prevent much work, but when the season has advanced far enough new machinery will be installed and the mine opened on a larger scale. H. L. Johnson, owner of the Tightner mine, may act as manager of the new company.——Another raise is being put up to tap the channel at the White Bear property.

SISKIYOU COUNTY.

(Special Correspondence).—The Oom Paul has arranged for the installation of a 5-stamp mill, and is considering the erection of a cyanide annex. A mill-site has been selected near the lower adit. Electricity will be the motive power. Will Pickard is manager.——The Siskiyou Syndicate is driving an adit on its holdings in Quartz valley.——At the Elk Creek a 12-in. vein of $50 ore is being mined. A 10 days' run of the 2-stamp mill recently netted $2177. At a depth of 115 ft. a new vein 15 in. wide has been cut. The company will either sink the shaft deeper or drive a lower adit to develop the new vein.——The Zarina is driving on an 8-ft. vein and running cross-cuts to other orebodies. New machinery has been installed and a force of 20 men is employed. The reservoir will be rebuilt in the spring.—The Scott Bar Hydraulic Co. and several other placer properties have been forced to suspend temporarily owing to snow and ice.—Arrangements are under way to sink a 500-ft. vertical shaft at the Morrison Carloch to open the vein abandoned by the former owners. The old incline shaft has been rendered unsafe by the sliding ground.—Activities in the Blue Ledge copper district are much in evidence, although the winter storms have greatly retarded development.—The Mines Finance Co., of London, will resume the active development of its copper holdings in the Happy Camp district as soon as spring sets in.

Yreka, January 13.

TRINITY COUNTY.

W. G. Collins and A. E. Paulsen have a train of 12 mules packing high grade ore from the Knob mine to Deadwood where it is forwarded to the Selby smelter. There are 10 tons of ore ready for shipment that assays about $700 per ton, and a large amount of lower grade opened in the stopes that will be shipped in the spring.—The La Grange, Hupp, and Union Hill mines have been closed on account of the cold weather.—Two giants are in operation at the Montezuma mine, at Junction City, and a good season's run is anticipated.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—One foot of ore containing 11 oz. gold per ton has been cut in the west drift on the Charter vein in Breckenridge mountain. Shipments are to be started at once.——Ore assaying 32.34 oz. gold and 37 oz. silver per ton has just been found on the Golden Jack vein which is being worked through the Homestake adit. The streak averages 3 in. wide. A. L. Stephens is manager.——A contract has been awarded to Thomas Randahl to drive the Prudential adit 100 ft. The bore is now in 800 ft., and from surveys the Magenta vein should be reached within a short distance. F. A. Maxwell is manager.——Work was resumed last week in the advance of the Kirkland adit on Democrat mountain. M. J. Riley, the manager, states that the adit is to be driven for 1000 ft. before any work on the veins is started.——Five carloads of electrical machinery for the Malm chemical-electro plant has been shipped from New York and is expected to arrive at Georgetown during the next week.

Georgetown, January 15.

(Special Correspondence).—A big force of men has been put to work at the Alice mine, in the Alice district. A shaft is to be sunk 100 ft., and the orebody further explored. A. H. Roller, the manager, states that work will be rushed on the 300-ton reduction plant as soon as the weather will permit.——The Resolute adit is being cleaned out and retimbered by Richard Ulrich. Ten lode mining claims are owned and all will be explored through the adit.——A contract has been awarded by the Henryin Irrigation Co. to the D. A. Camfield Development Co. for the driving of a 4-mile tunnel through the Clear Creek and Grand county range. The contract price is $4,421,500, which includes the tunnel, reservoirs, and canals. It is intended to irrigate 120,000 acres of land. A huge plant of machinery will be provided for each side of the Continental divide.——During the year 1909 the Newhouse tunnel was driven 3330 feet.

Idaho Springs, January 15.

GILPIN COUNTY.

(Special Correspondence).—William Mitchell & Sons are developing the Gulch mine and regular shipments of smelting and concentrating ore are being maintained.——For the week ended January 1, the Rocky Mountain National Bank purchased 231 oz. in gold retorts which was from the following mines: Egyptian, 95 oz.; Fifty, 87 oz.; Sleepy Hollow, 33 oz., and Baker, 16 oz.——The Champion mine, a former heavy producer, is being placed in condition for extensive operations. Last week the Trio adit intersected the vein at the eighth level, draining the entire workings of the great bodies of water.

Central City, January 14.

OURAY COUNTY.

Ore assaying 900 oz. silver and 4 oz. gold per ton has been opened on the third level of the El Mahdi mine, and shipments started to the smelter.——Jackson & Weatherly, operating the Wedge mine under lease, are shipping one car of ore per week.——Regular shipments are being made from the Black Girl mine which Fred Herzinger is operating under lease and several bodies have been blocked out that will pay well if treated in a local plant.

TELLER COUNTY.

The Strong Gold Mining Co., operating the Strong mine near Victor, shipped 50 tons of ore that assayed from $200 to $300 per ton. This is one of the richest shipments sent out of the camp. The company is mining above the water-level and taking out about three cars per day.——The production of the Vindicator Consolidated in December amounted to 3000 tons, valued approximately at $75,000. About 1300 tons of this was produced on company account, the rest by lessees.——The Pride of Cripple Creek Leasing Co. is installing an 8 by 10 in. geared hoist on the Pride of Cripple Creek claim on Ironclad hill.——Operations are to be resumed at the Blue Flag mill on Raven hill.——The Lucky Corner Mining & Leasing Co., operating the Lucky Corner mine on Raven hill, is shipping two cars per week.——A vein varying from 8 to 15 ft. in width has been opened on the 800-ft. level of the Trail mine.

IDAHO.

IDAHO COUNTY.

At the Seventeen group, near Newsome, which J. C. Hass is operating under a bond, an adit has been driven 160 ft. into the hill, a shaft sunk 100 ft., and a cross-cut driven from the bottom of the shaft to the ore.——Work is to be resumed at the Gold Medal mine, in the Elk City district, by C. E. Sample. The adit is in 200 ft. and the exploration work will be centered at this point.

KANSAS.

CHEROKEE COUNTY.

(Special Correspondence).—One of the best finds of recent weeks in the Galena camp is the ore cut by Savage &

The Missouri-Kansas Zinc Belt.

Co., who have opened 30 ft. of ore on the old Taylor Foster land, west of the city. The discovery was made in the third hole, the drill entering the ore at 60 ft., continuing to 90 ft. The Blue Mouse company a short time before cut ore on the same land, the face being 15 ft. thick.——Many operators are active on the old Templar tract. This land was a bonanza in the earlier days for shallow lead gouges and considerable pockety ore was taken out. The company is planning to drain the tract to 100 ft. next spring in order that the operators may mine the deeper zinc-levels. Some of the ore now taken out is milled at a custom plant while much is hand picked and sold in the rough without further cleaning.——The Missouri Zinc & Lead Co. has been prospecting a lease in the Cave Springs camp, and after finding good ore at different levels has bought the old Equitable mill and is ready to move it. The company will at present operate the shallow level from 75 to 100 ft., and later take up the deep levels which are similar to those of the Herald company adjoining, one of the deepest mines in the district. ——McClure & Kennedy are erecting a tailing mill in the Badger-Peacock camp on the S. H. & S. lease which will be ready for operation in a few weeks. The tailing contains a fair percentage of ore. Much of the ore on this and other neighboring leases is found in underground water channels lining the roofs, floors, and walls, in large pure chunks. ——The Elenita mill, the 250-ton plant recently erected by Frank Nicholson on the Murphy land, is now ready for operation.

Galena, January 14.

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—Gates & Co. have reached the ore-level on the Connor land at Prosperity, in the shaft after expensive sinking and cross-cutting. The ore is rich, the entire face of the drift assaying 10 to 12%. The lease adjoins the old Victor lease which was one of the bonanzas of the district a few years ago, paying $110,000 in royalties at a time when ore sold at $20 per ton. Two drill-holes cut the ore at 217 ft., continuing for 43 ft.——The Gussie K. Mining Co., in the Duenweg camp, is working three distinct runs of ore, zinc blende, galena, and calamine, the ore occurring from 100 to 140 ft. The blende and calamine are so closely associated that the separation of the two is very difficult. The galena ore is especially rich, being free and of pockety formation.——The United Zinc and Peacock Valley Mining companies have both been very active in prospecting different tracts held by them. The Peacock company has most of its holdings in the Badger-Peacock camp, but has also been drilling leases in Prosperity, Duenweg, and Four Corners. On the Innovator tract the lease shows sheet ore at 210 ft. The United Zinc Co. is draining the drifts of the old Lincoln mine at Four Corners where a disastrous cave-in occurred some years ago, leaving much good ore in the drifts. The company is also opening a new lease nearby and has two drill-holes in ore on the McBee land, the ore showing from 80 to 100 ft. The Leckie lease also held by the company has ore at 35 ft.——The 40-acre lease of the old Troupe company, at Carterville, is being re-worked by McDonald & Henson. This land has been mined at intervals for 15 years, being a steady producer and turning in as much ore as any land in that camp.

Joplin, January 14.

MONTANA.

LINCOLN COUNTY.

The Coldflint-Keystone mines, at Sylvanite, in the northwestern part of the county in the Yahk mining district, have been sold for $75,000, and work will be started at once under the management of H. I. Reynolds. The properties have been closed for a number of years by litigation and their reopening will mean much to that portion of the county.——The Victor Mining & Milling Co., operating 11 miles north of Libby, is installing a new compressor and Pelton water-wheel. Power will be developed from the water of Granite creek which is brought to the mine under a head of 219 feet.

NEVADA.

CLARK COUNTY.

The operators east of Searchlight have formed a new mining district bordering on the Colorado river, that is to be known as the Gold Eagle mining district. Some of the properties included are the Victor-Queen Bee, Capitol, Bonnie Brae, and Oxnard-Eldorado.——Power has been turned on at the Occidental plant in the Searchlight district and the mill will be started as soon as the weather modifies enough to allow the cyanide plant to operate successfully. ——Work has been resumed at the Eldorado Crown grad-

ing for the Huntington mill which the company will bring from Capitol. The dredge of the Colorado River Dredging Co. which proved a failure was wrecked by the high water and the barge with its costly machinery is completely ruined.

ESMERALDA COUNTY.

(Special Correspondence.) At Rawhide there are about a dozen leases running in a half hearted way. The people operating the Murray 10-stamp mill acquired the Victor lease and are milling the ore from that ground and the King Heisner mill (National Mining & Leasing Co.), is milling the Truitt dump on Hooligan hill. Neither mill is in a position to cyanide the ores of the district which contain much more silver than at first suspected. Ten dollar bullion is rare, while five is above the average. The camp is suffering from the want of a mill that can treat a low grade gold silver ore. This is a great drawback to the district and is seriously affecting its development.

Rawhide, January 14.

The cross-cut on the 1000-ft. level of the Clermont workings of the Goldfield Consolidated property cut the vein and it is reported that it will rival in richness the ore that made the Clermont a bonanza in the levels above. —At the Florence the mill is running smoothly, crushing from 150 to 160 tons per day, and making a saving of 40% on the plates, the pulp going to the cyanide tanks assaying about $8 per ton. In the mine the ore is being blocked out ahead of the mill and connections made with the old lease workings so the supply will be assured for some time to come.——The shaft at the Combination Fraction is down 650 ft., and will be continued to the 800-ft. point.——The Yellow Tiger Mining Co. and the Elks Leasing Co., operating in the Goldfield and Diamondfield districts, have consolidated, issued additional stock, and will probably build a mill when work on the properties is resumed. John F. Champion will manage the affairs of the company.——On the Gold Bar lease good ore has been opened on the 200 and 300-ft. levels for several hundred feet, and a carload is to be shipped to one of the Salt Lake plants to determine the most advantageous method of treatment to be installed in the mill that the lessees are to build this spring.

HUMBOLDT COUNTY.

Operations are to be resumed on the Vernon Consolidated ground, at Vernon, in the Seven Troughs district, a 15-hp. hoist, car, rails, and other equipment having been ordered.

LYON COUNTY.

The raises which are being driven at the Mason Valley mine are completed to the second level. It is expected to complete the work some time in February when the force at the mine will be doubled.——The 3-compartment shaft at the Nevada-Douglas has been completed and the work at the property will be confined to the construction of ore-bins and roads till the railroad is ready to handle freight.

NYE COUNTY.

(Special Correspondence).—The 30-stamp mill of the Tonopah Extension has been completed and the ore-crusher started in order to have the bins full when the stamps are put in operation, which will be within a few days. The ore supply will come from above the 600-ft. level, but development from the 700 down will be started immediately.——The Belmont vein in the east drift on the 1100-ft. level continues 8 ft. wide with the ore sampling $60 per ton. The width of 8 ft. continues for 100 ft., the high value occurring in the last 20 ft. of work. The ore is mainly sulphide with considerable native and wire silver occurring.——The MacNamara continues to limit shipments to one carload per day, in order that more attention may be devoted to development. Several veins, ranging from 3 to 6 ft. wide, have been opened above the 300-ft. level.——A. C. Eisen has levied an attachment on the Mayflower Consolidated for $50,320, alleged to be due him for money advanced to the company, or paid for them upon endorsement of unpaid notes to the John S. Cook bank. Eisen has also turned over the property to the Mayflower Consolidated Mining & Leasing Co. Mr. Eisen is president of both companies and used his power to make the transfer. The opposition states that the contest will be fought to a finish in the courts. The Bonnie Clare will shortly have the new equipment installed at the mill. The company has also decided to construct a railroad from the mill to the heart of the Gold Mountain district and will handle considerable custom ore. Eight miles of track, two locomotives and four 10-ton side-dump cars have been purchased to equip the line from the mill to the Rattlesnake mine. Andrew J. Trumbo is general manager. The Williams is arranging for active work. The value of the ore shipped by the Pioneer lease in December is approximately $20,000. A shoot of ore running about $60 per ton has been cut in the new workings. It is reported that the lease may be taken over by the parent company.

Tonopah, January 15.

OREGON.

BAKER COUNTY.

(Special Correspondence). The Oregon & Northwestern Smelting Co., in a letter dated January 8, 1910, addressed to ore and concentrate producers in this district, announces that its concentrating, smelting, and copper converting plant will be built at Homestead, Oregon, and that the company will have the plant ready for business about February, 1911. The Lewisohns are the promoters of the enterprise. Homestead is situated on Snake river and is the present terminus of the new Northwestern railroad that connects with the Short Line at Huntington, Oregon, and will eventually be built to Lewiston, Idaho. All the Seven Devils, Idaho, copper mines will be tributary to the new plant.——The local sampling works received 135,000 lb. of high-grade shipping ore today from the Highland Gold Mines Co., owning a group of promising claims on Rock creek. The property is being developed successfully for Eastern stockholders by Robert R. McGaughy.——A deal has been completed on the Golconda and Climax mines, in the Cracker Creek district, and preparations are under way to mill the Climax ore at the 20-stamp Golconda mill. B. L. McLane has been employed to overhaul the mill and machinery and put it in shape for immediate operations. F. M. Meyers, a Seattle mining man, has figured prominently in the negotiations, and William Jackson, formerly in charge of the Golconda, will be superintendent.——Considerable development work is being done on the Iron Mask Copper Co.'s group of 21 claims, near Sparta. Good copper ore is being opened in the 600-ft. adit.——The Bonanza mine, in the Greenhorn district, was recently sold at sheriff's sale for $14,000 to Frank Moore, the largest stockholder and creditor. Negotiations are now pending for the opening of the property, which is fully equipped and has 35 Risdon Iron Works stamps. The development work is to include a 1600-ft. adit that will open new orebodies at a depth of 500 feet.

Baker City, January 14.

(Special Correspondence).—The Oregon-Idaho Light & Power Co. will have finished its power-plant at Copperfield, on the Snake river, within 12 to 14 months. At this place the river makes a bend four miles long. A tunnel 1500 ft. long, 27 by 27 ft. in cross-section, has been driven, connecting the two nearest points in the bend, and obtaining a 50-ft. fall. This tunnel will carry one-third of the volume of water in the river, and will serve to develop 35,000 hp. At the upper end of this tunnel is an advantageous dam-site where a dam approximately 450 ft. long is under construction. The company has a payroll of $70,000 per month, and the work was commenced two years ago. It is stated that 75% of the plant's estimated power has been engaged by users of light and power in Oregon and Idaho, which includes mines, mills, and electric railways. The construction and engineering work is being done under contract by J. G. White & Co., and the Arnold Engineering Co., both of Chicago and New York.

Copperfield, January 15.

SOUTH DAKOTA.

LAWRENCE COUNTY.

No great change has taken place in the strike situation at Lead. The Western Federation of Miners still declares the strike in force, and the Homestake, together with the

largest operators of the district, are planning to resume work, with men who are not members of the Federation. Applicants for positions are forced to sign cards renouncing allegiance to the Federation before they can obtain work. A small force of men has been kept at work regularly in the mine and mill.

UTAH.

JUAB COUNTY.

Considerable development is being carried forward in the Chief Consolidated property in the Eureka district, and preparations are being made to install a complete plant. Walter Fitch is manager.——On the 300-ft. level of the East Tintic Development mine the company is stoping ore that assays from 10 to 30 oz. silver per ton with a good lead content. On the 500 the cross-cut is expected to open the ore any day. Three carloads were shipped recently that netted the company $2500.——Lessees in the Provo have opened a body of lead ore and are preparing to ship a carload taken out in the development work.——At the Opohongo, which is being operated through the Black Jack property, a winze is being sunk on the ore at the 300-ft. level. William Hatfield is directing the work.——The development of the American Star is being carried on through the Eagle and Blue Bell mine, and it is probable that a large working shaft will be sunk for the use of both properties, as the control of both companies is held largely by the same people.

SUMMIT COUNTY.

The cross-cut from the shaft at the New York Bonanza is in 140 ft., and is expected to open the vein at any time. A number of stringers have been cut.——At the Iowa Copper, on Scott hill, preparations are being made for the resumption of shipping. A silver-lead orebody has been opened and the bulk of the ore will be drawn from this. The company shipped some copper ore last fall, but the high freight and smelter costs were prohibitive in the transfer of low-grade ore.

TOOELE COUNTY.

The Bullion Consolidated Mines Co. has been organized to take over the Honerine Mining & Milling property, the Honerine Tunnel Mining & Milling Co., the Old Bullion Mining Co., Honerine Western Mining Co., and the Honerine Extension Mining Co. The properties are situated in the Rush mining district, near the town of Stockton, and have good records for production in the early days of the district.

AUSTRALIA.

NEW SOUTH WALES.

Prospectors at Mount Boppy have opened a quartzite lode 39 ft. wide with portions that assay as high as 40 oz. gold per ton.——Fraser & Ward obtained 108 oz. gold from 53 tons of ore taken from their Peak Hill property.——At Wyalong the reduction works are kept busy with ore from the neighboring mines. The drift on the 500-ft. level of the Golden Fleece has been extended 130 ft. south through ore a little below the average. The company crushed 17 tons of ore at the Cockle Creek plant, obtaining 44 oz. gold, and have another 20 tons ready for treatment at the same place.——A rich discovery has been made on what is supposed to be the continuation of the Victoria reef, near Drake, two feet of high-grade ore having been opened.

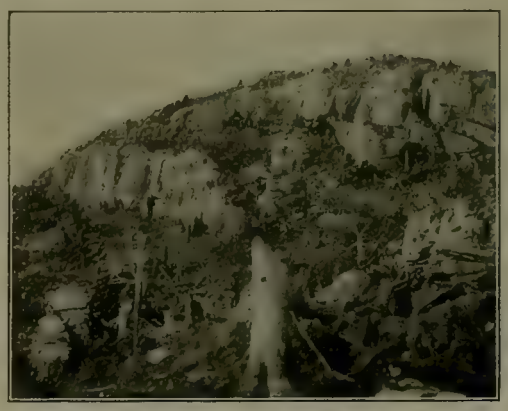
CANADA.

BRITISH COLUMBIA.

(Special Correspondence).—It appears evident that the year 1910 will be one of the best years that the mining industry of the Nelson district has ever experienced. Judging from the work being done as the year begins and from work planned at mines now absent from the shipping list, the coming year will be one of substantial progress. This applies to the lead-zinc mines particularly. It will mean a greater dispensation of the Dominion bounty on lead, and the possibility of a bounty on zinc being granted. The full lead bounty of 75c. per 100 lb. was payable during 1909, the total paid for the year amounting to about $340,000. The lead output showed an increase of over 1000 tons, amounting to 22,500 tons. The Sullivan group lead property will be worked extensively by the Consolidated company; a large force will work the Slocan Star; the work going on at the Big Ledge zinc deposit will, no doubt, result in heavy shipments; rumors of resumption of work on the Surprise mine at Sandon are heard; increased shipments will be made from the Richmond-Eureka by the Consolidated Co., and from the Van-Roi and Lucky Jim zinc mines.——W. J. Milne, of Vancouver, bonded the Golden Gate, Fanny, and Golden Fate claims in the Poplar Creek gold district camp. A crew of four or five men immediately started work.——The year opens auspiciously for the Sheep Creek-Ymir district with steady production at the Queen, Nugget, and other gold properties. The Vancouver capitalists who some time ago bonded the Alma M., have permitted their lease to lapse and the property is now being worked by the owners.——It is stated that some of the coal mines in the Crows Nest district are contemplating the installation of by-product coke ovens, following German designs, which will enable them to save the by-products of the manufacture of coke by distillation.——Ore shipments from the Rossland district for the first week of the year amounted to over 5700 tons, which is above the average for the past year by nearly 1000 tons. The Centre Star, Le Roi No. 2, Ltd., and Le Roi, are shipping and work is also going on at the Velvet, Fife mines, I. X. L., and others. Resumption of work early in the spring is looked for on the Blue Bird and Hattie in the south belt and on the Jumbo and possibly the O. K. in the gold belt to the west of the camp.

ONTARIO.

(Special Correspondence).—The Kerr Lake Mining Co., of Cobalt, has increased its dividend to 50c. per share, quarterly. The public indifference to Cobalt issues continues, but there seems to be some interest growing in the reports coming in from the Porcupine mineral district, lying



Huronian Conglomerate, Cobalt District.

about 80 miles north of Cobalt. The camp is not in a silver district, but yields gold, the surface ore being evidently very rich, even allowing for a heavy discount on the tales as they come in. Ore is said to run as high as $10 per pound, and the formation is declared to show true veins, with enormous outcrops. As is always the case with new born mining camps, no language is used in describing the new finds, save the highest power superlatives.

Cobalt, January 12.

MEXICO.

SONORA.

(Special Correspondence).—The Mexico Mining, Refining & Exploration Co., which for two years has been developing its property situated 30 miles west from Hermosillo, has two veins which have been opened by cross-cuts driven from a shaft that was sunk between the veins. Some of the ore that was shipped ran high in silver, lead, and copper, with a little gold. W. T. Calderwood, the manager, states that a new boiler is being added to the steam plant, and this will enable them to increase their pumping and drilling facilities.

Hermosillo, January 13.

Personal.

Professional men are invited to send items of their engagements and travels. Such news is interesting to friends.

O. JENNINGS is at Parker, Arizona.

CHARLES BUCHERS is at New York.

S. H. WEMBERLEY has gone to England.

F. L. RANSOME was at Boston recently.

HORACE F. EVANS is at Portland, Oregon.

F. W. OLDFIELD is in Guadalajara, Mexico.

E. H. GARTHWAITE has gone to New York.

J. W. INGERSOL is residing at Blair, Nevada.

E. W. CARSON is at Picacho Basin, California.

G. R. EASLEY has removed to Twin Falls, Idaho.

LLEWELLYN HUMPHREYS, of Salt Lake, is in Arizona.

F. W. DE WOLF was at Boston and Washington recently.

HENRY B. HAIGH has returned to New York from Europe.

W. B. MCDOUGAL, of Homestead, Oregon, was in Salt Lake.

J. V. N. DORR is now at 728 Equitable Bdg., Denver, Colorado.

F. B. REECE is with the Blaisdell Syndicate at Pachuca, Mexico.

A. J. ROBIN has gone to Ellora, Jersey, Channel Islands, England.

G. D. GERSON has come to Berkeley, California, from Portland, Oregon.

W. A. KINKLE has gone to the Socorro mines, Mogollon, New Mexico.

M. C. ALLEN has returned from Durango, Mexico, to Denver, Colorado.

S. F. PARRISH has removed from Georgetown, Idaho, to Parker, Arizona.

A. H. ELETMAN was in San Francisco, and has returned to Tonopah, Nevada.

R. S. CHASE has left Silver City, Nveada, and will reside at Masonic, California.

R. D. SKELLEY has gone from Round Mountain, Nevada, to Riverside, California.

S. F. BRETHERTON has returned to San Francisco from Shasta county, California.

WALTER HARVEY WEED is at Ely, Nevada, examining properties for New York clients.

EDMUND JUESSEN was in San Francisco, and will go in a few days to Oaxaca, Mexico.

H. C. WILMOT, of New York, is in the Mormon Basin district, Malheur county, Oregon.

E. M. HAMILTON has returned to Ventanas, Durango, from Lluvia de Oro, Chihuahua, Mexico.

A. E. DRUCKER has been visiting Cripple Creek, Colorado, and is on his way to Salt Lake City.

H. R. NORSWORTHY has accepted a position with the Comstock Pumping Association at Virginia City, Nevada.

HORACE V. WINCHELL has gone to Arizona to examine the Helvetia Copper property, at Helvetia, Pima county.

WALTER B. MURDOCK, of Pachuca, Mexico, is at New York, on his way to London, England, in the interest of the Pachuca tunnel.

C. L. CONSTANT & Co. are to examine the Santa Rita mine in Nicaragua; R. B. LAMB, of Constant & Co., will sail from New Orleans on January 22 to conduct the work.

PHILIP ARGALL has associated his sons PHILIP HENRY ARGALL and OATES ARGALL with him under the firm name of Philip Argall & Sons, with offices in the Majestic Bdg., Denver, Colorado.

Obituary.

F. SEYMOUR SHEWELL died January 10 at his home in Hinsdale, Illinois, after a protracted illness. He is survived by a mother, wife, and child. Mr. Shewell was a valued contributor to the MINING AND SCIENTIFIC PRESS.

Market Reports.

LOCAL METAL PRICES

San Francisco, January 20

Antimony	12–12½c	Quicksilver flask	$41–41.50
Electrolytic Copper	16¼–16½c	Spelter	7½–8c
Pig Lead	4.85–4.90c	Tin	36.50–37c

METAL PRICES

By wire from New York

Average daily prices in cents per pound

Date.	Electrolytic Copper	Lead	Spelter.	Silver per oz
Jan. 13	13.69	4.70	6.16	52⅛
" 14	13.69	4.70	6.15	52⅛
" 15	13.69	4.70	6.15	52⅛
" 16	Sunday.	No market.		
" 17	13.63	4.70	6.14	52⅛
" 18	13.63	4.70	6.13	52⅛
" 19	13.63	4.70	6.10	52⅛

ANGLO-AMERICAN SHARES.

Cabled from London.

	Jan. 13. £ s. d.		Jan. 20. £ s. d.	
Camp Bird	1 9 0		1 8 6	(Jan. 19.)
El Oro	1 7 6	ex div.	1 7 3	
Esperanza	2 18 0	ex div.	2 18 9	
Dolores	1 8 9		1 8 9	
Oroville Dredging	0 9 9	ex div.	0 9 9	
Mexico Mines	6 12 6	ex div.	8 0 0	
Tomboy	0 18 0		0 17 6	

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

SOUTHERN NEVADA STOCKS.

San Francisco, January 20.

Atlanta	$ 10	Mayflower	$ 3
Belmont	1.35	Midway	20
Booth	8	Montana Tonopah	89
Columbia Mtn	5	Nevada Hills	65
Combination Fraction	39	Pittsburg Silver Peak	75
Daisy	8	Rawhide Coalition	17
Fairview Eagle	12	Rawhide Queen	20
Florence	2.52	Round Mountain	55
Goldfield Con	7.17	Sandstorm	5
Gold Kewenas	6	Silver Pick	8
Great Bend	3	St. Ives	9
Jim Butler	9	Tonopah Extension	77
Jumbo Extension	20	Tonopah of Nevada	6.75
MacNamara	27	West End	21

(By courtesy of the San Francisco Stock & Exchange Board.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices. January 20.		Closing prices. January 20.
Amalgamated Copper	82½	Miami Copper	23¾
A. S. & R. Co.	92½	Mines Co. of America	½
Boston Copper	18¾	Montgomery-Shoshone	1
B. C. Copper Co.	7½	Nevada Con.	24⅛
Butte Coalition	24⅞	Nevada Utah	1½
Cumberland-Ely	8½	Newhouse	3¼
Davis-Daly	3½	Nipissing	10
Dolores	7⅜	Ohio Copper	4⅜
El Rayo	2⅝	Ray Central	3½
Ely Central	1⅝	Ray Con.	22⅝
First National	5¼	Superior & Pittsburg	14½
Giroux	10⅝	Tenn. Copper	36⅛
Guanajuato Con	1⅝	Trinity	9¼
Inspiration	9⅜	Tuolumne Copper	3¼
Kerr Lake	8¼	United Copper	7⅝
La Rose	4½	Utah Copper	51⅛
Mason Valley	2¼	Yukon Gold	4¼

COPPER SHARES—BOSTON.

	Closing Prices. January 20.		Closing Prices. January 20.
Adventure	7¼	Mohawk	70
Allouez	52	North Butte	40
Atlantic	10½	Old Dominion	45½
Calumet & Arizona	94	Osceola	168
Calumet & Hecla	665	Parrot	20
Centennial	32	Santa Fe	2¼
Copper Range	80	Shannon	15⅝
Daly West	8⅜	Superior & Pittsburg	14⅛
Franklin	18¾	Tamarack	101
Granby	101½	Trinity	9½
Greene-Cananea, ctf.	97⅛	Utah Con.	40½
Isle Royale	24½	Victoria	4½
La Salle	16½	Winona	11½
Mass Copper	7¼	Wolverine	145

(By courtesy of J. C. Wilson, Mills Building.)

COMPANY REPORTS.

FEDERAL MINING & SMELTING CO. V. BUNKER HILL & SULLIVAN M. &. C. CO.

The following statement concerning the pending litigation in the Coeur d'Alene has been issued to the stockholders in the Bunker Hill & Sullivan company, by its president, F. W. Bradley. As presenting the point of view of that company, it will be welcomed by the public in general.

"On June 9, 1905, the Federal Mining & Smelting Co. was the owner of a claim, known as the Republican Fraction claim, a triangular-shaped piece of ground, having for one of its claimed end-lines a length of 2 ft. and its complement a length of 506.96 ft. On that date the Federal company commenced an action in the U. S. Circuit Court for the Northern District of Idaho, against the Bunker Hill & Sullivan M. & C. Co., in which action it claimed that the apex of the vein crossed these two so-called end-lines, and that they were entitled to extralateral rights. The extension of these claimed end-lines, a distance of nearly one-half mile, intersected a small portion of the orebodies of the Bunker Hill & Sullivan company in our underground workings, and challenged our right to work them. The bill of complaint asked for an interlocutory injunction and an accounting as to the value of the ores extracted within the extended extralateral claims of the Republican Fraction, claiming $2,000,000 as the value of the ore taken by the Bunker Hill & Sullivan company, and $2,000,000 more as the value of the ore remaining within the Republican Fraction extralateral claims. Application was made to the Court for an opportunity to inspect all the workings of the Bunker Hill & Sullivan company.

"The matter came up before the Federal Court, Judge Beatty presiding, and he peremptorily refused to grant them even the privilege of inspection and survey, a privilege which is invariably granted where there is the least suggestion that the plaintiff in the case has a tangible right. The Court, in rendering its opinion on this application, clearly stated that in his judgment, there was absolutely no extralateral right possible attached to the Republican Fraction claim. Having been defeated in this application, the Federal company remained quiescent for a long period of time. Subsequently, for the purpose of avoiding the force of the Federal judge's decision against the claim of extralateral right of the Republican Fraction, and getting into the State Courts, the Federal company organized a corporation under the laws of Oregon, under the laws of which State the Bunker Hill & Sullivan M. & C. Co. is organized; the new company organized by the Federal company being called the January Mining Co. The Bunker Hill & Sullivan company, and the newly created January company, being, through this strategy, made citizens of the same State, Federal jurisdiction was made impossible.

"The Federal company then caused to be conveyed to the January company, through a dummy intermediate grantee, its counsel, F. T. Post, the title to the Republican Fraction claim, so that it ultimately vested in the January Mining Co. It also transferred for a named consideration of $100, all of its causes of action against the Bunker Hill & Sullivan company by reason of trespasses alleged to have been committed. The January company then brought a suit in the District Court of Idaho, a State Court sitting in Shoshone county, upon the same cause of action as asserted in the former Federal case, and also to recover for trespasses alleged to have been committed subsequent thereto. In its complaint, the January company asks judgment against the Bunker Hill & Sullivan company for $7,300,000, apportioned as follows: $4,000,000 for damage accruing to the Federal company prior to its dummy sale to Post, its counsel; $3,000,000 for the period during which title stood in Post, and $300,000 for ore extracted after title had been transferred by Post to the January company. Prior to the January company bringing this action in the State Court, proceedings were instituted by the Federal company in the Federal Court against the Bunker Hill & Sullivan M. & C. Co., based upon the ownership by the Federal company of the San Carlos and Overlap claims. The extension of the claimed end-line planes of these two claims intersect at a distance of nearly one mile, some of the present underground workings of the Bunker Hill & Sullivan M. & C. Co., and also intersect and conflict with the extended claimed end-line planes of the Republican Fraction. It having appeared to the counsel for the Bunker Hill & Sullivan company that the organization of the January Mining Co., the taking over of the title to the Republican Fraction, and the alleged causes of action, was manifestly an attempt to evade Federal jurisdiction, the Bunker Hill & Sullivan company filed their answers in the Overlap and San Carlos cases, and set forth therein fully the action of the Federal company in transferring the title of the Republican Fraction for the purpose for which the transfer was made; that is, to avoid Federal jurisdiction; and applied to the Federal Court for an order compelling the Federal company to bring the January company into the Federal Courts; and compel it to submit to the Federal jurisdiction, in order that all controversies of interlocking extralateral rights might be there determined, that Court having first acquired jurisdiction.

"In the suit brought by the January company in the State Court, the Bunker Hill & Sullivan M. & C. Co. alleged all these facts and asked that the State Court stay its hand until the Federal Court had passed upon the question of bringing the January company into the Federal Court. The Federal company resisted this procedure on the part of the Bunker Hill & Sullivan M. & C. Co, and the matter was fully argued before the Federal Court, and on December 22 an order was made in that Court compelling the Federal company to bring the January company into the Federal jurisdiction. This order has consolidated the litigation in the Federal Court, and, through comity, the action in the State Court should be suspended abiding the event of the action in the Federal Court. From time to time, the Federal Mining & Smelting Co. has suggested that the litigation be compromised, and recently one of its officials made us a tentative offer of compromise which is now being considered."

Catalogues Received.

THE JEFFREY MFG. CO., Columbus, Ohio. Catalogue No. 69 B. 'Screens'. 24 pages. Illustrated. 6 by 9 inches. Bulletin No. 17. 'Mine Locomotives'. 68 pages. Illustrated. 7¾ by 10 inches.

The EUGENE DIETZGEN CO., San Francisco, is distributing free to the engineering profession a complete Solar Ephemeris for 1910. It contains all tables required in making solar or stellar determinations of the true meridian.

THE WESTINGHOUSE DIARY FOR 1910. A convenient vest-pocket diary containing all sorts of useful information and maps. It is issued by the Westinghouse Companies' Publishing Department at Pittsburg, Pennsylvania, and is for gratuitous distribution.

POWER & MINING MACHINERY CO., Cudahy, Wisconsin, and THE SNOW STEAM PUMP WORKS, Buffalo, New York. Catalogue No. 104. Combined catalogue of Loomis-Pettibone gas generators and Snow gas engines. It contains handsome illustrations of many gas-power installations in the United States and Mexico. 64 pages. Illustrated. 8½ by 11 inches.

Commercial Paragraphs.

The HARDINGE CONICAL MILL CO., New York, has opened a tentative branch office in room 415 Bailey Block, Seattle, Washington. V. G. Lunt is in charge.

The Needles mines and smelters have been taken over by the UNITED STATES SMELTING, REFINING & MINING CO., and will be operated as a subsidiary company under the title of the Needles Mining & Smelting Co. The Needles plant is now in the market for custom ores.

The STANDARD BRASS CASTING CO., Oakland, California, advises that its business with mining companies during the past year shows a gratifying increase. The 'Bear Brand' bronze, of which this concern is the sole manufacturer, is meeting with an unusual demand, particularly for high-speed bearings.

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EDITORIAL.

OPERATIONS at the Homestake mine in South Dakota have been resumed with non-union workmen. The plant is now running at half capacity. The situation fortunately is not embarrassed by a formally declared strike, and a peaceful solution of the difficulty is anticipated.

GOLD production in the United States for 1909 has been variously estimated at from $94,560,000 to $105,000,000. The total reached by the Director of the Mint, A. Piatt Andrew, is $99,232,000. The details of his estimates are given on another page. Our own figures, made up a month ago, were evidently high, due to overestimate of the gold resulting from copper production in Arizona and Utah. It will be long before exact figures are available, but the final total is more likely to be above than below the $100,000,000 mark.

RUMORS regarding the Reclamation Service have provoked the *Engineering News* to a strong defense of that excellent organization. The Service has recently suffered considerable criticism because of certain unsatisfactory conditions due to the laws of the land rather than to the administration of the work. The attempt to force the resignation of the accomplished Director, Mr. F. H. Newell, is deservedly regarded as one to bring politics into the Service. Engineers especially should remember that clean and able service in such a position inevitably engenders opposition and the real basis of the criticism should not be overlooked.

Dividends and Speculation.

Revival of trade is world wide, with evidences of steady growth. The measure of returned prosperity in the United States is afforded by the dividend payments in January of this year which surpass all previous records. It is announced that the dividend and interest disbursements of 150 of the leading railroads, traction companies, banks, and industrial corporations have exceeded two hundred million dollars, which is an increase of twenty million dollars above the semi-annual payments by the same group in July last. In England the year has been notable for extraordinary new capital issues, aggregating $910,000,000, while in Paris there were listed new issues amounting to $735,000,000. German trade has expanded to such an extent as to create a demand for capital that has made of that country one of the greatest borrowers in the world. The German Government has likewise deliberately discounted prosperous times by again making up a budget which will produce a deficit, thus necessitating large Gov-

ernment loans. Money rates have ruled higher in Germany than in other markets for many months, and in the sense that the borrower reveals his ability to utilize other people's money better than they can apply it themselves, the Germans are becoming aggressive trustees in a great expansion of trade throughout the world. The financial situation indicates a pronounced renewal of speculative operations, which must greatly stimulate development of the mineral industry.

Utah Copper and Nevada Consolidated.

Electrolytic copper is carrying a high-potential current these days, and the transformers are growing uncomfortably hot. Mr. James Phillips, Jr., has created consternation by a letter to the stockholders of the Nevada Consolidated that is bristling with accusations. The arraignment of the Messrs. Guggenheim is perhaps the least important. The people have grown accustomed to having the financial linen of these gentlemen washed in public. The attack by the president of the Nevada Consolidated, however, elicited a response from Mr. Daniel Guggenheim, which neither denies nor affirms anything, but promises equal terms to all stockholders who may accede to the proposed plan for merging the Utah Copper with the Nevada Consolidated.

The chief public importance of the letter from Mr. Phillips is the necessity which it reveals for a re-appraisal of copper stocks. It is incumbent upon the Utah Copper, in the face of the statement now made, to show what its reserves really are, and to frankly reveal the true costs of production. Mr. Phillips concedes to that company a probable 40 million tons of ore averaging 1.5 per cent copper. Taking 70 per cent extraction as an attainable average, the total recovery would be 840 million pounds, although the present sand tailing averages about 0.6 per cent copper. At an average price for the metal of 13½ cents, and a cost of 10 cents, the visible profit would be $29,400,000. The present capitalization of the Utah Copper is 750,000 shares, selling in the early part of January at about $60. Buyers at those prices would need to see a profit of $45,000,000 in order to get their money back without interest. Tested by Inwood's Tables the present value of the shares, if they paid 5 per cent on a proper market price, with a life of 14 years for the deposit, the earnings being re-invested annually at 4 per cent, would be $26.74. The Utah Copper Company is milling not less than 8000 tons per diem, hence the above estimate is warranted, if the assumption of 40 million tons of reserves be correct. The dividend rate, on the basis of $60 per share, is 3⅓ per cent.

We believe the consolidation of the Utah Copper with the Boston Consolidated will materially improve the situation. To effect this, exchanging 2½ shares of Boston Consolidated for one share of Utah Copper, the latter company increases its capitalization to 1,198,888 shares. This, furthermore, provides for the exchange of one share of Utah Copper for 2¼ shares of Nevada Consolidated, as desired by the Messrs. Guggenheim. There would then remain 150,000 shares for improvements, and 400,000 shares to be used, according to current rumor, for the consolidation of the Garfield smelter and the Baltimore refinery with the group. This would involve carrying the dead weight of the Silver Lake Mining Company which now oppresses the Garfield enterprise.

The skewback needs to be strong to resist the thrust of this Guggenheim arch, and the distribution of strains within the arch itself is almost too complicated for calculation. On one side is the Silver Lake, depending on the Garfield smelter; next is the interesting spectacle of Utah Copper and Boston Consolidated proposing to hold each other up. On the other side is the Nevada Consolidated playing Atlas to a burdensome Cumberland-Ely. The Nevada Consolidated has a supposed total earning power, at present prices for copper, of between 50 and 60 million dollars. Its two million shares of stock, at prevailing market quotations, represent about 48 million dollars. The ore reserves are stated to be 30,000,000 tons and the recovery 33 pounds of copper per ton. The costs are stated to amount to 6½ cents per pound, and on the same basis as was used in figuring the value of Utah shares, those of the Nevada Consolidated would have a present value of $23.68 each.

In extenuation of the absorption of the Cumberland-Ely by Nevada Consolidated it must be said that this was necessitated after the initial blunder of dividing interests in the railroad and reduction works. According to the terms of the original alliance the Cumberland-Ely acquired half of the railroad, and was to assume half the cost of constructing the smelter at Steptoe, Nevada. It was further provided that if either party to the contract could not supply sufficient ore to employ its half of the capacity of the reduction works, the other could do so with its own product, paying for the extra capacity thus utilized at the rate of 7 per cent on the capital invested in the plant. The Cole-Ryan interests having bought the Giroux mines at Ely, were negotiating for the purchase of the Cumberland-Ely. This was manifestly for the sake of the extremely valuable contract with the Nevada Consolidated. Certainly they would not care to buy a mine in which the known ore reserves are understood to be largely exhausted, where the application of the caving system proved more expensive than the value of the ore could sustain, and where it seems clear that advantage was taken of a convenient miners' strike to shut down before the physical difficulties of the property should become generally apparent. In order to avoid complications that might embarrass its operations and restrict its output, the absorption of the Cumberland-Ely by the Nevada Consolidated was essential. It was a case of stock-watering in self-protection, and the Nevada Consolidated was quite strong enough to stand the dilution.

The proposed merger with Utah Copper is altogether different. As Mr. Phillips points out, there are no financial, geographic, or other good reasons for the combination. The cost of making copper will not be reduced for either party. The only result that could follow would be re-apportionment of dividends, and it is worth while to demand proof that the stock-

holders of one company will not suffer at the expense of the other in the process. Mr. Phillips shows by tables, the accuracy of which Mr. Daniel Guggenheim did not assail in his interview for the New York *Times* of January 14, that the proposal to exchange $2\frac{1}{4}$ shares of Nevada Consolidated stock for one share of Utah Copper would result in an annual loss of 61.1 cents per share for the former company, with the dividend rates at $1.50 per share for Nevada Consolidated, and $2 for Utah Copper. It is claimed, however, that the merger of the Utah Copper with its neighbor, the Boston Consolidated, will enable it to mine its higher-grade ores, bringing the average up to 1.8 per cent. This would enable it to pay $3 per share in dividends. Even on that basis the earning power of one share of Utah Copper would be 37.5 cents less than the $2\frac{1}{4}$ shares of Nevada Consolidated for which an exchange is proposed, even if the dividends of the latter should not exceed $1.50.

No valid reason appears for a coalition of these two concerns. Furthermore, an argument of no small moment, indicating the necessity for pause, is the absolute fearlessness of Mr. Phillips in accusing the Messrs. Guggenheim of having broken their engagement not to take any steps leading toward a consolidation of interests until the figures submitted by the Guggenheim engineers had been independently verified and the accounts of the Utah Copper Company submitted to the examination of auditors. Here is a public challenge which should be answered in the interest of the good name of the mining industry that can only be sustained by its leaders. The public is coming to look upon 'coppers' as a stain on the market. The miner understands that a few tons of copper will impregnate a mountain with vivid green; it seems that a similar disproportion exists between actual assets, and the copper deals that are being made in the world of high finance.

Until the value of all the properties involved shall have been set forth by engineers enjoying the public confidence, and until the financial conditions of the respective companies, and the total costs of producing copper, are demonstrated, the time is not at hand for a consolidation. At present the 'coppers' are like a train of cars; there is no more room inside; and it is expedient to call attention to the sign, 'passengers standing on the platform do so at their own risk.'

A sharp cleavage must be recognized between the financial manipulations that are bringing so many copper companies into disrepute, and the splendid technical work of such managers as Messrs. Daniel C. Jackling, C. B. Lakenan, and Lafayette Hanchette, and their able corps of assistants. In the case of 'disseminated porphyries' great problems have been met and solved. The extraction from ores containing such finely divided copper minerals has been more creditable than the world at large may realize. The fine grinding required to liberate the copper minerals produces in the pulp the most disadvantageous physical conditions for their recovery. The proved feasibility of saving from 70 to 75 per cent under such circumstances is a triumph. That financial exigencies have led to overloading the mill of the Utah Copper does not derogate from the technical ability of Mr Jackling. The reduction of mining and milling costs, elevating porphyry with $1\frac{1}{2}$ per cent of copper into the category of commercial ore, is like adding directly to the resources of the nation. This is a contribution to the wealth of America made by men of such note as Mr. Jackling and Mr. Mark L. Requa, who demonstrated the possibilities with elaborate testing plants, making sure the way to success which others might follow if willing to earn their money out of the mines rather than to win it from a manipulated market. Nevada Consolidated has been comparatively free from objectionable financial methods. The public has seen fit to discount the future more heavily than is warranted, but the management is disposed to steer an independent course. It certainly should be permitted to stand as another example of dignified and honorable mining by the side of such enterprises as Calumet & Hecla and Phelps, Dodge & Company, whose fair fame none can impeach.

Charles Benjamin Dudley.

Among the most notable men in the evolution of technical methods was the late Dr. Charles B. Dudley, whose death we chronicled in a recent issue. For thirty-four years he had been at the head of the chemical and experimental laboratory of the Pennsylvania Railroad Company, and his work had an important influence in perfecting the service of that corporation. The position which he occupied was unique. He held the confidence of the public as a scientist laboring not only to obtain an economic end for his principals, but to promote efficiency and safety in transportation, in which the people were profoundly interested. The fruits of his investigations were shown in numerous addresses and published papers which have influenced the course of other technologists here and abroad in the testing of metals, and it is not too much to say that his studies upon the characteristics of steel, begun nearly thirty years ago, revolutionized railroad construction. In the beginning his work drew upon him the hostility of the steel-makers, which was evidence enough of the need of reform in the manufacture of rails, on which depended the lives of countless thousands. Dr. Dudley is also responsible for the elaboration of the rules governing the transportation of explosives, which have been adopted by common consent of the railroads in this country, a noteworthy result when it is considered that the diversity of State legislation would have prevented the adoption of a uniform system, while the question could not well have been dealt with by Federal statute.

Dr. Dudley is a good example of the type of man who entered upon a scientific career late in life. He was twenty-nine years of age when he completed his classical course at Yale, and it was three years later when he graduated from the Sheffield Scientific School. He began life as a farmer boy in Chenango county, New York, and partly by his own labor, and partly with borrowed funds, he succeeded in making his way through college. He will long be remembered as a leader in the practical application of science in this country.

NITRATE OF SODA INDUSTRY OF CHILE.—II.

Written for the MINING AND SCIENTIFIC PRESS
By S. H. LORAM.

The assay of caliche for nitrate content is carried out as follows: 5 gm. of the ground sample is boiled in 100 c.c. of water, filtered, and the filtrate made up again to 100 c.c. To 20 c.c. of this, 10 c.c. of sulphuric acid (50° Beaumé) is added, and the mixture heated to between 70 and 80° C. in a porcelain evaporating basin; and while still maintained at this temperature over a small flame (it is convenient to stir with a marked thermometer) it is titrated with a standardized solution of about 12% ferrous sulphate, acidulated with sulphuric acid. A dark brown coloration is produced which disappears on stirring, but leaves a sage green tint to the solution, which deepens as the titration proceeds. Toward the end of the reaction effervescence is noted, and the end-point is reached when further addition of ferruous sulphate ceases to produce the brown coloration. Some little practice is necessary to be able to note the end, but once acquired, the method is rapid and correct to within 2%, which is near enough for practical purposes. Exception should perhaps be made of caliche carrying large quantities of calcium nitrate, which naturally gets reported as the equivalent of nitrate of soda. In a few of the modern plants the method is checked from time to time by more exact determinations. In the finished product for sale, the nitrate content is estimated by difference; standard must contain 95% $NaNO_3$, and the so-called refined, which is really only selected, 96% and less than 1% of NaCl. The following will give an idea of an ordinary lot:

	Per Cent.
Nitrate of soda	94.245
Nitrate of potash	1.249
Chloride of soda	1.180
Iodate of soda	0.017
Perchlorate of potash	0.239
Sulphate of magnesia	0.303
Chloride of magnesia	0.342
Sulphate of lime	0.041
Insolubles	0.174
Moisture	2.210
	100.000

The extraction of nitrate of soda from caliche depends upon its greatly increased solubility in hot over cold water, and upon the property of nitrate in hot saturated solutions of itself and common salt, of precipitating the sodium chloride and dissolving.*

*Table by M. A. Preito, showing approximately the solubility of nitrate and chloride of sodium from an excess of both salts in 100 c.c. of water at various temperatures.

Temp., deg. C.	Nitrate, gm.	Salt, gm.	Density, deg. Twaddell.
10	49.50	27.00	72.0
20	57.00	26.00	75.5
30	65.80	24.00	78.5
40	75.50	22.50	82.5
50	86.50	20.50	87.0
60	98.00	18.90	91.5
70	110.40	17.50	96.0
80	123.80	17.00	100.5
90	139.00	16.20	103.5
100	157.50	16.00	107.5
110	184.00	15.40	108.5
120	220.00	15.00	110.5

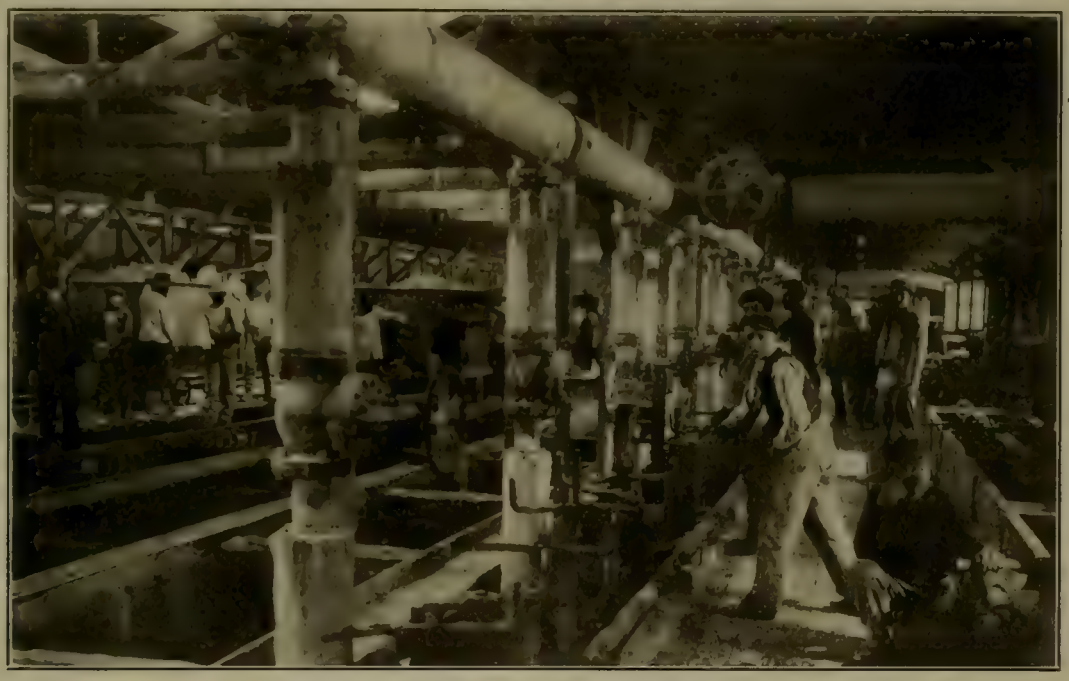
Nitrate is crystallized out of hot liquors by allowing them to cool, and the still saturated, but now cold mother-liquor, is pumped back to the boiling tanks to take up a fresh charge, by being heated with more caliche. The solution in the first stages takes up a large proportion of salt, which in turn is re-precipitated by continued heating in the presence of an excess of undissolved nitrate of soda in the caliche. Part of this goes into solution, while the salt remains behind with the solid matter, where, if present in large quantities, it is found as white crystalline masses, often in the interior of lumps of caliche, where it has replaced the nitrate. Evaporation takes place both in the boiling and crystallization tanks, but this really represents a loss, and on theoretical grounds the process could be carried out better in closed vessels.

The method of extraction is a modification of the Shank system originally used in the soda industry, and adapted to nitrate working in this country by Mr. Humberston of the Agua Santa works in 1880. Works vary in size from a productive power of 200 up to 7500 tons per month, but the output of each is limited to a certain proportion fixed from time to time for commercial reasons by the nitrate combination. At present it is 47% of the nominal power. From an engineering point of view, although working on one system there is as much difference as in capacity, from the crudest tumble-down plants, to handsome all-steel structures that make a close approach to mechanical perfection. Unfortunately, however, the latter are in the minority, and the average plant leaves much to be desired.

There is a marked absence of technical control throughout the entire industry. Some brilliant exceptions exist, and to them must be credited the advance that has been made. While the necessity of specially trained men to run the complicated modern plants is becoming more evident, as a rule the managers are drawn from the office staff. Few of the works even employ chemists. Systematic sampling of the caliche is rare, automatic machines for the purpose are not in use anywhere. The same applies to the tailing, which consists of a mixture of slime with lumps of earth, rocks, salt, etc., which would be difficult under any conditions.

In a modern works of about 5000 tons output per month, running on caliche containing 20% nitrate of soda, the method followed is: The caliche arriving in cars or carts is dumped on an inclined platform capable of holding 24 hours' supply. Quarrying and haulage are carried on only during the day, while the factory runs continuously. From this point it is passed down through one of four 24 by 16 in. Blake crushers, set to crush to about a 3½-in. ring. It then falls into tip-cars for elevation to the boiling tanks. These, 16 in number, placed side by side, are rectangular, 32 ft. long by 8 ft. wide by 9 ft. high, open on the top. They are fitted with two bottom-discharge doors, with raised inside collars, 18 in. high. An iron-plate screen, known as a 'crinolin', is set at the same height above the bottom, with openings corresponding to the collars of the discharge doors. Each tank has eight or nine turns of a 3-in. steam-coil, so placed as to divide the long section into three

nearly equal spaces. There is a so-called 'siphon' which draws from below the crinolin plate of each tank, and discharges into the next at a height of 6 ft above the bottom. These siphons are placed in the sides, at alternate extremities, so that the liquor passing through a series of tanks has to travel diagonally from one end to the other, as also from top to bottom. There is a pipe-connection between all the tanks and a centrifugal pump. Each has a discharge-valve for saturated solutions which draws from below the crinolin, and a bottom-discharge plug for draining the space between the crinolin and the bottom of the tank. There are also a series of three pipes for supplying cold mother-liquor, wash-water, and fresh water. Two tracks for tip-cars run across the tops of the tanks at right angles to their length, and two



Nitrate Works, Chile, Showing Boiling Tanks.

tracks run beneath them, one under each line of discharge doors. The caliche is treated in sets of four tanks, exclusive of two which would be discharging and filling. The process, being semi-continuous, is best shown in a simple series. Tank No. 1 we will suppose to contain fresh caliche, boiling with strongly concentrated liquor which has come through the other three tanks; heating is continued until the density reaches 105 to 115° Twaddell* varying with the caliche and the purity of the nitrate desired.

For reasons already stated the higher the density the purer will be the nitrate, but the greater the coal consumption. Steam is then shut off from the coils, and after a few minutes' settling the liquor is drawn off from below the crinolin to a discharge opening about two-thirds the way up the tank. When the level in the tank is, say, 2 ft. 6 in. below that in No. 2, which latter has caliche boiling with its second liquor of less density, the siphon between the two is opened, and No. 2 tank begins to discharge from the bottom into the upper part of tank No. 1. Siphons No. 3 and 4 are also opened, and there is a movement through the whole series. To tank No. 4 mother-liquor and wash-water are added as fast as the siphon removes the solution from the bottom. This continues until the discharge from No. 1 falls in density by addition from tank No. 2, to the lowest desirable limit, and is then stopped. The liquor will now come to rest in the four tanks at different levels according to their density, unless pumping has been resorted to to aid the siphons, as is sometimes done. After further boiling, the second liquor in tank No. 1 is run into No. 5, which in the meantime has been filled with fresh caliche and already partly heated by the coils. Here the liquid is again evaporated by boiling to crystallization density. No. 4, after a wash of cold fresh-water to cool the content and remove further nitrate, is ready for emptying, which is done by shoveling through the discharge-doors to tip-cars below; the tailing containing still on an average 7% nitrate. The cold-water wash is run to a sump, to serve as addition to the last tank of the series, at the next opening of the siphons, which will be No. 3; No. 1 will then receive its third liquor, and later on a fourth. In the above manner the content of each tank is submitted to four boilings in successively weaker solutions, and to one wash with fresh-water; while the liquor has been boiled four times, each in the presence of caliche containing more and more nitrate, until brought up to the required density for crystallization. The object of the perforated plate or crinolin is to equalize the circulation of liquor through the caliche, and also to form a space in which the mud and fine material may settle. Sometimes this is discharged to separate tanks for washing. The total time of treatment, filling, and dis-

*The number of degrees Twadell multiplied by 5, plus 1000, equals the weight in grams of one litre of solution. Consequently 115°T. liquor weighs 1575 gm. per litre. See also note on page 18.

charging, in about 27 hours. The strong liquor from the boiling-tanks runs to one of two settlers for clarification, where, as it cools slightly, the density increases, and more salt is thrown down. The sediment is sometimes washed for its nitrate content (often reaching 40%), but more often is thrown away. The clarified liquor is run in half-round iron channels to the crystallization tanks, of which, for the above works, there would be 100. Each is 15 ft. square, with an inclined bottom, the depth being 27 in. on one side and 33 on the other. After five days for cooling and crystallization, the mother-liquor is drawn off, and the nitrate, after shoveling to the upper part of the incline, or to special trays to drain and dry (which it does in about four days), is filled into tip-cars which run from between the lines of crystallization tanks, to dumping moles above the storage floors, where it is left until required, and is then sacked in 100-kg. bags for transport.

Steam for the coils is generated by a separate set of boilers, generally of the Lancashire type, although a few of the modern plants have multi-tubular. The steam-pressure is from 60 to 70 lb. per square inch, and as the boiling tanks are at a considerable height above the boilers, and as there is a closed circuit from the steam-dome through the coils to the boiler-feed inlet, the condensed water runs back without the aid of a pump, and circulation is continuous. Additional feed is added only to counterbalance the leakage. In the plant taken above as an illustration, three 8 by 30-ft. Lancashire boilers, which under the circumstances would generate about 150 hp. each, would be required, plus one spare unit. The power-station is separate, a duplicate set of steam-driven dynamos (one always held in reserve) providing for the crushers, pumps, elevator, light, etc., about 150 hp. The total cost-consumption would be about one-fifth to one-fourth of the nitrate output.

The working costs of one of the larger works, which serves as a good example, are as follows, items being given in pence per quintal of nitrate produced, the works running on caliche containing 24 to 25% of nitrate of soda:

	Pence.
Quarrying caliche	10.79
Transport of caliche by carts and tip-cars to railroad	5.46
Transport of caliche by railroad to works	1.40
Crushing caliche	1.40
Water	0.84
Extraction (or leaching, etc.)	8.54
Administration house expenses	0.84
General charges, administration, port-charges, etc.	4.06
Sacks, sacking, and loading on railroad cars	3.50
	36.82
Less profit in store for sale of food and supplies to workmen (truck system), 12% on 33.32d. (that is, all but sacks, etc.)	3.99
	29.33 = 2s. 5.33d.
To the above must be added railroad freight to the coast, about	4.5
Export duty	28.0
Lighterage	0.5
	33.0

Total f.o.b. about 5s. 2d. per quintal of 46 kilograms.

The extraction of iodine as a by-product is limited by the iodine combination for commercial reasons to a small proportion of the possible total, so that the process is only carried out under the most favorable conditions, in works running on caliche particularly rich in sodium iodate. The method consists in treating the mother-liquors from the nitrate crystallizing vats, which contain iodine principally as sodium iodate, and also as free iodine, and iodide, with a mixture of sodium sulphite and sulphurous acid, and is carried out as follows: the sulphite of soda is prepared by burning a mixture of nitrate of soda and coal-dust, the soda so formed is leached out, decanted, and sulphurous acid gas, made by burning native sulphur in iron stoves, is passed through to excess. To a given quantity of mother-liquor, a sufficient quantity of the above mixture is added to produce a temporary brandy coloration (due to freed iodine), and then about 25% of its volume of fresh mother-liquor, by which the iodine is precipitated; the required proportions being determined by tests made beforehand. The iodine is allowed to settle, is filtered, pressed, and the cakes so formed, which contain about 75% of iodine, are placed in about one-ton charges in iron retorts, connected with condensers made of earthenware drain-pipes about 75 cm. diam., and placed on a gentle incline. The retorts (after careful luting with clay) are gently fired until the iodine is all driven over. The aparatus is then allowed to cool for several days, after which the pipes are opened, at night on account of the lower temperature, and the iodine, now in crystals about 99.6% pure, is raked out and packed in 100-lb. barrels, which are afterward sewn in raw-hide for transport. The cost of extraction varies from 1.2 to 1.4d. per ounce, and its market value is about 5.8 pence.

The analysis of a sample of mother-liquor as used for iodine extraction is as follows:

	Grams per litre.
Nitrate of soda	342.221
Chloride of soda	103.019
Nitrate of potash	205.208
Perchlorate of potash	12.103
Sulphate of magnesia	36.565
Chloride of magnesia	37.816
Iodate of soda	3.099
Total	740.031

According to Semper and Michels, caliche was first worked in the province of Tarapacá for its potassium nitrate content by a German, Tadeo Haenke, in the year 1809, but the industry may be said to have received its great impulse at the time when the value of nitrate of soda as a fertilizer became known in Europe, about 1830. Prior to 1856 the boiling tanks had been fired direct; after that time heating by blowing steam into the liquor was introduced, with considerable economy and consequent increased production, as shown by the accompanying table. As before stated, the Shank system started in 1880, since which time it has been, with a few exceptions, the only process used.

Although the production shows a fairly steady and rapid increase, the industry has passed through a succession of 'booms' and 'slumps' consequent upon the rapid increase of production during good times, fol-

lowed by the inevitable fall in prices when the market was satisfied. With the object of avoiding this the 'Nitrate Combination' was formed during the depression of 1884 to limit the production, and so maintain the price. This although successful for a time failed in the end, owing to the heavy accumulated stocks in Europe that more than counterbalanced the decreased production, and the Combination broke in 1886. It was replaced by the Permanent Nitrate Committee of London, formed with the object of making the use of nitrate more generally known, and increasing the demand. This was successful, and between 1886 and 1890 the consumption almost doubled, but the output increased more rapidly than the market, and prices again fell. A second Combination in 1891 lasted until March 31, 1894, coming to an end from want of unity between the producers.

NITRATE PRODUCTION BY YEARS.

	Spanish quintals.*
From March 1812 to January 1813.....	22,723
From March 1830 to January 1834.....	361,386
From March 1850 to January 1854.....	3,260,492
From March 1860 to January 1864.....	6,979,208
During 1870	3,943,000
During 1875	7,191,000
During 1881	7,739,000
During 1885	9,378,000
During 1890	23,373,000
During 1895	27,401,297
During 1900	31,741,293
During 1905	35,877,467
During 1907	42,840,867

*The Spanish quintal of 46 kg. is the unit used in almost all nitrate calculations; roughly 20 Spanish quintals equal 1 short ton.

After this the Nitrate Propagation Association (Asociacion Salitrera de Propaganda) was formed in Iquique and legalized by Congress in 1896. The object was to have the keeping of statistics and general furtherance of the welfare of the industry in the hands of a stable institution, independent of the Combination. It was composed of ten members of the industry from Tarapacá, and one delegate from each of the districts Tocopilla, Antofagasta, and Taltal, producers paying ½d. per quintal of nitrate produced to defray expenses. It still exists at present, and has been a most useful institution. Excessive production, which had begun to be noticeable after the second Combination of 1892, was made worse by the Government auction of nitrate grounds in 1894 and 1895. The third Combination was formed in 1896, with the usual object of limiting the production, and as the nominal capacity of each works was to be determined by its output during the first three months of the year, the majority of them forced their production during that time regardless of cost or efficiency. Owing to excessive stocks in Europe from the previous year, competition of ammonium sulphate, speculation, and the scare caused by the discovery that some of the nitrate carried excessive quantities of perchlorate of potash, which is detrimental to vegetation, prices fell so rapidly as to cause the worst depression known to the industry. From 5s. $11^{13}/_{16}$d. per quintal in November, 1896, prices declined to 4s. 6⅛d. in April, 1898, in spite of restricted production. The Combination ended in October, 1898, and the rest of that year and 1899 were run on free production. In October, 1899 English firms controlled the greater part of the business, and several of them headed by Gibbs & Co., attempted to form a 'Sales Syndicate', which was to fix the total to be manufactured, arrange freights and sales—in fact, to bring the industry under one control, but the project failed. After two and a half years of depression, the fourth Combination was formed in October, 1900, for a period of five years. It was agreed that this could only be dissolved before the stated time by a majority representing 65% of the total nitrate output, the parties not only binding themselves to respect the contract, but to stipulate its continuance in case of the sale of any one of the properties. The directorate of the Nitrate Propagation Association took over the management of the Combination. It fixes, on or before May 15, the total exportation for the nitrate year beginning April 1. This figure can only be

La Democracia Works near Iquique.

altered if decided upon by a representation of at least 65% of the total, before the first week in July. It is understood that the total fixed upon shall not be less than the consumption of the previous 12 months. The quota allotted to each works in the first year was to remain constant for the following four, except the proportional decrease demanded by the starting of new works to keep a constant total. In case of a new works starting, its quota was to be fixed by three experts delegated by the Directorate, or by an arbitrator in case of difference. Should a new producer start who is not willing to enter the Combination, the Directorate has power (after a general meeting of producers) to declare the Combination at an end. If a works belonging to the Combination produces more than 15% in excess of its quota, or exports more than the amount assigned to it, the owners pay a fine of 6d. per quintal in the first case, and 18d. in the second. The Combination expenses are defrayed by a contribution of one-eighth of a penny per quintal of nitrate produced. At the end of 1901 there was a total of:

Works.	Nationality.	Quota, quintals.
48	British	20,184,000
11	Chilean	5,407,000
12	German	4,976,000
8	Spanish	3,762,000
6	Various	2,666,000
85		36,595,000

Of the above, 19 were not working, being either

permanently shut down, or closed to collect caliche. The active ones were distributed as follows: in Tarapacá 56 works, in Tocopilla 5, in Taltal 4, in Antofagasta 1.

During 1903 a craze for the formation of new nitrate companies started in Antofagasta, Aguas Blancas, and Taltal, which grew steadily to the end of 1907. Titles to ground that had been considered of so little value that the owners had tried in vain to sell it for a few hundred pesos, suddenly found a ready market, bringing thousands of pounds sterling. Locations were searched for, and either found, or titles made to fit elsewhere: companies were formed with enormous capital, prospecting was done, and elaborate reports published of the wealth that had been lying forgotten. Branch lines were extended from the trunk railroads, and works were hastily erected in such numbers that the ports and railroads were entirely unable to handle the machinery and supplies; labor became scarce and went up in price accordingly; in fact the region had the appearance of a collection of mining camps during a boom. The cause is difficult to explain. A little consideration would have pointed to the probability that the old-established companies in the districts, working with ample capital and wide-awake possibilities, would have purchased most of the ground, if valuable, when they were to be had for almost nothing, which, as a matter of fact, with few exceptions, they did. Moreover, deposits of this nature, although because of their extent costly to prospect in detail, lend themselves remarkably to rough estimation, compared to most mining ventures. But wild-cat schemes were the order of the day, the public wanted them, and there are generally plenty of persons willing to cater for such a market. When the works were nearing completion, water began to be searched for. These efforts failing, some 'water diviners' did quite a flourishing business for a time, and want of water was made one of the chief reasons for delay; but finally want of sufficient nitrate of soda had to be confessed. Now the after effects of the boom are being badly felt. It is not to be said that the whole of the companies formed during this period come under the same heading, but it may be safely stated that 80% will not return their capital, while many have already shut down. Some idea of the movement during this boom may be gathered by comparing the list of works for 1901 with that for 1908, which is as follows:

Locality.	Works.	Quota, quintals.
Tocopilla	8	6,610,000
Aguas Blancas	14	10,000,000
Taltal	15	12,075,000
Antofagasta	17	15,860,000
Tarapacá	91	39,837,000
Totals	145	84,382,000

The average cost of plant alone may be taken roughly at £1 per quintal productive-power per month. This would represent an expenditure of about £4,000,000, without taking promotion expenses, cost of ground, working capital, railway construction, etc., into account. To the above must be added 14 works in various stages of construction.

The following quotations are from a consecutive list of nitrate companies published by one of the leading papers:

APPROXIMATE HALF-YEARLY AVERAGE PRICE OF NITRATE OF SODA PER SPANISH QUINTAL, ON SHORE, DUTY PAID, SINCE 1900.

	First 6 months.		Second 6 months.	
	s.	d.	s.	d.
1900	4	11¼	5	6
1901	6	¾	6	7¼
1902	6	7	6	5¾
1903	6	5	6	11¼
1904	6	9¼	7	10
1905	7	6½	7	8
1906	7	11¼	8	10
1907	8	7	8	8
1908	7	10¼	7	6

Calculations concerning the life of the deposits, made in 1892 by Mr. Bertrand, the Fiscal Delegate, taking into consideration the annual increase at that time, set a 25-year period. Semper and Michels in 1901 calculated that at the annual output of 30,500,000 quintals, there was a stock sufficient for 44 years; at the same time stating the probability of a continually increasing demand, and consequently shorter life, partly counterbalanced by better technical work. Gandarillas and Ghigliotti, criticising the foregoing calculation, and pointing to the then rapidly developing southern districts as proof of a total stock much greater than had been reckoned, came to the conclusion that an actually measured and surveyed supply for 88 years was in existence. There was also to be predicted a much larger quantity still, that had not yet been discovered. The general failure of the new ventures brings one back, however, to the stern reality that new discoveries of great extent or value are hardly to be expected, and that attempts have already been made to work deposits too poor to pay; so that Semper and Michels' estimate of what was then considered as workable at a profit, probably is nearer the limit.

In calculations of this nature, with so many varying factors, it is difficult even approximately to foreshadow results. The present export duty on nitrate is 28d. per quintal, and constitutes the main source of revenue of the Republic. Other circumstances continuing their natural course, it stands to reason that when the deposits rich enough to bear this charge have been exhausted, the duty will have to be lowered, and as at present this is rather more than the average cost of manufacture, its reduction to half for example, would throw open to profitable handling a considerable area that is at present valueless. The same would happen through any material increase in the price of nitrate, although offset by decreased consumption and keener competition from the rapidly growing manufacture of artificial fertilizers. Improved methods of working, with an actual recovery of more than the present 60 to 70% of the nitrate content of the ground, must come into vogue before long, and will have its effect, but what the final adjustments of these and other conditions will be is for the future to decide.

Ley of an ore in Spanish signifies the gold or silver content expressed in ounces per ton, kilograms per metric ton, or otherwise.

CONSERVATION AND ALASKAN COAL.

Written for the Mining and Scientific Press
By H. Foster Bain

The coalfields of Alaska outlined on the accompanying map (Fig. 1), lie in three separate provinces, the Pacific slope, the central districts, and the northern region. A. H. Brooks, in discussing the subject,[1] has shown that the problems of economically developing and utilizing the coal-beds of these three areas are markedly different. Much controversy has recently arisen regarding certain of these questions in connection with the coals of the first-named province and particularly of the Bering River or Controller Bay field which lies within it. On the accompanying map (Fig. 3), prepared from data furnished by G. W. Evans, of Seattle, is shown the distribution of coal and its relations to railway surveys and harbors. In Fig. 2 the relations of the field to the copper mines and railway being built is shown. The coal lies at the end of the stub line running out from Katalla.

Fig. 1. Coalfields and Coal-Bearing Rocks of Alaska From Maps of the U. S. Geological Survey.

The 'Cunningham Claims', of which so much has recently been said, are situated east of the Kushtaka glacier and cover parts of the areas of coking and of semi-anthracite coal there shown. Adjacent are the claims of the Alaska Petroleum & Coal Co., Pacific Coal & Oil Co., the Portland-Alaska, Seattle-Alaska, and other groups which have recently attracted attention. The Bering River coalfield was discovered in 1901 by certain prospectors who were looking for petroleum. It was seemingly known before to the Indians. It lies about 1300 miles by sea from Seattle, within 12 to 25 miles of tide-water and within reach of harbors accessible the year round by protected routes of travel. The field was studied for the United States Geological Survey by G. C. Martin and from his reports[2] and the admirable summary by Mr Brooks already cited, the following data have been compiled.

The Bering River coalfield has been surveyed and prospected in part only. The rocks trend to the northeast, and in the unsurveyed area it is probable that there are important extensions or even additional fields to be discovered. It will be noted from the map that later surveys by Mr. Evans have already resulted in some additions to the field as at first outlined. In the known portion of the field there are at least 21.6 sq. mi. underlaid by anthracite and 22.7 by semi-bituminous and semi-anthracite coal. The coal-bearing rocks are of considerable thickness, 3000 ft. or more, and are believed to be of late Tertiary (Miocene?) age. They are closely folded and faulted, but lie in such position as to bring much of the coal above water-level. There are numerous beds of coal from 6 to 25 ft. thick. Local swellings give greater thicknesses, but the figures quoted are representative of much of the coal.

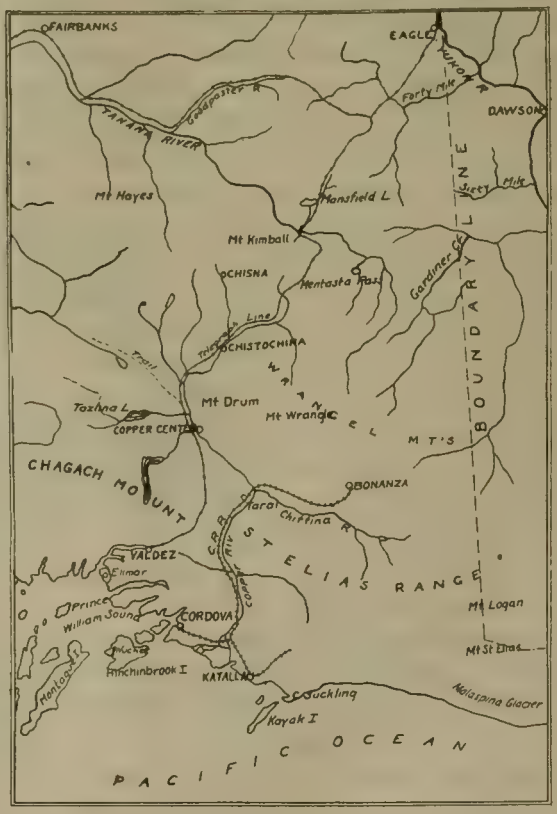


Fig. 3. Relation of Bering River Coalfield to Copper Mines and Transportation.

[1] Papers on the Conservation of Mineral Resources, U. S. Geol. Surv., Bull. 394, pp. 174-188.

[2] U. S. Geol. Surv., Bull. 225, pp. 365-382; Bull. 250, pp. 11-36; Bull. 259, pp. 140-150; Bull. 248, pp. 65-77; Bull. 314, pp. 40-46; Bull. 335.

In quality they vary from anthracite with 84% fixed carbon to semi-bituminous with 72. Some of the coal will coke, and indeed among the anomalies of the field are certain beds of natural coke so thick as to be of possible economic value. Analyses of the coals are given below:

	Moist.	Vol.	Fix. Carb.	Ash.	S.
Anthracite (average of 7 samples)	7.88	6.15	78.23	7.74	1.30
Semi-anthracite (average of 11 samples)	5.80	8.87	76.06	9.27	1.08
Semi-bituminous (average of 28 samples)	4.18	14.00	72.42	9.30	1.73

These analyses, given by Mr. Brooks, are evidently based on air-dried samples, but are none the less of value in showing that the coal has low ash and low moisture, and medium low sulphur. Mr. Martin, whose experience especially qualifies him to pass opinion in the matter, states that the coals are "higher in heating power and in purity than any other coal mines on the Pacific Coast in the United States, or the British Columbia and Australian coals."[3] The coal is conceded to be valuable for metallurgical coke, though the nature of the data on which this opinion is based is not published.

It will be seen that the field is one of large potential value, though in the attempt to give this statement more exact form there has been much misinformation and some exaggeration. Mr. Brooks has, with due reservation, estimated that in the Pacific slope coalfields of Alaska there are over 6,000,000,000 tons of workable coal. Since the Bering River and Matanuska fields are approximately equal in area it will be sufficiently accurate to assume that this tonnage is divided somewhat equally between them. It is difficult to assign any value to the coal. As is well known to all familiar with the coal industry the value of coal in the ground is but a very small part of the price at which the coal sells. In 1908 the average price of bituminous coal realized at the mine in the Unitd States was $1.14, and for anthracite $1.91. In Alaska and the Pacific Coast States, where this coal would necessarily be marketed, and where prices as compared with the rest of the country are abnormally high, it was $2.10. It is thoroughly understood also that the price of coal on the Pacific Coast at many points is artificial, and that the introduction of even a moderate amount of coal at lower prices would break the market. There can be little doubt also that for an indefinite number of years in the future, coal is likely to sell for less, rather than more in this territory. There is also question as to the capacity of the market to absorb large quantities of coal. In 1904 the total coal consumption in this trade territory, according to figures compiled by Mr. Brooks, amounted to approximately 1000 tons per day. Later figures have not been compiled except for Alaska where the consumption is now less than 200 tons per day. The Pacific Coast States absorb some, but not a great deal more coal than when Mr. Brooks made his estimates.

As there are already a number of collieries supplying this trade, it is evident that any large development of the Alaskan fields must be contingent on increased population and new industries. This is the most satisfactory sort of development, but it necessarily proceeds slowly. In the meantime interest charges mount, and against any assumed future selling price must be offset a large but unknown sum for interest on any present development. The value of the coal, however, should not be assumed at its selling price. Necessarily the cost of production and transportation, with fair profit on the money used, must be deducted. Perhaps the best measure may be obtained by a study of coal royalties. These generally, throughout the United States, run but a few cents per ton. In favorable situations, high-grade coal, easy mining conditions, and assured market, the royalty may be 10c. per ton. I have known a few cases of local mines near cities working on old leases, which paid more, and in the Eastern States limited areas of coal of value for particular uses bring more money. The average I believe to be less, though G. H. Ashley has recently concluded that 10c. may be taken as a fair value.[6]

Nevertheless, thousands of acres of excellent coal are available in areas of dense population at royalties of 3c. per ton and less, and in Illinois, as G. S. Rice has shown,[4] coal lands may be bought at prices which figure back to as little as $^1/_{12}$c. per ton for the coal in the ground. Even at these prices companies make little money and a number have been unable to pay interest on the bonds issued to secure the purchase price of the coal lands. If this is so of the value of coal lands in the midst of a big coal consuming district, with low mining costs, and with transportation already available, it is evident that the present value of coal lands in Alaska with unknown mining costs, transportation yet to be provided, and a limited and somewhat uncertain market, can not be high. Something may properly be allowed for scarcity of coal on the Pacific Coast but, as already suggested, that is probably less important than has been assumed. In the light of these data the value of $22,500,000 for one 2560-acre tract of the Cunningham claim, figured recently by the always interesting but sometimes inaccurate *McClure's*, is fanciful. This estimate is based on an evident misunderstanding of a statement made by Mr. Brooks where he was comparing the value of the coal at the pit mouth, with the corresponding values of metals produced in the territory. It is questionable whether the present value of Alaskan coal in the ground is more than of similar coal in the Middle West, and 1c. per ton would seem to be now an ample figure. I do not believe that the Conservation movement needs to be bolstered by any misinformation.

The essential features of the problem of conserving this coal supply have been put so excellently by Mr. Brooks,[5] that I can not do better than quote him verbatim.

"The conservation of the coal of the Pacific slope province is a more complex problem, both because of the high grade of some of the fuels and of their greater accessibility. While none has yet been ex-

[3] U. S. Geol. Surv., Bull. 259, p. 148.

[4] U. S. Geol. Surv., Bull. 424.

[5] Chatanooga meeting, Amer. Inst. Min. Eng., 1908.

[6] Loc. cit., p. 186.

portend the great demand for the high-grade bituminous and anthracite coals, such as are found in the Controller Bay and Matanuska regions along the Pacific Coast will lead to their exportation as soon as railways make them accessible. It is probable that the market for these coals will for a long time exceed the production, which will greatly stimulate mining activity once the transportation problem has been solved. When the coals are put on the market, they will probably curtail, if not entirely cut off, the demand for the lignitic and lower-grade bituminous coals which are so abundant in the Pacific Coast province of Alaska. Therefore the production of the high-grade fuels will effectually conserve those of lesser fuel value for the present. Some of these low-grade fuels, however, are so accessible and so abundant that future demands and strong competition may lead to wasteful methods of mining, provided they are all permitted to pass into unrestricted private ownership.

The reserve of these anthracite and bituminous coals of the Pacific slope, while it can not now even be approximated, in all probability is far below that of the lignites. It seems probable that an extensive area of the high-grade fuels may be found among the mountains and glaciers to the northeast of the present known limits of the Bering River field. If such be the case, this will be another locality where the geographic conditions will prevent mining until there is far more demand for the fuel than at pres-

Fig. 2. Bering River Coalfield from Data Supplied by G. W. Evans.

ent. In the Matanuska there is probably also a large quantity of coal under the Quaternary coating of gravel. Making allowances for future discoveries, however, the high-grade fuel is not abundant, considering the demand for it.

"From the standpoint of conservation and economic utilization, the possibility of intense competition between the coal of the Bering and Matanuska fields and that of Puget Sound is the danger point in the prospective situation. If each field develops

only to the extent of supplying the demand for the kind of coal which it best can furnish, then the immediate use of the coal will be legitimate and economical. But if the individual fields develop beyond the demand of their respective proper markets—if the Bering River field produces more than the needed supply for steamship, smithing, and local railway and smelting needs and of domestic anthracite, if the Matanuska produces more than is needed for its local railways and smelters, for bunker coal at its tidal terminus, and for shipment to the Pacific Coast coke-ovens, and if the coal from other fields invade these markets—there is sure to be ruinous competition, which may lead to cutting prices with the sole object of destroying all competition and establishing a general monopoly. In such ruinous competition as has existed in some of the Eastern fields the coalfields will be robbed of the more cheaply minable coal at the cost of the destruction of larger amounts which will be left in the ground so crushed and buried that it can never be recovered, coke for distant shipment will be made by wasteful processes at the mines instead of shipping the coal to points where both the coke and the by-products can be used, coal will be coked which would better be used for other purposes, and the waste by consumption en route will be extended to the Alaska coals.

"If these high-grade fuels, some of which make excellent coke, are not exploited, several conditions will probably be brought about: (1) The west coast of the United States will probably continue to draw heavily on the fuels of British Columbia, Australia, and Japan, and to the amount imported will conserve its own supply. (2) There will be an increasing demand for fuel oils, which, while it may not affect the production, will stimulate the search for new oilfields. (3) The west coast will probably continue to rely on the East for its pig iron and steel, for in the absense of good cheap coke—except as Alaska can supply it or the processes of coking coals are improved—the local supplies of iron ore will not be utilized, unless, possibly, by electrical methods of smelting. As a concomitant to this, the iron ore and coking coals of the East, which are of the most value to the nation, being nearest the centres of the population, will be correspondingly diminished. (4) What has been said of the relation these coals bear to the development of an iron industry on the Pacific Coast is to a lesser extent true of copper smelting. Without the use of Alaska coke either the copper ores will be transported to British Columbia or Puget Sound, or the coke will be brought to the copper deposits. In either case there is a loss in transportation. While it is true that these factors will affect the copper-mining industry and lead to the exploitation of only the richer deposits, yet the past few years have shown that it is economically possible to bring either the coke to the copper or the copper to the coke. (5) Certain loss of fuel in transporting Eastern coals to the west coast for certain purposes where their use is imperative will continue. This is, however, a small item, as the total tonnage of Eastern coals to the West is insignificant. (6) There will be no local supply of high-grade coals on the West Coast for the use of the navy.

"In considering the above facts it must be remembered that these Alaskan bituminous and anthracite coalfields can be made accessible only by the expenditure of a large amount of money. The millions of dollars necessary for the development of these fields will not be forthcoming unless provision be made by which a large tonnage of coal will be made available."

The difficulties it will be seen are both real and numerous. They have been intensified by the unfortunate controversy which has sprung up, but the latter may serve a useful purpose if it attracts serious attention to Alaska and its needs. The importance to the country at large of securing for Alaska as promptly as possible a vigorous and self-sustaining American population, needs no argument. This can only be accomplished by development of Alaskan resources and of the latter the minerals, here as always, are best adapted to prompt utilization because they represent concentrated value. Much can be obtained at small cost and with relatively little risk, and to tempt people into new territory liberal rewards are necessary. Undoubtedly also the simple and quick way to produce this result is by organized effort, syndicate control of special areas and deposits. The question is one of relative worth. There can be no question also that our coal-land laws are archaic and not adapted to the present situation. Indeed the present coal industry in the Western States has come in spite of rather than through their help. It is well understood that they were for years disregarded and evaded. Development of coal mines requires large expenditure, particularly in new territory. This cannot be based on small holdings and the modified law allowing 2560 acres is over restrictive rather than over generous. Present day facts and business methods should be recognized. The whole coal land law should be revised and its basis changed. Some way should be found for responsible companies to secure enough land to warrant the expenditure necessary to develop it. For myself, I believe the conditions may best be met by long-time leases, which would necessarily be at low royalties, but as to method there are legitimate differences of opinion. In the meantime rights accrued or accruing under existing laws should be scrupulously regarded and even liberally interpreted whether their holders be 'bartenders', 'laundry-men', 'Y. M. C. A. secretaries', 'politicians', or even 'capitalists'. The exact nature of those rights is clearly a matter for trial in the courts rather than in the newspapers.

Gold is found at a number of points in the Carolinas and ajacent States. When the early Spanish explorers came to America the Indians showed them rich nuggets and ornaments of gold which came from the southern Appalachian region. At the close of the eighteenth century gold was discovered in South Carolina, and 30 years later it was found in North Carolina. In the year 1829 gold to the value of $3500 was mined in South Carolina, and from that time until the Civil War gold mining was carried on in the Carolinas with profit. The total gold production of the region has probably been about $10,000,000.

SURVEYING THE PUBLIC LAND OF THE UNITED STATES.

Written for the Mining and Scientific Press
By H. W. MacFarren.

The method by which the public land is subdivided and marked upon the surface should be known by all miners. The prospector making his location, or holding his claims by 'possesory right', does not usually require this knowledge. In patenting a claim it is necessary that the position of the claim be accurately determined with reference to the land corners, that the Surveyor-General may be able properly to enter the claim in the plat-book; but this is the duty of the Deputy Mineral Surveyor who surveys the claim for patent. However, there will always come times when it may be desirable or necessary to locate tracts and to survey lines in the field by their markings, especially where claims conflict with or are contiguous to land held by agricultural or other title than mining patent or right. The Government is desirous that placer claims conform to legal subdivisions whenever practicable, and in such cases permits the claim to be entered for patent without further survey or plat.

The present method of surveying and subdividing the public land of the United States had its genesis in an ordinance passed in 1787, subsequent acts of Congress providing for such modification and further elaboration as changing of conditions necessitated.

As a starting point for the surveys a prominent landmark is taken in different localities as an 'Initial Point'. Through the initial point a 'Principal Meridian' is laid off, running north and south and conforming to a true meridian, and also a 'Base Line' running east and west and conforming to a parallel of latitude. The correct method of designating this initial point is to refer to the base line and the principal meridian that intersect at the point, as Salt Lake Base and Meridian, abbreviated S. L. B. & M.; though the general way is to refer to the meridian only, as Salt Lake Meridian, abbreviated S. L. M. The above is the designation of the initial point upon which the land surveys of the State of Utah are based, the initial point being in Salt Lake City. For the State of Idaho, the Boise Meridian, having its locus at Boise, Idaho, is used. California and Nevada make use of the Mount Diablo and San Bernardino meridians.

There are initiated from the principal meridian at intervals of 24 miles, east and west lines conforming to parallels of latitude, and similar to the base line. These are successively known as 'First Standard Parallel North', 'Second Standard Parallel North', 'First Standard Parallel South', etc, as these lines may be north or south of the initial point and base line. From the base line are initiated north and south lines at intervals of 24 miles, known as 'Guide Meridians'. Since all north and south lines converge toward the poles, these guide meridians are started anew from each standard parallel in contradistinction to the principal meridian which runs directly without change to the confines of the area governed thereby. These lines, though broken and displaced each 24 miles, are known and numbered successively from the principal meridian, as 'First Guide Meridian East', 'Second Guide Meridian East'.

Special base lines and meridians have been established to govern lesser areas remote from the main initial points where it was impossible or impracticable to carry the standard parallels over the mountains. The Uintah Base and Meridian, governing the northeast part of Utah, is an example. Local standard parallels or guide meridians have sometimes been established where necessitated.

The tracts, 24 miles square, are subsequently divided into 'Townships', 6 miles square, by east and west lines intersecting north and south lines. The townships in turn are divided into 36 tracts, known as 'Sections', each one mile square, and containing 640 acres; these are numbered as shown in the diagram. Only the exterior boundaries of the sections are run by the Government, but corner stones or monuments are placed each half-mile on these lines,

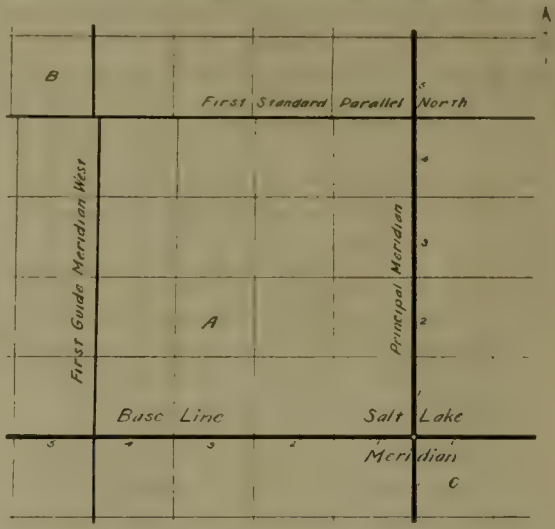


Diagram illustrating division into townships.

that the sections may be readily divided into 'Quarter Sections'. Each quarter section is held to contain four square 40-acre tracts—'Quarter-Quarters'—the smallest legal subdivision; though the Government in the case of patenting placer claims conforming to the land surveys does recognize and allow entry on 10-acre tracts, that are the regular subdivisions of these 40-acre subdivisions.

Any row, or series of contiguous townships, extending east and west, is spoken of as 'Townships', though the proper term is 'Tier', but the latter is not used. Any row or series running north and south is known as a 'Range'. A township in the first row of townships north or south of the base line and initial point or meridian is designated as Township 1 North, or Township 1 South, while a township in the second row becomes Township 2 North, or Township 2 South, etc. Similarly the rows of townships east and west of the principal meridian and the initial point are known as Range 1 East, Range 1 West, Range 2 East, Range 2 West, etc. By co-ordinating these systems of numbering, easy reference can be made to any township. In the diagram, the township designated by A is known as Township 2 North, Range 3 West, Salt Lake Meridian, and is abbreviated T. 2 N., R. 3

W., S. L. M. Likewise the township indicated by B is T. 5 N., R. 5 W., S. L. M., while C is T. 1 S., R. 1 E., S. L. M.

The method of surveying a township into sections, the exterior boundaries of the township having been run, and all monuments on these lines having been placed, is ordinarily to start from the south boundary of the township and close the survey on the east, north, and west boundaries. Starting from the southeast corner of Section 35 on the southern boundary of the township, the surveyor will run a line north, noting the topography of the country he passes over and recording the distances in chains of 66 ft., or 80 to the mile. At 40 chains, or one-half mile, he will set a rough undressed stone or a dressed post, called a 'Quarter-Section Corner'. This stone will probably be 8 by 12 in. by 2 ft. long and will be set with two-thirds to three-quarters of its length in the ground. If a post it will be 3 ft. long by 3 or 4 in. square. On a side parallel to the direction the line is being run will be chiseled '¼' if a stone, or inscribed '¼S', and the numbers of the sections it stands for, if a post. Should any trees over 3 in. be found within 20 ft. of the corner, one in each section will be marked on the side directly facing the corner by being blazed and having cut into the blaze the initials B. T. and the abbreviated section in which the tree stands. These trees are known as 'bearing trees', and are recorded in the surveyor's notes. From this corner the surveyor will continue north another 40 chains, making a full mile, where he will place a stone or post for the section corner common to sections 25, 26, 35, and 36. This monument should be set with its edges facing the cardinal points; on the east corner should be chiseled or cut one notch to denote that it is one mile from the east boundary of the township, while on the south should be one notch to indicate that it is one mile from the south boundary. If a post, it will bear in addition the sections for which it stands, and the township and range. A mound of rock will be raised beside the monument, and any suitable trees blazed as bearing-trees with the initials B. T. and the abbreviated section, township, and range, in which they stand. From this corner the surveyor will run east on a random or trial line, setting a stake for a temporary quarter-section corner at 40 chains. Running another 40 chains, and arriving on the east boundary of the township, the surveyor measures and calculates his error in bearing and distance in striking the section corner to sections 25, 30, 31, and 36, that was placed when the township boundaries were run. Returning from this corner on a true line to the corner for sections 25, 26, 35, and 36, he sets permanently, in the proper place, the quarter-section corner that was temporarily marked. From the corner for sections 25, 26, 35, and 36, the surveyor will run north one mile and east one mile, as before, and continue in this way, marking all section corners on the east and south edges with cuts or notches indicating the number of miles the monument is from the east and south boundaries of the township. The last mile on the north (between sections 1 and 2) will be run in a way similar to the east and west lines, so that the line may close on the corner already in place on the north boundary of the township. Where the north boundary of the township is a base line or standard parallel (formerly called a 'Correction Line'), the north between sections 1 and 2 will be run as a true line without reference to the corner already existing on the township boundary. A 'Closing Corner' will be set where the section line intersects the standard parallel or base line as the closing-corner of sections 1 and 2 only. This corner will bear the letters C. C. on the south, facing the township it represents, and notches or grooves to indicate the number of miles it is from the corners of the township, in this case one on the east and five on the west. This is the plan of marking section corners on township boundaries. It will be noticed that notches on these corners will always total six, and are on the opposite faces of the monuments instead of on edges adjacent and quartering toward each other, as in the case of section corners within townships. For illustration, the corner to sections 19, 24, 25, and 30 on the township boundary line will have two notches on the south face and four on the north.

All lines will be carried from the southern to the northern boundary in this way. The closing on the west boundary will be done by means of trial or random lines, just as on the north and east boundaries. Closing-corners are placed in the interior of a township only when it has been surveyed at different times, and it is impossible to close within proper limits the lines of the latter survey upon the corners of the earlier one.

A township corner is a monument marking the corner of a township. Due to the necessity of making corrections along the standard parallels to correct the convergence of the meridians or of joining old surveys to new ones, a township corner may be the corner of from one to four townships. There are certain methods of marking corners to show this or other facts, but the details would only be confusing to any but surveyors. A corner common to four townships bears six notches on each of the four corners of the post or stone. One common to two townships, or referring to one alone, is marked by six notches on two edges facing toward these townships. Township corners on base lines or standard parallels bear six grooves on three faces. Township corners that are closing township corners bear the letters C. C., and three sets of six notches. Such corners must necessarily be placed along the standard parallels when the 24-mile tracts are surveyed into townships; they also occur in joining different surveys. When it is impossible to place a corner in the proper place due to inaccessibility, a corner is placed on the line as near the proper point as practicable; this is called a 'Witness Corner', and bears in addition to the usual markings the letters W. C. Where rock is not available for a mound, pits may be dug and the earth raised as a mound. Stone monuments and mounds of rock are to be preferred to wooden posts and earth mounds, as being more substantial. Recently new corners have been adopted, being iron pipes surmounted by brass caps, similar to the bench marks of the Geological Survey. Mounds and pits will accompany them as with the old style corners. Trees should be marked by the surveyor; those intersect-

ing the line by two opposite blazes facing the directions of the line: those within a half chain by two blazes quartering toward the line. Brush should be cut to indicate the line.

By the method of surveying, all the error in measurement is thrown on the north and west boundaries of the townships, for this reason the outside quarter sections on these boundaries are reported and sold according to the measurements returned by the surveyor, the other tracts being presumed to be of full area. This error is platted into the outside tier and range of 40-acre tracts on these boundaries. These particular sub-divisions are called 'lots', and in these sections are numbered as shown in the diagram. Any tract of the 40-acre subdivision class that contains more or less than 40 acres is called a lot. Also any part of a 40-acre subdivision that may be cut off and left remaining by a piece of land, the title of which has passed from the Government, is called a lot. There can be no regularity in numbering such lots as can be seen in the case of the lots made in sections 9 and 16 of the diagram, by the issuing of patent to the group of mining claims indicated.

Though the Government does not sub-divide sections, it issues the following instructions for such procedure: First, determine the boundaries of the section by the established corners, then divide into quarter-sections by running intersecting lines from the opposite quarter-section corners. To still further reduce by dividing the quarter-sections into quarter-quarters 40-acre subdivisions), locate quarter-quarter corners at points midway between the section and quarter-section corners, likewise between the quarter-section corners and the centre of the section as determined in dividing into quarter sections. Then run intersecting lines from these quarter-quarter corners. In subdividing the quarter-sections on the last half mile of the lines closing on the north or west boundaries of the township, where the errors in measurement are thrown, the inside rows of quarter-quarters are made exact by measuring 20 chains along the section lines from the quarter-section corners, the outside rows of quarter-quarters becoming lots of various areas.

The nomenclature of the subdivision of a section is simple. In the diagram the tract indicated by *G* is the southeast quarter of section 23, abbreviated the SE. $\frac{1}{4}$ sec. 23; *E* is the west half of the southwest quarter, abbreviated the W. $\frac{1}{2}$ SW. $\frac{1}{4}$ sec. 23; the quarter-quarter *D* is the northwest quarter of the northwest quarter, abbreviated the NW. $\frac{1}{4}$ NW. $\frac{1}{4}$ sec. 23; *F* is the southeast quarter of the northeast quarter, abbreviated the SE. $\frac{1}{4}$ NE.$\frac{1}{4}$ sec. 23. A 10-acre placer claim conforming to legal subdivisions and situated in the extreme northwest corner of *G* would be the NW. $\frac{1}{4}$ NW. $\frac{1}{4}$ SE. $\frac{1}{4}$ sec. 23.

After completing the survey, the surveyor will file a copy of his field notes with the Surveyor-General, who binds them into a book open for inspection by all upon application. The surveyor also files a map of the township, which is open for inspection and tracing. These maps are made by entering on the plat the topography of the section lines as found in the field notes of the surveyor and connecting these according to the sketches in the surveyor's field book. The fact that the interiors of the sections are only sketched in and consequently creeks, roads, etc., are often wrongly connected or misplaced in the interior of a section, should be remembered when trying to fit the known topography of a section to the map of the same. The topography of the section lines should be accurate, and invariably is.

After the notes and plat have been filed with the Surveyor General, the Government sends an examiner who inspects the survey, measuring a number of the lines, and endeavoring to determine if the survey has been properly made, marked, and returned. In case errors are found, the surveyor is required to return and correct his work: this frequently happens. The errors and omissions of the surveyor may consist in initiating his surveys from wrong corners, in putting up poor corners, in failing to mark his line, or in willfully neglecting to run lines or set corners in a difficult part of the country where it is expected that the surveyor will not go. Errors in measure-

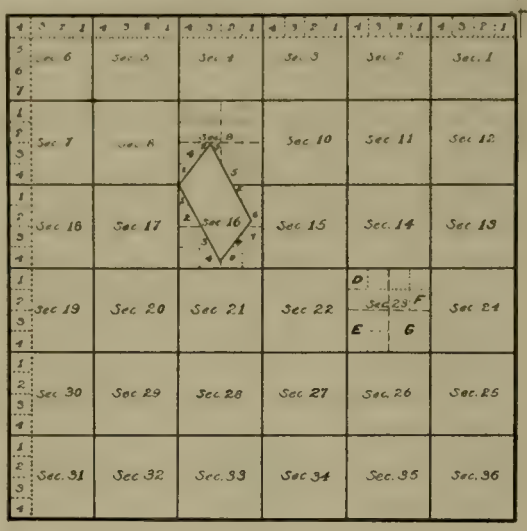


Diagram illustrating division into sections and subdivisions.

ment and alignment are sometimes found, though these should not occur since by the method of surveying there is a constant check on the work. At first, previous to the 'eighties', examinations of surveys were not made, but so many irregularities resulted, willful and otherwise, that all are now inspected. Gross irregularities are often found after a survey has been accepted, such as a corner being a quarter of a mile from its proper point, but after a survey has been accepted the corners hold and cannot be changed.

All lines do not run due north and south or east and west or the prescribed theoretical distance. Many of them vary in small amounts, and occassionally some vary greatly for a short distance. This is only done when necessary to close surveys, and is fully shown in the notes and plats.

With the passing of time the corners or monuments disappear. Men may intentionally or unintentionally remove them; cattle may tear them down; the elements and the various forces that change the surface of the earth may obliterate them. Anyone who has observed the condition of patented claim-stakes on

a steep hillside subject to much snow can understand how these corners disappear. Corners that have disappeared may be restored by running lines from existing corners in the vicinity, or a re-survey of a township or locality may be ordered to be made, starting from known corners and following the notes of the old survey. Section 57 of the United States Statutes, as revised and amended March 4, 1909, reads:

"Whoever shall willfully destroy, deface, change, or remove to another place any section corner, quarter-section corner, or meander post, on any Government line of survey, or shall willfully deface, change, or remove any monument or bench mark of any Government survey, shall be fined not more than two hundred and fifty dollars, or imprisoned not more than six months, or both."

The mounds of rock thrown up by the surveyor are usually too meagre. The requirements are that they be of 2 ft. base and 1½ ft. high; properly, they should have earth placed in the base to hold the rock together. Too often only a few stones are placed on a pile. There is a great difference between the land surveyor's corner and that of the prospector. The prospector's corner looms up large, well built, and often has a stake in the centre. The experienced man can almost instantly distinguish the prospector's corner from that of the land surveyor. It may be said without attempt to be sarcastic that the prospector is a professional 'monument builder' who takes a peculiar pride in building it in a substantial and workmanlike manner. It would be well for the land surveyor to add to his crew such a man who may be in need of recruiting his exchequer.

The Government does not hire land surveyors directly, but contracts the work, the successful bidder receiving in the past a stated amount per mile, the maximum price ranging from $9 to $25 per mile, depending on the nature of the country passed over, and the kind of line run. Since introducing the new iron corners contracts have usually been given at a rate per diem instead of per mile. A crew for surveying will consist of the surveyor in charge, who will operate the instrument, two chainmen, a head flagman, one or more brush cutters, a combined camp cook and packer, and four or five burros or mules for moving the camp. Being a case of 'more miles, more money', the work is hard and the hours long, to which the discomforts of a constantly moving camp is added. But it is interesting work, and lingers long in the memory. For the instrumentation a light mountain-transit is used, fitted with magnetic needle and with solar attachment or direct observation device. Each member of the crew carries with him several yards of white bunting which he tears into flags and attaches to poles cut from the brush. These flags are left at all corners and on high ridges as back sights, as range flags, and for triangulation points.

The stadia method, which was not officially sanctioned in earlier years, has been used lately to a considerable extent, by permission, as being more accurate and easier than chaining. It is especially valuable over rough, mountainous, or brushy land. Sights up to 1500 ft. can be taken, and with less accuracy up to 2600 ft. The objection to the use of stadia is that too little topography is taken; the sights are taken from ridge to ridge as far apart as convenient, the intervening topography being generally approximated rather than obtained by intermediate determination.

The General Land Office has been criticised because parts of the country have been long unsurveyed, and that lines have been poorly marked. It must be remembered that the task of subdividing the great area of the West is stupendous, and that the magnitude of the work and the money available will only permit it to be done gradually. Also the greater part of these surveys are made during the early settlement of a country, and it is impossible that all corners and markings should remain indefinitely. To have chiseled the letters U. S. on the monuments, and to have instructed the people to take a greater interest and to assist in preserving these corners and markings, would have been well. There is hardly a person so illiterate as not to know the meaning of the letters U. S., or so devoid of reverence or fear of the consequences as not to respect them. One of the visible indications of this is the safety that surrounds stamped parcels lying on top of a mail box, or a street car bearing the sign, "U. S. Mail" passing through a crowd of strikers. It may be mentioned that the new iron posts have inscribed on the brass caps, in addition to the usual markings, the words 'U. S. General Land Office', and the penalty for their removal.

In all communities are found men who are familiar with the surveys, but the majority are not. Many do not know in what section their land lies or the marks that definitely fix its position. The latter class often unknowingly remove or destroy the corners. Again, corners are removed by the knowing ones in order that area in excess of the rightful amount may be claimed. This is especially true in districts used only for grazing. Cases are constantly cropping up in which a party has applied for and obtained title from the Government for the tracts of land which he considers he is occupying, without looking up the markings and corners on the land. Eventually some investigator finds that the land being occupied is still open for entry and is not that to which title has been obtained, the first party having filed upon the wrong tracts, whereupon trouble ensues.

The literature bearing on the subject of public land surveys consists of a bound volume issued by the Department of the Interior, and entitled 'Manual of Surveying Instructions for the Survey of the Public Lands of the United States and Private Land Claims, 1902'. This is a book of detailed instruction for study and reference. It can be secured by unofficial applicants at cost from the Superintendent of Documents, Washington, D. C. The same Department also issues a circular for free distribution, entitled 'Restoration of Lost and Obliterated Corners and Subdivisions of Sections—Revision of June 1, 1909'. A pamphlet under the name 'The Rectangular System of United States Land Surveying', by Charles L. Du Bois, Chief of Public Surveys, General Land Office, being a re-print from the Technology Quarterly of December 1899, explains in a general and interesting way the method in use.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Leasehold System for Mineral Lands

The Editor:

Sir—In a recent editorial you have set forth at length the disadvantages of a leasehold system as applied to mineral lands, and especially to those containing phosphate. I think, however, that there are certain considerations to which you have not attached proper weight. Your objections are: (1) that a leasehold affords a less secure title than a fee, and (2) that the system takes from the individual locator a part of the unearned increment and therefore discourages individual initiative. As to the first it may be said that, even granting your conclusion, the objection might not be valid. As a matter of fact the cases you cite are those of short-time leases of agricultural land with 'fluctuating rental'. I am not aware that any such system has been proposed in connection with the phosphate or other mineral lands, and there is certainly a great difference between the proper appeal made in behalf of the small holding and home of the individual farmer and the large tract of rich mineral ground held by a big corporation; which happens to be the exact case in point. However, the leasehold system might afford less secure title than a fee, and yet be eminently just and proper. The advantage which it affords is that it allows all possible degrees of security to be given a title. There is all the difference in the world between the right of the 'crop farmer' in the South to raise cotton one year, and the 999-year lease of one railroad to another. To all practical purposes the latter is just as secure a title as an outright sale would give, and that it is so regarded by the business world is shown by the present price of New York Central securities. If another case need be cited, the enormous investment in buildings on leased ground in London, New York City, and elsewhere ought to remove any lingering doubt as to the adequacy of a 'leasehold' tenure.

Now it happens that there are substantial reasons why title to mineral property may justly be given, where desirable, some insecurity—that is, may properly be made contingent on the performance of specific acts or the payment of agreed sums. Mineral deposits are concentrations. They represent the gathering together of a large amount of wealth in a small space. It is impossible that they should be equally divided, and in a peculiar sense their possessors are 'trustees of the public'. This becomes a matter of first importance whenever the material is one restricted in quantity and vital to the continuance of our civilization and prosperity, as in the very instance of phosphate reserves. In such a case the necessity of preventing extortionate prices and wasteful development is paramount. The leasehold system permits this without, I am persuaded, incurring to any serious extent (to make the maximum concessions to your argument), the dangers you seem to see.

As to the second point, possible discouragement of individual initiative, I think your fears equally groundless. It is to be admitted that the proposed system will take from the possessor of phosphate land some of the unearned increment. Why shouldn't it? He is justly entitled to, and it is proposed he should have, liberal reward for his industry and the use of his capital but why should he have more? To the extent that the deposits rise in value because of increasing density of population, of decreasing abundance elsewhere, of improvements in transportation and similar factors, he, having contributed to these no more than others, is entitled to no more reward. Provision is already made in the patent office for securing to him ample rewards for any improvements in process which he may make. None of us want to discourage individual initiative. As you well say "it is too valuable an asset to be seriously jeopardized," but is not your argument really the old one that restrictive measures will frighten away capital? It sounds, at least, suspiciously like it.

The same argument was originally urged against any term-limit on street railway franchises, and yet there are now millions of dollars being invested regularly in what are virtually 'leases' of the public streets. In cases these franchises provide for the property being taken over at any time by the public and yet the securities sell at a higher rate and are better regarded by trust companies and even the 'widows and orphans' than under the old system. However, the practical test is, does the leasing system discourage development of mineral lands?

I think no one can have had experience under it who gives an affirmative answer. Even in the case of 'short-time' leases it is notorious that resort to leasing has saved many properties at Cripple Creek and elsewhere from closing, at the same time that it has given many a good miner an otherwise impossible opportunity. Incidentally the leasing system has been the main preventive of labor troubles in Gilpin county, the production of gold from which is notoriously as regular as a Kansas wheat crop where land is held in fee. Look also at the Joplin district; it is the one place which is at once 'a poor man's camp' and a profitable district for large investments, and yet the leasing system is there universal. You admit its applicability to petroleum, but how about coal and iron? The fact that much, not to say most, of the coal mined is from leased ground does not seem to have prevented the growth of our largest mining industry. Many Lake Superior iron mines are on leased ground and, incidentally, the State of Minnesota derives a large revenue and will eventually have an enormous school fund as a result. To come still closer home, it may be well to recall that a large part of the phosphate output of South Carolina has been derived from State lands under a leasehold system, and yet the development of the territory was, if anything, too rapid. Your fears are groundless. It is entirely possible to be just to investors, and no American wants to be other than just, and yet adopt this ef-

ficient system of retaining for future generations a proper control over deposits whose wise use is fundamental to our future prosperity. I take it, that the desirability of doing so, if it can but be done justly, is beyond dispute. Long-time properly drawn leases will secure at once adequate development and wise use; will prevent extortion; and will give to the general public some direct share in the 'unearned increment'. I put the latter last as the proposed law is not primarily a revenue matter. Theodore Roosevelt, when he made an earnest plea for the introduction of the system, specifically stated that the royalty assessed might well be purely nominal. It is control, not money, which is wanted.

CONSERVATIONIST.

Denver, Colorado, January 1.

The Copper Game.

The Editor:

Sir—Referring to your editorial, 'The Copper Game' in your issue of November 27, the final and most important idea comes out in the closing of the last sentence, "but meanwhile the shearers on Wall Street are busy at the old trade." The crop of suckers for 'The Copper Game' seems most abundant, when such issues as Utah Copper, with outstanding shares of over 730,000, reaches a quotation of $66 per share, or a valuation of over $48,000,000 for a property paying $1,000,000 per year in dividends. This dividend rate is but little over 2%, not so good as a first-class Government bond, and the most enthusiastic promoter or stock-seller could hardly claim that Utah Copper had security for its stock value equal to Government bonds. At the present rate of dividends, it would take an investor over 40 years to get his principal back without interest: it certainly must be that there is a good crop of suckers for 'The Copper Game'.

Another instance of the copper-crazy sucker is found in the flotation of Ray Consolidated, with a paper-value by market quotation of over $14,000,000. Even the officers of this company put the first dividend in the indefinite future. The first unit of 4000 tons capacity will not be in commission for over a year, and allowing the same margin of profit on this ore as on Utah Copper, the hoped-for dividend could not be over $500,000 per year, or practically it would take 30 years from date to get back the principal without interest. Four thousand tons per day for 30 years equals 43,800,000 tons, or much more than the rosy prospectus of this company claims is in sight. The sucker, if he bought for investment, would be lucky in dealing in either of the above stocks to get his principal back in a lifetime. Possibly the investor is to be considered as a gambler; he buys paper-values only, hoping for a rise and a chance to unload on a less-posted sucker. Some of the States have laws to prevent betting on horse races, but there is no restraint on betting on copper or any other old stock. There never was a 'fixed' horse race that could equal, for a 'sure thing' for the promoters the average of the newer great copper issues.

C. M. FUELLER.

Los Angeles, December 17.

Who Is a Mining Engineer?

The Editor:

Sir—The discussions, frequent lately, about what constitutes a mining engineer, are leading to some clarified thoughts on the subject. Perhaps no one has yet given, or can give, a satisfactory definition. If I were to try, it would be "one who can perform any of the duties inseparably connected with mining, or who can determine when those duties are properly performed." As knowledge has increased it has become clear that the duties are so varied and many, that it is impossible for any single individual to become proficient in the performance of each and all of them; but it is possible for one to gain enough knowledge to enable him to form a correct opinion as to the merits of a performer in any one of them; in other words, to distinguish between pretense and merit.

In the schools students are taught enough mathematics to perform any of the calculations required; surveying in its various branches; metallurgical chemistry, and mineralogy; a very little practical and more theoretical mining, book-keeping, geology, metallurgy, mechanics, and physics. Just as in the classical course, no intellect can retain and digest all it studies, but the student has an opportunity to learn where to look for the things he does not know. This, in fact, is one of the best results of a college education. After graduation he takes up such specialty as his taste, or perhaps necessity, gives him. If, as a result, there are some round pegs in square holes it is only in accordance with the law of things. While I believe that the mining schools turn out a larger percentage of men fitted for their work than are turned out by the medical schools, there is something lacking in both. There are European art schools where students who do not show talent for the work are dismissed and advised to seek an occupation for which Nature has better fitted them. All technical schools need a little of that drastic weeding out. If they had it, the degree of E. M. would not be so undeserved by graduates as it is often supposed to be.

Under the definition of mining engineer above, those who are entitled to the designation are not abundant. It is not limited to those who have attended mining schools, nor to those who are really entitled to school degrees. Perhaps none are until experience has ripened their knowledge.

The suggested system of examination and licensing which is applied to medical doctors would draw the lines pretty clearly. In the case of one superintending work where human life or health are endangered, certainly the public good demands that he should be capable, and a license would do much to bar out the incapable. But should State or Government control go any farther than is required to guard health and life? Is there necessity for a law to prevent an arrant humbug from adopting a title to which he has no right, when such humbuggery deprives no one of life or health, but only of what Shakespeare calls 'trash'? Laws to prevent people from being fools have never been eminently successful.

W. C. WYNKOOP.

San Francisco, December 29.

Special Correspondence.

LONDON.

English Copper Companies.—Cape Copper.—Copiapo.—Messina.—Edmundian.—Cordoba.

At the present juncture when copper mining is receiving close attention, it may be of interest to review the actual position of some of the English companies. In particular the fortunes of such old companies as the Cape Copper, the Copiapo and the more recent ventures, the Cordoba, Edmundian and Messina are of interest.

The Cape Copper Co. Ltd., was formed in 1867 to acquire the O'okiep mine in Namaqualand, South Africa, and for many years it made handsome profits out of high grade bornite and chalcopyrite, which was and still is shipped to Britonferry, South Wales, for treatment. John Taylor & Sons are the managers. For some time it has been known that the reserve of ore is limited, and other properties have been acquired on trial in Africa and elsewhere. The report for the past year shows a profit of £90,223, which is only one-half of the average of the last twenty years, and £50,000 less than last year. The low price of copper is accountable for most of the fall, as may be judged from the fact that two and three years ago the profits were four times as great as during last year. Another reason for the fall of profits was the strike at the Britonferry works which lasted for 13 weeks. During the year, sales of copper brought in an income of £187,914. The company owns shares in the Tilt Cove Co., of Newfoundland, and treats its ores at Britonferry. The company's profit from this source during the year was £10,661. Other items brought the income to £205,700. Mining, smelting, and investigations cost £106,736. London and other expenses brought the total cost to £115,456, leaving a balance of £90,223. Taxes also absorbed £26,148, so that the balance available for distribution was £64,075. As a large balance, £74,864, was carried forward from the previous year, it has been possible to distribute £12,375 on the preference shares, which is at the rate of 13¾%, and £82,500 on the ordinary shares, at the same rate. During the year 15,968 tons of ore assaying 15.45% was obtained from the O'okiep mine, and the reserve is calculated at 10,000 tons. The Nababeep mine yielded 54,000 tons of ore assaying 5.04%, and the reserve is 150,000 tons, practically the same figure as a year ago. Trial workings have been conducted at the Narrap, Springbok, and other mines in the district, with moderate results. Details of operations at the properties under option in America and India are not given.

The Copiapo Mining Co., Ltd., operating the Dulcinea copper mine in Chile, is not in a promising condition. This company was originally established in 1833, and for many years made good profits. Three years ago the control passed into the hands of the Siemens group, who also own the Tyee. Additional capital was subscribed with the object of developing the property and erecting a modern smelting plant. J. H. Cordner-James is chairman and L. C. Stuckey was recently appointed manager. During the year ended June 30 the amount of ore smelted was 11,374 tons averaging 8.4% copper, which produced 1343 tons of matte assaying 51½% copper, and containing also 428 oz. gold and 9766 oz. silver. Some of this ore was pyrite and some oxidized; no mechanical dressing is done, but some waste is picked out by hand. The receipts from the sale of matte were £33,631, and the loss on the year's working was £25,893. If it had not been for the action of Henrik Loeffler, one of the largest shareholders, in advancing £26,000 with practically no security, the company's finances would have been seriously embarrassed. The company has a share capital of £225,000 and a debenture issue of £50,000, no money could have been raised by temporary loans on security, so that Mr. Loeffler's course partook of the generous. Smelting is far from perfect, and the height of the blast-furnace is to be increased with a view to decreasing the consumption of coke, which is an expensive item. In June last, damage and interruption were caused by an earthquake. On June 30 the ore reserves were 21,757 tons of oxidized ore and 39,234 tons of pyrite, a total of 60,991 tons averaging 3.1% copper. The amount developed during the year was approximately equal to the consumption. The directors do not take a cheerful view of the future and hardly hope to make a profit unless the price of copper rises.

The Messina mine, owned by the Messina (Transvaal) Development Co. Ltd., is in the northern part of the Transvaal. The company was floated in London by Chaplin Milne Grenfell & Co. The mine was worked in prehistoric times and is rich in chalcocite. Owing to its inaccessibility it has not yet been possible to proceed rapidly with development and production. The cost of labor, the supplies precludes for the present any scheme for smelting locally, and the cost of shipping concentrate to Swansea is excessive. The policy has therefore been to go slow, to ship sufficient high grade concentrate to pay expenses of development, and to wait for railway connections. Last June an extension of the Pretoria Pietersburg railway to Bandolier Kop was authorized and its construction is already well advanced. When this is completed communication will extend to Johannesburg and Cape Town. In addition another railway is being built from Komati Poort to Leydsdorp, which will complete communication with Delagoa Bay. These lines when completed will help to reduce the cost of transport. During the last year the development of the mine has been satisfactory. The rich ore has been proved to exist down to 400 ft., where a winze contains ore assaying 20% of copper. The high-grade ore reserves on June 30 have been increased to 43,315 tons having an average content of 15% copper. In addition, there are 10,000 tons of lower-grade ore, and it is safe to estimate another 60,000 tons of probable ore. During the year ended June 30, 1906 ft. of development work was done at a cost of £8471, and the high-grade ore reserves were increased by 15,533 tons. During the same period 15,011 tons assaying 12% copper were milled, yielding 2240 tons of concentrate assaying 52.3% copper, together with 1217 tons of middling product averaging 20.5%, and 56 tons of pyrite concentrate averaging 31.8%. The total recovery of copper was 80%, and the average assay value of the tailing and slime was 2½%. Of the rich concentrate 1885 tons were sold to Swansea, yielding £53,135, or £28 per ton. The cost of shipping to Swansea averages £5 17s. 6d. per ton. The cost at the mine, including development redemption, depreciation, and shipping charges, was £45,802, the London office expenses, £3805, and interest on debentures and overdrafts, £3650. The total expenses were therefore £53,257, which practically balances the receipts from sale of concentrate. The company has an overdraft at Chaplin, Milne, Grenfell & Co.'s of £42,591, and there are other creditors. It is intended when railway communications are completed to raise further capital in order to straighten finances and actively pursue operations. Though present conditions are complicated the ultimate prospect is distinctly hopeful.

The Edmundian Copper Mining Co., Ltd., belongs to the Consolidated Gold Fields group and operates a copper mine in Mozambique territory close to Rhodesia and adjoining the Beira-Salisbury railway. The copper occurs as chalcopyrite which is exceedingly friable. The content is fairly regular, but the vein varies in width. Though in many cases the average is over 15%, a lower content is used in estimating the value of the ore actually mined, 9.8% being the figure adopted at present. The ore as it comes from the mine is hand-picked on belts, rich ore being taken out on one side of the belts and barren rock on the other. The discharge from the end of the belt averages from 4 to 5% copper. It is sent to stamps, where it is crushed to pass through a screen with 300 holes to the square inch, and is afterward concentrated in an Elmore vacuum plant. The concentrate here obtained runs from 20 to 22% copper and the tailing contains about 1%. The ore and concentrate is smelted in a reverberatory, where a matte averaging 50 to 60% is obtained. The engineers have not been able to get as much work out of the crushing plant as they expected, for some reason not explained. Three air-cushion stamps are in use, each with an estimated capacity of 20 to 25 tons per day. The engineers could not get more than from 11 to 12 tons per day through each stamp, so that the

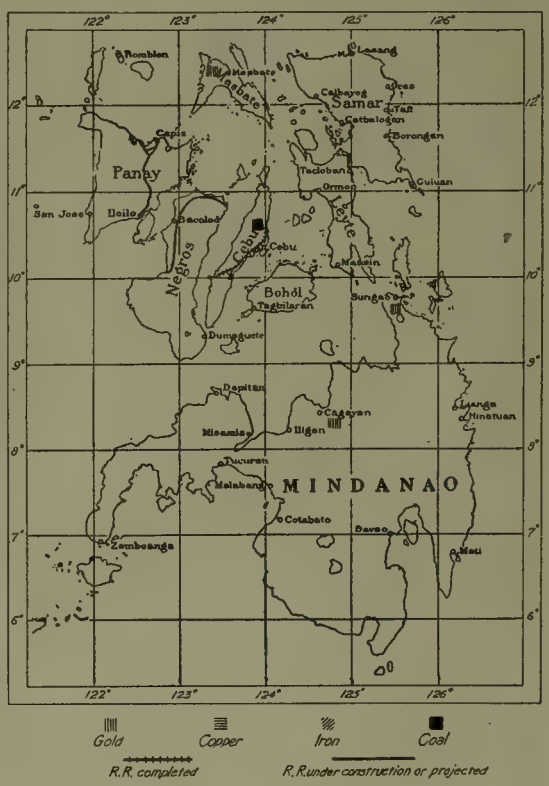
daily duty was only 35 tons instead of 60 to 70, as expected. The capacity of the reverberatory furnace has also been less than was expected. Modifications are therefore being introduced into the crushing and the smelting plants. In future the fine ore is to be removed before crushing and the coarse ore will be sent through the air-cushion stamps with a larger aperture and subsequently through a Chilean mill. In addition to the reverberatory, a blast-furnace is being erected. It will be designed to use pyritic smelting, and it will treat the slags from the reverberatory and the coarser parts of the ore. The company was formed in 1907 and operations commenced toward the end of 1908. The present report covers the nine months ended June 30. From October 1908 to June 30 the production was 569 tons of matte, which sold for £15,749. Since the latter date to the end of November the output was 400 tons of 50% matte. The expense at the mine for the nine months was £17,867, which shows a loss, but when the new crushing and smelting plants are completed, the operations should show a profit. The ore reserve on June 30 was 26,965 tons averaging 9.8% copper.

The Cordoba Copper Co., Ltd., was formed in August 1908 to acquire copper mines belonging to the Cerro Muriano and the North Cerro Muriano companies, owning properties near Cordova, Spain. The management is in the hands of John Taylor & Sons. The mining, concentrating, and smelting problems encountered at these mines have been by no means easy. A great deal of development has been accomplished lately with fairly encouraging results. On September 30 the ore reserves were figured at 122,395 tons, with an average assay of just over 3% copper. The decomposition of the country rock makes stoping difficult, and to ensure safety the workings are filled with waste immediately after stoping. During the past year 61,486 tons were raised. The preparation of these ores for smelting is not simple. About half of the production is sent to the wet-dressing plant, where 522 tons of concentrate averaging 20.9% copper and 3128 tons averaging 14.9% copper were produced. The former were sold and the latter sent to the sintering plant. There is also a magnetic separating plant where some of the crude ore and also the middling from the wet plant are treated after receiving a preliminary roast. During the period under review 19,627 tons of crude ore and 6971 tons of middling were treated and produced 3155 tons of concentrate averaging 16¼% copper. Of this 124 tons were sold and the remainder sent to the sintering plant. Aside from this, 3000 tons of rich fine was sent to the sintering plant and 2326 tons was picked out and sent to the blast-furnace. At the sintering plant 8808 tons of smelting material was produced, of which 8755 tons was sent to the blast-furnace and 53 tons of return fine was briquetted. The average assay of the sintered product was 12.69%. The blast-furnace commenced operations in August 1908, and as its capacity is greater than the ore supply, it is only being worked every alternate month. During the period under review 10,489 tons of ore have been smelted, made up as follows: 2280 tons of picked ore, 8070 tons of sintered product, 74 tons of screened fine, and 65 tons of briquettes. In addition 1073 tons of slag have been re-smelted. The fluxes added amounted to 6274 tons, and the coke consumed was 2360 tons. The product of smelting was 1838 tons of matte assaying 62% copper and 69 tons of bottoms assaying 85 to 90% copper. The directors report that the magnetic process is expensive in repairs and renewals and that it is not easily kept in an efficient condition. The wet-dressing plant is not at all up-to-date, and a modern one is now being erected. The problem of concentration is far from an easy one. The ore was tried in the Elmore vacuum plant, but owing to the presence of so much calcite, the results were not satisfactory. For some months parcels of the ore have been sent to the Murex Magnetic Co.'s plant at London, and the preliminary tests have been sufficiently encouraging to warrant the erection of a small experimental plant at the mine. As regards the financial position of the company, the profit and loss account on September 30 showed receipts from sales of ore and matte of £65,102 and a total income of £76,873. Against this the expenses at the mine and in London were £73,462.

MANILA, P. I.

Mining Claims Located.—Gold Production. — Tayabas Oilfield to be Tested.—Copper Deposits.

In the fiscal year ended June 30, 1909, there was great activity in the filing of mining claims with the Bureau of Lands, according to the annual report of the director. During the year there were 656 lode and placer claims filed, and the whole number since the opening of the bureau has reached the large total of 3442. By provinces these claims are: Albay, 7 gold placer claims; Ambos Camarines, including the Paracale district, 156 lode and 99 placer gold; Benguet, 110 lode gold; Bulacan, 1 iron placer and 2 placer not stated; Ilocos Norte, 9 lode manganese; Lepanto-Bontoc, 3 lode not stated; Mindoro, 9 gold and 1 copper placer; Nueva Ecija, 4 gold placer; Rizal, 1 building stone placer; Sorsogon, including the Masbate district, 45 lode and 2 placer gold; Surigao, 32 gold placer; Tayabas, including the Tayabas oilfield, 4 lode gold and 168 petroleum placer;



Southern Philippine Islands.

Zambales, 3 asbestos placer claims. During the year 14 patents for lode claims and 5 placer patents were issued. Eighteen other claims were perfected for which patents were issued after the close of the last fiscal year. Ten additional lode claims were surveyed and advertised and were ready for patent soon after the close of the year. The period was marked by a small but steadily increasing production of gold from the lode mines in Benguet and the placers of Paracale, development work in Masbate, and activity in locating oil claims in Tayabas. During the last six months of 1909 a decided impetus has been given to mining. Three dredges are now at work in Paracale on ground averaging 50c. per yard. The Benguet mines have increased their production. Masbate gives promise of entering the list of producing districts soon and lode claims in Paracale are ready to yield returns. The Batan coal mines have now a steady output. Arrangements have been made for sinking two wells to a depth of 200 ft. on the Tayabas peninsula should oil in quantity not be found before that depth is reached. These two wells are to be sunk on what is known as the Bahay Valley Oil Co.'s property, comprising about 200 acres of some of the most promising oil ground in

the district. The best expert opinion is that the oil should be struck at a depth of from 600 to 1200 ft. The capitalization of the company is ₱100 000 divided into 1000 shares of ₱100 each offered to the public at par.

The Mancayan mines which are the most important and best known copper deposits in the Philippines have lately come under the control of a local syndicate composed of American and English capitalists. This company has applied for and obtained a franchise to build a railroad from Mancayan to Bangar a town on the western coast of Luzon. Such a road is of prime importance to the interests of the copper company, but the gold mines of Suyoc and northern Benguet will also be benefited. The Mancayan property is now being thoroughly examined by a mining engineer from the United States. Promising specimens of the carbonate ores from eastern Pangasinan have recently been brought to Manila, but no authentic reports have yet been received concerning the extent of the deposits. Similar specimens, but more data, have been recorded from Cagayan de Misamis. Large boulders of chalcocite float carrying appreciable quantities of gold and silver have been found in Marinduque, but up to the present time the mother lode has not been discovered. Native copper occurring as a thin stringer in igneous rock has been discovered in Masbate and rich carbonate ore carrying gold and silver have been found in the same region.

WASHINGTON, D. C.

Bills for Classifying Public Lands. — Proposed Leasing Systems. — Adverse Claimants in Alaska Get Longer Time.

Among the bills recently introduced is one by Knute Nelson, Senator from Minnesota, and chairman of the Senate Committee on Public Lands. It provides for the classification, care, and disposal of the public lands of the United States. Under its terms the President will have power at any time to withdraw from settlement, sale, or entry, any of the public lands of the country, and reserve them for forestry, water-power, irrigation, or other public purposes, and such withdrawal will remain in force until revoked by him or by an act of Congress. Mr. Nelson would separate the public lands into eight classes: agricultural, irrigable, dry-farming, timber, coal lands, mineral lands, national forest, and water-power lands. The bill provides for the disposal of these lands under the various laws with the following provisions relating to the mineral lands: "That all valuable mineral deposits other than those embraced under the head of coal lands, as defined in this act, in the public lands and national forest lands of the United States shall be free and open to exploration, and shall, together with the land requisite for the development and working of the same, be subject to location, purchase, and entry under the mining laws of the United States. In case valuable mineral deposits are found in any subdivision of agricultural, irrigable, or dry-farming lands, as defined in this Act, or in case any of the mineral lands of the United States are suitable for agriculture or grazing, only so much of the land in any subdivision shall be subject to location and purchase under the mining laws as is needed for the development and the working of the mineral deposits; and the residue of any such subdivision shall be subject to entry and disposal as agricultural, irrigable, or dry-farming land, according to the class to which it may belong. That all valuable deposits of coal, petroleum, or other mineral oil, phosphate, asphaltum, or natural gas, in the coal lands or other public lands shall be free and open to exploration and discovery. The Secretary of the Interior may, however, under such rules and regulations as he may prescribe, grant a license for a limited time, not exceeding one year, to any person to explore for such deposits in any specified public lands, not exceeding in the aggregate —— acres; and for such license the licensee shall pay a fee of not less than —— dollars per acre for the land included in such license. The license shall give the licensee the exclusive right to explore the land designated in the license during the term thereof, and shall give to him preference right to lease such of said deposits as he may have explored and discovered under his license. None of the said deposits shall be sold or disposed of, but the right to develop and work the same and to dispose of the product may be secured to lease as herein after provided. The Secretary of the Interior is hereby authorized and empowered on behalf of the United States to lease such deposits and the right to work the same and to dispose of the product thereof for a limited period not exceeding in any case 25 years as to deposits of coal and not exceeding 10 years as to deposits of petroleum, other mineral oil, asphaltum, phosphate, or natural gas. The lessee under such lease shall pay for coal deposits a rent and royalty of not less than —— cents per ton of the coal extracted, and not less than —— cents per barrel for petroleum, mineral oils, or liquid asphaltum extracted, and not less than —— cents per ton for asphaltum not in a liquid state, or for phosphate. In no case shall a greater amount of land be leased with the deposit than is necessary to develop and work the same, and in no case more than 2000 acres, as to coal, and in no case more than 640 acres as to the other deposits referred to in this section. The Secretary of the Interior shall determine and the lease shall prescribe the minimum development and the output to be extracted of the deposit each year during the continuance of the lease. Such lease shall also contain a covenant on the part of the lessee covenanting not to violate the provisions of an act entitled, 'An act to protect trade and commerce against unlawful restraints and monopolies', approved July 2, 1890. In case the lessee violates the said act or fails to develop the deposit and extract therefrom each year the output required by the terms of the lease, his lease shall be subject to forfeiture in a suit brought by the Secretary of the Interior. That so much of the surface of any subdivision of land containing any of the deposits, as is not necessary and requisite for developing and working the deposit shall be open to entry and sale as agricultural, irrigable, or dry-farming land, according to the class to which it may belong." Mr. Nelson has left the figures blank in the bill to give the members of the Senate an opportunity to fix them. The bill further provides that forest lands not valuable for their mineral or coal deposits, or for agricultural, grazing, or water-power purposes shall continue withdrawn and to be administered in accordance with existing laws governing the maintenance, use, and care of national forests. The bill also provides for the leasing of water-power sites for a term not exceeding 25 years at a rental not less than 1% for the first ten years, 2% for the next ten years, and 3% for the remaining five years of the gross earnings.

Frank W. Mondell, of Newcastle, Wyoming, Representative and Chairman of the House Committee on Public Lands, has introduced a bill which provides for agricultural entries upon the public coal lands, the Government reserving to itself the coal in such lands and the right to prospect for, mine, and remove it. The bill has practically been approved by the House Committee. It would affect 35,000,000 acres of coal lands already classified and as much more unclassified. The bill does not apply to Alaska. Under this bill any person obtaining a patent upon the land for agricultural purposes shall have the right to mine sufficient coal for domestic purposes until the coal is disposed of by the Government. C. I. Crawford, Senator from South Dakota, has presented a bill which provides that all public lands and lands included in national forests containing workable deposits of coal shall be classified as coal lands and disposed of by leasing, the title in fee to remain with the United States. Mr. Crawford would have the lease run 25 years, and would not grant to any one person, association, or corporation to exceed 2560 acres of coal lands, exclusive of the surface, in legal subdivisions of not less than 160 acres, which subdivisions need not be contiguous. He would require an annual rental per acre of 5% of the classified price for such lands, and in addition thereto a royalty upon the coal taken from the ground.

The statute which gives adverse claimants to mineral lands in Alaska 60 days in which to file their claims will soon be amended by the Senate in such manner as to give the claimants 90 days. A bill introduced last March by Mr. Nelson, of Minnesota, has been reported favorably by the committee on public lands. In its report, the committee

says. "It is a matter of general knowledge that during a considerable portion of each year communication by mail and otherwise between different parts of Alaska and between that Territory and the States is practically suspended. Hence it is not only possible, but probable, that a notice of an application for patent published, say, at Nome, may not be brought to the attention of claimants to the same ground residing at Juneau or in some other portions of the Territory or in some portions of the States at any time during the period of publication. This can be appreciated when it is remembered that the distance between the two Alaskan points named is, roughly stated, 1100 miles in a direct line overland, and 2200 miles by water. During the winter season there is an overland mail between certain Alaskan points, which, however, carries only letter mail. There is no doubt but that by delay of publication of mining notices until after communication on account of the season is practically closed in Alaska, unscrupulous claimants may render the requirement of mining laws in this particular ineffective, and for that reason the statutes providing for publication and the assertion of adverse claims should be amended. In fact instances have occurred where the Land Department found it necessary to suspend publication in Alaska mining cases in order to prevent injustice."

MEXICO.

Ortiz Mines in Guerrero.—Butters Copala.—Cinco Minas.—Oil Concession, Baja California.—Mexican Petroleum Company.

The Exploration Co., Ltd., of London has obtained an option on the famous mining properties of the Reforma Mining & Milling Co., at Campo Morado in the State of Guerrero. This company is practically a close corporation controlled by the Ortíz family, José M. Ortíz being president and Vicente Ortíz general manager. Due to this fact very little has ever been written about the properties, although they can well be classed among the great mines of Mexico. The area of the company's holdings is approximately 2500 acres, and the workings have a length of more than six miles. There are 14 adits, and an extensive system of development has been carried on for years. Although the actual tonnage of ore reserves is not made public, it is stated by those who have visited the mine to be enormous. There must be something great when a man with the experience of R. M. Raymond, the present managing director of the Exploration Co., is prepared to enter into a contract which calls for a payment of ₱20,000,000. The mines are about 30 miles from the railroad at Balsas, and all of the high-grade ore is packed on mule-back from the mines to Balsas station for shipment to the smelters; about 1800 mules are kept going in this service. The company had a scheme some time ago for constructing an aerial tramway from the mines to Balsas station. The oxidized ores near the surface are principally lead carrying from 750 to 5000 gm. silver and from 10 to 50 gm. gold per ton. At greater depths the ores consist mainly of iron pyrite, carrying from 3 to 8% copper, with some silver and gold.

The company is operating a concentration plant, and one 30-ton, and one 100-ton, lead-smelter. Plans have been made for the installation of a pyritic smelter. The plant is equipped with steam and electric power aggregating about 200 hp., and about 700 men are employed.

The Butters Copala Co. owns about 26,000 acres of land and practically all of the mineral claims worth having in the Copala district of Sinaloa. This has been a famous camp for over 200 years, and there should be no difficulty in finding sufficient ore to keep a large mill going, but there are persistent rumors to the effect that there is such a shortage of ore blocked that the mill has not been running at full capacity for a long time. The mill has 40 stamps and a thoroughly modern equipment, including a Butters cyanide plant. There is also a fine central steam-power station with electrical distribution of power to the mill and to the hoisting and pumping plants.

The final payment on the Cinco Minas has been made by H. E. Crawford on behalf of the Marcus Daly estate. The first payment which was made when the option was first granted was for ₱70,000, and the final payment was for ₱500,000, making a total purchase price of ₱570,000. The history of the reason for obtaining the option which has led to the final purchase of this mine reveals the value of a thorough knowledge of economic geology by a mining man of broad experience. When the former owners offered the mine for sale they thought that the bottom of the ore-shoot had been reached, and the vein had pinched, and they put the sale price of the mine on a rather high estimation of the blocks of milling ore left in the stopes, and on the possibility of a new ore-shoot being encountered. The vein is a silver-gold quartz, and has been formed in a fissure in the andesites in the hills on the south side of the Santiago River canyon. The veins occur in this district in the older andesites, and have been exposed only by the erosion of the more recent rhyolite flows which form a comparatively shallow capping in the immediate vicinity of the Cinco Minas. The fact that the main valley of the Santiago river has been eroded to fully a thousand feet below the present mine workings of the Cinco Minas would insure the ultimate permanent water-level being far below that in the mine. Mr. Crawford noticed that there were evidences of numerous small faultings in the vein, and evidences of extensive brecciation which had been re-cemented. Large zones of brecciated and leached ore were found in the lower levels, and this led to a search for the outlet of the downward percolating waters. A system of step faulting was found, and the vein continued with large and valuable ore-shoots. A winze was sunk 250 ft., which revealed the extension of a valuable body of ore.

Guanajuato.

Valuable deposits of high-grade iron ore are known to exist in the States of Colima, Michoacán, and Guerrero, and engineers representing John W. Gates have recently been making examinations of various prospects along the Pacific Coast. The Republic Development Co. of New York has been acquiring title to a number of properties recently.

Orders for two, each 55-ton, Kelly filter presses were placed with the British Mexican Development Co. of Mexico City by the Guanajuato Mining & Milling Co. for their Carmen mill. The slime from the ores treated in this mill is difficult to filter, but the results obtained from a small press erected for tests is so satisfactory that it is probable that all of the slime will be treated in Kelly presses.

A concession covering 40,000 acres of land has been granted to Flavio Gonzales to explore for coal and oil in Baja California. The land is Government property and the concession has been obtained to protect prospect work on a number of oil-seepages that have been found. New wells are continually being 'brought in' in the existing oil-fields in Mexico. In the Huasteca district the Mexican Petroleum Co. has just brought in three new wells and is now drilling two more in the same field. Tanks having a total capacity of 55,000 bbl. have been erected and are receiving the oil from the wells. From the oilfield to Tampico a pipe-line is being laid. The total distance is about 110 miles, of which about 10 miles has been completed and the material for 65 miles has been received. A narrow-gauge railroad of 130 miles will be built so as to give access to the properties.

NEW YORK.

Copper Merger Again. — Lake Copper. — Finds Rich Ore. — Santa Gertrudis Commissions.—Channing on Ray Central.

The interest in mining circles during the past week has been centered in the market. The present hysterical condition of the East bordering as it does on a semi panic, will undoubtedly have the effect of indefinitely postponing the large plan for a copper merger. J. P. Morgan is far too astute a reader of financial futures to attempt the flotation of a project to be equal in scope to the U. S. Steel Corporation. Copper merger plans are also halted because of complications that seem to have been unexpected. E. A. Wall of Salt Lake, has obtained an injunction from the courts of New Jersey, temporarily restraining the merger of the Utah Copper with the Boston Consolidated. As the matter now stands the Guggenheim merger has developed into a three cornered fight. James Phillips, Jr., is heading the Nevada Consolidated stockholders and opposing any union of Nevada Consolidated with Utah Copper, whether the latter is to include Boston Consolidated or not. Mr. Phillips' opposition is based on his contention that the terms of the proposed exchange would be a distinct loss to the Nevada Consolidated shareholders. Mr. Wall's chief argument against the merger plan is that it is contrary to the Sherman Act, and secondarily, that Utah Copper is paying too much for the other two companies. His lawsuit, viewed in this light, becomes interesting, as one of the important questions to be solved before the larger organization could be effected is whether or not it would come within the scope of the Sherman Act. It is stated here, apparently without contradiction, that the copper 'merger' would have been a fact long ago if the promoters could have been comfortably assured of a complacent attitude upon the part of the legislative and judicial authorities. There has been no drop in price so far as copper metal is concerned, but it is to be accepted as a certainty that the copper surplus must be absorbed and a price for the metal established that will show a reasonable profit for the so called high cost producers, before any big copper flotation can be pulled off successfully. In Boston, Lake Copper continues to be the sensation. It is now claimed that the orebody as developed by diamond-drills, will prove to be the richest vein ever opened in the Lake Superior country and possibly a richer and wider lode than any in the Calumet & Hecla. The neighboring properties of North Lake, South Lake, and the Indiana, are looked upon as having almost equal possibilities, and conservative leaders in Boston are already deprecating any wild market movement with its possible disastrous culmination.

The General Development Co. has declared a special dividend of 10%, making a total of 101½% returned as dividends since the organization of the company. Bitter complaint is heard from some stockholders of the Camp Bird, Ltd., both in this country and abroad, regarding the commissions paid on the purchase of the Santa Gertrúdis property. It appears that John Hays Hammond draws a retainer of £4000 per annum as consulting engineer for the Camp Bird. As a commission he receives about 119,000 full paid £1 shares of stock in the new Santa Gertrúdis company, and in addition receives a call on about 38,000 shares at the subscription price. Some of the stockholders think the commission is more than should be charged by an engineer in the regular employ of the company, though on the other hand it is not contended that Camp Bird lost anything on the bargain. It is conceded that the company has made a splendid purchase in acquiring the Santa Gertrúdis.

J. Parke Channing has just made a report on the Ray Central ground, in which he says that while it is impossible to determine the thickness of the orebody that has been explored on some 600,000 sq. ft. of the ground, he assumes it to be on the average 150 ft., giving a total of 90,000,000 cu. ft. of mineralized rock, which, as estimated at 12 cu. ft. per ton, would make a total of 7,500,000 tons of developed ore. Mr. Channing states that he feels safe in assuming that this ore will average 2% in copper content. These figures would give Ray Central a possible profit of $12,000,000 to $15,000,000.

DENVER, COLORADO.

Conditions in the San Juan District. — Cripple Creek News. — Property Transfers.—Clear Creek. — New Process.

Mining throughout the State has been hampered thus far by the severity of the weather. The outlying camps are practically isolated. The Denver & Rio Grande railroad from Durango to Ouray was blocked from December 31 until January 10. Many families in Ouray suffered from the cold as the local coal dealers had only a small supply of coal on hand. The business men of the town raised nearly $200 to help the railroad get the trucks cleared. To add to the difficulty, warm weather was experienced from January 3 to 6 which caused slides to run in nearly every gulch in the district. All Western Union, railroad, and telephone wires connecting Silverton with Durango were down. The canvas plant at the Iowa Tiger mine was completely wrecked and some damage done to the main mill, necessitating a temporary shut down. Eight men in all have been reported as lost in the slides. The Silverton, Gladstone & Northern railroad, connecting the Gold King mine with Silverton, has been leased to Otto Mears.

Ore hauling and all surface work in the Cripple Creek district was at a standstill during the first part of the month. Teams were kept busy delivering coal. All pipelines supplying compressed air were frozen. There is a persistent rumor that the Golden Cycle & Milling Co.'s holdings are to be sold to the Consolidated Gold Fields of South Africa, Ltd. At the annual meeting of the Cripple Creek District Mine Owners & Operators Association, the old officers were re-elected. The association is waging war on high-graders and operators of 'fences'. It is estimated that $250,000 was lost to the owners and operators last year by petty thieving. James F. Burns has secured control of the Jennie Sample Consolidated Mining Co. by purchase of 60,000 shares from S. S. Bernard. Howard Masterson has been elected president. The Portland Gold Mining Co. paid its regular quarterly dividend of 2c. per share on January 15. The Vindicator Consolidated Gold Mining Co. has announced its quarterly dividend of 3c. per share payable on January 25. The Deep Drainage Tunnel is in softer rock and is advancing rapidly. The heading is now within the lines of the Beacon Consolidated Mining Co.'s holdings on Beacon hill. Several transfers of property have taken place since the first of the year. The old Buell mine in Gilpin county has been sold to the U. P. R. Mining & Milling Co. This mine has a recorded production of $2,000,000. The mill is to be remodeled and equipped to treat the lower grades of ore. The sheriff's sale of the property of the Golden Dale Mining & Milling Co. on Raven hill in the Cripple Creek district has been adjourned until January 29. The sale is to satisfy a judgment of $3295.

The success of the Newhouse tunnel has made similar projects look more hopeful. There are now six tunnels boring into Saxon mountain near Georgetown. It might not be amiss to suggest that a consolidation of tunnel interests in such a case would mean a great saving in time and money. The Newhouse tunnel was driven 3332 ft. during 1909. More than 15,000 ft. of lateral has been driven from this tunnel. Work at the face has been stopped until about March 1. The Stanley mine on Spanish bar just above Idaho Springs has been bailed out to the third level and is now shipping. The placer operators on the creek bank below the mine are doing well. The Maim dry chlorination mill being erected at Georgetown is progressing slowly, because the material and machinery cannot be secured as rapidly as expected. The Colorado Springs and Denver daily papers have recently given some space to heralding a new process for extracting gold from so-called ore from the Front Range. The story goes that an expert chemist living near Woodland Park has discovered this process. A quotation from one of the articles may serve to illustrate. "The acid he has invented is a neutral one, and its chief value lies in the fact that it saves the flour gold. In other words, the acid when poured over the ore to be tested sets free the volcanic gases, whereas in ordinary methods where fires are first used the flour gold is lost in freeing the volcanic gases."

General Mining News.

ARIZONA.

COCHISE COUNTY.

The shaft at the Copper Queen property at Courtland is down 150 ft. It is the intention of the company to sink to the 200-ft. level and connect with the first shaft that was sunk on the property, a distance of 900 ft.——New cages have been installed at the property of the Great Western Mining Co., and new ore-cars purchased. Good ore has been opened on the lower level of the Mary shaft and the company is erecting living quarters for the men in anticipation of a considerable increase in the force employed.——The Red Mountain Development Co., operating at Dragoon, opened a body of sulphide ore in the shaft at a depth of 60 ft., and is planning on installing power and hoisting machinery. Frank Briggs is manager.——At Paradise the California & Paradise company is erecting a hoist preparatory to more extensive development.

GILA COUNTY.

(Special Correspondence).—The Williams shaft of the National Mining Exploration Co. has cut a new formation at a depth of 500 ft., and is now in material consisting largely of hematite that contains a small amount of copper. It is believed that the new formation may prove to be the main orebody which the shaft is expected to open. H. W. Woodward, the superintendent, is employing 25 men.——A force of 350 men is employed by the Arizona-Commercial Copper Co. in underground, surface, and smelter work. The sixth level is yielding most of the commercial ore, but on the fourth and fifth levels also valuable copper deposits are opened. Two winzes being sunk from the sixth level between the Eureka and Black Hawk shafts are down 75 ft. Both of these follow the vein at an angle of about 63° and have been in ore continuously. The amount of ore for the smelter has been slightly increased, so that the output of fine copper for January should be nearly 500,000 lb.——The 200-ton ore-bins at the McGaw shaft are completed, and the railway spur from the Arizona-Commercial smelter to the McGaw is practically done, so that the Superior & Boston Copper Co. is in readiness to ship ore. The date for beginning shipments has not yet been set but when production has once begun no less than 50 tons per day will be sent to the smelter.——The cross-cuts north and south on the 500-ft. level of the Telfair shaft of the Arizona-Michigan property are about 400 ft. long, the north being in quartzite containing some manganese and the south in diabase. Work has been discontinued temporarily on the drifts running east and west from the north cross-cut at a distance of 130 ft. from the shaft, because the vein followed is narrowing and contains little mineral of any kind. The formation in the face of the north cross-cut indicates the proximity of the Dewett lode.

Globe, January 21.

GRAHAM COUNTY.

At the Gold Belt property, in the Clifton-Morenci district, the new 5-stamp mill has been running about a month with excellent results. The cross-cut on the 100-ft. level has opened the vein showing it to be 10 ft. wide with an average value of $10 per ton.——The ore from the Standard mine is now being shipped to the Shannon smelter instead of the Detroit Copper plant as in the past.——The Copper Mines Co. of Arizona has been re-organized as the Arizona Morenci Copper Co. The company owns 100 claims in the Clifton-Morenci district and at present is prospecting the Celtic group with two churn-drills.

MARICOPA COUNTY.

The east incline of the Vulture Mines Co., at Vulture, has been retimbered to a depth of 275 ft. and will soon be completed. A connection has been made between the two shafts giving better ventilation and good ore opened on the No. 6 level. The mill has been kept running steadily on ore that assayed from $8.50 to $11.50 per ton and by April 1, the company will have the new mill in operation which will greatly increase the milling facilities. A second artesian well is being drilled and a cold-storage plant is under construction.——George Margaretic is preparing to forward a shipment of ore from the Unida mine to the Humboldt smelter when it resumes operations about the first of March.

PIMA COUNTY.

The shaft of the Chesterfield company near Tucson is down 330 ft. and the cross-cut on the 200-ft. level has opened a body of shipping ore. The company is preparing to open the ore on the 300-ft. level and expects to be shipping by May 1.——The Pontotoc mine, 8 miles northeast of Tucson, which has been idle for a year, is being unwatered and operations will be resumed on a larger scale. Duran Daily is superintendent.——A new hoist has been installed at the Old Growler mine and the company will sink to the 500-ft. level.——An extensive report has been made on the Gould mines 18 miles west of Tucson and the company is contemplating the erection of a smelter.

YAVAPAI COUNTY.

Considerable activity has been manifest in the Big Bug district since the announcement that the Humboldt smelter would resume operations about March 1. B. S. Bowen, manager for the Humboldt Consolidated Mines Co., is to purchase a hoist and power-plant for the company's property near McCabe. A new shaft has been started on one of the claims and as soon as the hoist can be installed, the ground will be thoroughly prospected.——Considerable ore is being stored on the dump of C. P. Wingfield's group, near McCabe, which will soon be shipped to the El Paso smelter.——The drift on the 100-ft. level of the Mint Gold Mining & Milling Co.'s property in the Copper Basin district has opened 4 ft. of $30 ore. George W. Montgomery is manager.——The Golden Idol mill, in the Cherry Creek district, is being repaired by the Hillside Consolidated Mining Co., and will be in operation in a short time.——Activities are to be resumed by the Arizona Copper Gold Mines Co., operating in the same district, and plans for a 50-ton mill are being considered.——The Arizona Power Co. has connected the wires between its plant on Fossil creek and power house of the Prescott Electric Co. The local plant has been closed down but is kept in repair for reserve.

YUMA COUNTY.

The Ryan group, near Vicksburg, has been sold to El Paso capitalists for $10,000. The new owners are erecting new quarters for the men and are to sink on the ore which has been opened in several places showing a fair gold content.——J. W. Brown has shipped another lot of ore from his property near Quartzsite to the custom mill.——A large dredge is being erected at Middle Camp, four miles west of Quartzsite, to operate on the ground that was formerly worked by dry placer machines.——The Yum Yum mine has been sold to Eastern capitalists and is now in charge of O. A. Pease.——W. E. Scott is milling ores from the Old Goodwin and Poor Man properties, the last clean-up resulting in a $4500 gold bar.——The rails of the Arizona & Swansea road are laid to within eight miles of Bouse, and it is hoped to complete the track this month. Another locomotive has been ordered for the line and five converter shells and a 500-hp. Sterling boiler for the smelter of the Clara Consolidated Gold & Copper Company.

CALIFORNIA.

AMADOR COUNTY.

(Special Correspondence).—The north drift from the 1750-ft. level of the Bunker Hill has struck a strong flow of water and several promising bodies of ore have been intersected. As soon as the vein has been cut a drift will be extended from the 1950-ft. level to open it at that point. The December clean-up approximated $22,000.——The west drift on the 3300-ft. level of the Kennedy has cut a body of ore believed to be a portion of the foot-wall vein.——The Argonaut is completing a new station on the 3300-ft. level. Good ore has been opened at several points in the lower workings and monthly dividends of 5c. per share are being paid.——The South Eureka is paying regular monthly dividends. The December clean-up of the mill exceeded $42,000.——It is reported that a 9-ft. body of milling ore has

been opened in the adit on the Wiley property. The Mitchell has installed a new hoist and is arranging to add an air compressor. An agreement for air paper has been signed by the South Eureka and Central Eureka companies. It provides for the connection at several points of the shafts of the two companies for the improvement of ventilation, for the promotion of greater safety and to facilitate operations in case of a fire or cave-in. The shafts are about 2400 ft. apart, and are already connected.

Kennedy Mine, Amador County.

The Argonaut Mining Co. and the Kennedy Extension Co. are collecting evidence for the impending suit involving disputed ground.

Jackson, January 24.

CALAVERAS COUNTY.

Operations are to be resumed at the Pilot mine near Mountain Ranch. The mine has an excellent record and should prove a good producer.——At the Columbia property the shaft is being retimbered and a 6-ft. vein opened. —— Eastern capitalists have purchased the Ophir Consolidated Mines property from John Nuner and will commence work on the group in a short time. There is a good supply of water on the property, and an adit has been driven, opening the vein at a depth of 500 ft.——A small force of men has been started to work at the Boston mine near Mokelumne Hill.

KERN COUNTY.

(Special Correspondence).—One of the most important transfers of mining property that has taken place in this district for many years was completed the other day by the purchase of the famous Weatherbee group of tungsten claims. The purchaser is C. Grant Illingsworth, proprietor of the Miners' Supply Store, Randsburg. The Weatherbee group is situated near Atolia, the tungsten country, and includes the well known Goldstone claim. The tungsten occurs in the form of scheelite, of which a 3-ft. vein has been traced throughout the claims. This has been developed for a considerable distance, and a large body of valuable ore blocked out. The purchase price of the property, $12,000, has been paid and the further development of the claims will be carried on vigorously.——Great activity prevails in the Stringer district. This district gets its name from the fact that the gold-bearing quartz is not found in continuous veins of any great thickness, but in stringers or occasional patches of ore that are sometimes of great richness. One of the best of the claims in this district, developed and a constant producer, was bought last week by C. G. Illingsworth. The sellers were Ostick & Renne, and the purchase price was $2000. The mine, which is known as the Pearl Wedge, is in the neighborhood of the Sunshine mine.——Frank Feldman, who is working on a claim leased from W. Houser, in the Stringer district, has run into a large body of ore that promises well. Two tons milled last week ran over $100 per ton.——Spurlock and associates, who are working the Merced mine, have run into a promising body of ore. Up to this point their drift has been driven through quartz of unusual density, which has been found very hard to work. The present body is softer and the owners are much cheered by their prospects.

Randsburg, January 24.

NEVADA COUNTY.

The transfer of the Champion properties has finally taken place, the new company being represented by I. N. Kelly. The lessees have stopped work in the mine, although they have 500 or 600 tons of ore ready for crushing. The drift on the 1050-ft. level of the Onstonmah opened the shoot at a distance of 300 ft. from the shaft. The ore is high grade, and two feet in width. The drift at the Erie mine near Grantteville, opened the shoot at a vertical depth of 150 ft. The vein is 10 ft. wide, and mills $40 per ton. There is a 30-stamp mill on the property which had been put in good order and will be started in a short time. At the Keller mine in the same district the adit opened a 10-ft. vein that assays $8 per ton at a depth that will give several hundred feet of backs. Several stopes have been opened at the Prudential and 12 stamps are dropping in the mill.——Arthur H. Hoge has secured a bond on the Lily mine in the Grass Valley district. The bond runs for three years and calls for a payment of $35,000 if the option is taken up.

PLACER COUNTY.

The Spring Garden Mining Co. is retimbering the old shaft and installing new machinery at the property, and will drive a bedrock adit to open the channel. C. A. Palmer is superintendent.——Machinery is being hauled to the new Cash Rock dredge from Auburn. The new boat will be larger and better equipped than the old one.——The channel on the ground of the Pacific Mining Co. has been opened and good prospects obtained.——The mill at the Barton has been overhauled and a winze started at the adit-level. E. B. Quigly is superintendent.——Work will be resumed shortly at the Crandall mine under the direction of F. B. Norton.

SHASTA COUNTY.

A 2-stamp Nissen mill is to be installed at the Happy Jack mine, on Clear creek, west of Shasta. There are six claims in the group which is one of the first properties worked in the district, and is now under bond to Charles L. Page.——The Northern California Power Co. is extending its line from the substation at the Balaklala mine, to the Uncle Sam property. L. C. Monahan is superintendent. ——Operations are to be resumed at the Climax mine near Igo. A hoist has been ordered and a contract let to sink 100 ft. which will give the shaft a total depth of 300 ft. Experiments are being carried on to determine the advisability of erecting a cyanide plant. H. W. Robinson is operating the property.——The Victor Power & Mining Co. will install a 5-stamp Nissen mill at French Gulch next summer.——It is reported that the Gold Leaf Mining Co., owning properties in the Lower Springs district, expects to resume in the early spring.——The Delta continues idle, pending the adjustment of its difficulties with the Inca Mining Co.——The new machinery for the Milkmaid is arriving. The mill is operating at full capacity.——The working force at the Sibyl has been increased.

SIERRA COUNTY.

The Gold Star property, in the Alleghany district, has been purchased by the Alleghany Quartz Channel Mining Co., and will be developed on a larger scale this spring. The old adit has been recently cleaned out and retimbered for 3500 ft. opening gravel that averaged $5 per car.—— The new mill at the Bear Creek mine, in the American Hill district, is running smoothly and the management is looking for an excellent clean-up.——The adit at the Queen Radigunde mine on Kanaka creek is expected to open the contact within the next 400 ft. Frank B. Smith is manager. ——The Golden Fraction claim, on Chipps flat, has been bonded to Los Angeles parties.

TUOLUMNE COUNTY.

It is reported that operations are to be resumed at the old Dead Horse mine upon which the Erie Mining Co. holds a lease.——The Republic mine, near Parrot's ferry, is to be equipped with new machinery and a larger force of men put to work. A good shoot is known to exist in the property and with proper equipment the mine should be made to pay well.——The owners of the Gold Spring property near Jamestown have satisfied themselves as to the amount of

ore in the property and are preparing to erect a fully equipped 10-stamp mill. A new 30-hp. motor is being installed at the Draper mill. In the mine work is being carried forward on the second, third, and fifth levels.

COLORADO.

LAKE COUNTY.

The Virginius adit, in the Sugar Loaf district, opened a 1-ft. vein when in 1600 ft. that assays 12 oz. gold and 148 oz. silver per ton. There are seven veins in the property which will be opened by the adit, all of which have proved rich in the upper workings. The management expects to open these within the next 750 ft.——New dump cars have been added to the equipment at the Saguache adit, and electric power installed to operate the machinery. The face is now in over 500 ft. and has opened the first vein on the property.——A new air-compressor has been installed at the Little Vinnie property on Breece hill, and shipping will be resumed in a short time.——On the 365-ft. level of the Little Ella mine, in South Evans gulch, the drift has been run 70 ft. on a high-grade streak of ore.——The American Zinc Extraction Co. has installed three new concentrating tables in its plant.——The Yak tunnel has tapped the water in the Resurrection No. 2 shaft and is slowly draining the workings.

SUMMIT COUNTY.

The tunnel of the King Solomon Tunnel & Development Co. is nearly 4000 ft. and is expected to open a number of rich veins in its progress this year. This is the longest tunnel in the Ten Mile range and it is expected that the company will erect a large plant when the work is completed.——The severe weather has resulted in the shutdown of the New Pennsylvania property at Argentine, and a curtailed output from the Sallie Barber mine.——The mill at the Wellington is running steadily producing a good grade of concentrate. The output will be considerably increased when the tram from the mine to the mill is completed.

TELLER COUNTY.

James F. Burns, former president of the Portland Gold Mining Co., has secured the control of the Jennie Sample Consolidated Mining Co. Two sets of lessees are now working through the main shaft and shipping high-grade ore. ——A rich shoot has been opened between the tenth and eleventh levels of the Findley property by Frank Clay and associates who have a lease on that portion of the mine. It is estimated that the fine ore will run about 2 oz. gold per ton, and the coarse 1.——At a stockholders' meeting A. E. Carlton, president of the Findley Consolidated Mining Co., reported that the company had paid off its indebtedness of $20,000 during the past year, and now had a balance in the treasury of over $16,000.——Gibbs, Sharpe & Klatz are shipping $40 ore from the lease they recently obtained on the Bonanza King property. An air-line has been laid from the Anchoria Leland plant enabling the lessees to operate machine-drills.——The Consolidated Cripple Creek Mines Corporation has been incorporated to take over and operate the properties held by the Cameron estate.——The Success Leasing Co., which has a bond on the Gold King mine on Gold hill, is to build a 50-ton mill below the dump at the International shaft.——A new set of rolls has been installed in the mill of the Trilby Mines Co. increasing the capacity of the plant to 70 tons per day.

KANSAS.

CHEROKEE COUNTY.

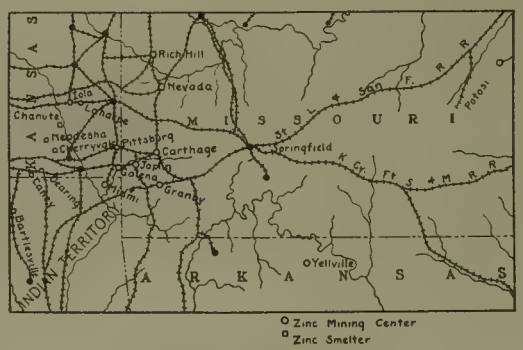
(Special Correspondence).—Steady progress is being made at the Mission mine at Baxter Springs, where the ground has just been drained and tracks laid preparatory to furnishing the large new 500-ton mill with ore. Many new saving devices have been added to the equipment of the new mill which other companies are watching with interest as several other large mills are to be built this year. ——The Tennessee Metal Producing Co. has been extending its possessions by the acquirement of new properties recently. The 30 acres of ground, including two shafts of the old Quivera company, has been taken over with the mill upon the tract, and work will be started at once. The company also took over the Mascotte mine and 10-acre lease, and a tramway will be built from the latter shaft to the old Quivera mill where the ore will be treated.——The Omaha Petersburg Mining Co. has four drills at work on the lease to determine the extent of the ore and its general dip in order to determine the best point upon which to build its large new mill. All the holes so far show both lead and zinc.

Galena, January 21.

MISSOURI

JASPER COUNTY.

(Special Correspondence).—The Mandarin Mining Co., west of Joplin, has resumed operations after a six months' shut-down. At the time of opening the mine a splendid ore-face was opened up which later pinched out and the company was forced to suspend operations. Since that time the operators have been busy trying to re-open the run and have recently succeeded in finding the ore in the roof of the old drifts. The former sinking was too deep for the ore. The mill on the lease is exceptionally well equipped for the treatment of the ore.——The new 400-ton mill of the Mercantile Mining Co., operating north of Webb City, is just completed and is only awaiting more favorable weather to start work. This is the third mill to be built on the lease by the company, the other two each having a capacity of 300 tons. The company has been working in sheet ground from 165 to 175 ft. for some time. Below this level is a thin layer of barren rock below which another sheet run extends to 200 ft.——The Hercules Mining Co., operating on the Luke & Ash ground, in the west Joplin dissem-



Zinc Mining and Smelting Centres.

inated field, is just completed and will start work soon. The mill has a capacity of 500 tons. The shaft is down 202 ft. and drifts have been started on that level. The run extends from 182 to 200 ft. The sheet ore in this part of the field is somewhat different from the Webb City sheet ore being in a softer formation and more easily mined.—— The Maple Leaf Mining Co. is building a 200-ton plant on its developed lease in the Duenweg camp. The lease adjoins the Lincoln and Wolfsheart and the formation is similar.——S. A. Stucky, of Carthage, who owns a lease on the Knight land at Peacock, is planning the erection of two large mills on the lease. Several drill-holes block out a good ore deposit.——A steam-shovel is being operated in the Mohler-Smith open pit at Carl Junction and it is found more economical of operation than hand labor.

Joplin, January 21.

MONTANA.

SILVER BOW COUNTY.

(Special Correspondence).—The report that the Anaconda Copper Mining Co. will run a cross-cut for the North Butte company from the bottom of the Diamond mine to the Edith May still lacks official confirmation, though it is understood that the matter has been under consideration for some time. According to recent reports of average car samples the North Butte ore, which used to average 6 to 8% copper, now runs below 4.——The Butte & London Development Co. held an annual meeting of stockholders a few days ago and a report to the stockholders concerning the company's financial condition is promised later. The company still has a little cash on hand and considerable

stock in the treasury. The only expenditures since 1909 have been for a watchman, taxes and small office expenses. There is no immediate prospect for a resumption of work at the property, and so far as known no effort is being made to re-finance the company.——According to the reports of engineers there are 750,000 tons of ore blocked out in the Ophir mine, the property of the Butte Central Copper Co., and this fact adds interest to the report of Lewis & Walker, assayers and chemists in Butte, who made a concentration test for the company on 500 tons of ore. The ore was crushed to 30 mesh, and 9¾ tons were concentrated into one. The concentrate assayed 180 oz. silver and $8.40 gold per ton, with 8.03% copper, 18% sulphur, 26% zinc, 18.8% iron, 7.6% silica, and 15.87% manganese. There was lost in the tailing 26 oz. silver and 10c. gold. The chemists say the ore is splendid for concentrating, not being inclined to slime much, and that the tailing can be pan amalgamated with a possible saving of 85 to 90% of the value. The possibilities of the mine lie in the big tonnage of ore in sight, the cost of treating concentrate, which is $2 per ton as against $8 that was charged by the smelters for treating the ore, and the claim of the management that the ore can be mined and milled at a total cost of $2.50 per ton. The Basin concentrator, owned by La France Copper Co., a Heinze concern, has started operations on ore shipped from the mines of the Butte & Superior company. Only half of the concentrator is being used and the remaining portion will be reserved for La France and Davis Daly ores. The Butte & Superior is shipping about 175 tons of ore per day, and is concentrating only for zinc and silver. A gravity tramway has been built from the mine to the bins and a railroad spur line is being built to connect with the Great Northern railway, over which the ore is transported to Basin.——The stockholders of the British-Butte Mining Co. held their annual meeting in Butte last week and re-elected the old board of directors, with the exception of Mr. De Hora, who resigned as president, manager, and director of the company. Norman L. Jenks, of London, representing the British interests in the company, was elected president and manager, and W. R. Hocking, of Butte, succeeds Mr. De Hora as director. Operations on the big gold dredge near Butte were suspended last October, and the dredge has been idle ever since. The work is now confined to prospecting and a bore-hole is being sunk from the bottom of the 670-ft. shaft, in an effort to find bedrock. The bore has reached a depth of more than 500 ft., giving a total depth from the collar of the shaft of 1175 ft. A considerable quantity of water has been coming into the bore-hole and that gives the impression that the bedrock is near. The gold value continues quite uniform throughout the bore-hole.

Butte, January 22.

NEVADA.

ESMERALDA COUNTY.

(Special Correspondence).—Interest in the holdings of the Jumbo Extension Co. has been aroused by the discovery of pay-ore at a depth of 760 ft. in the shaft of the Annex lease, operating on the Poleverde claim, adjoining the Clermont on the east and the Velvet and St. Ives claims of the Goldfield Merger Mines Co. on the west. This double compartment shaft has been sunk with an objective depth of at least 1000 ft. at about which point it was expected to penetrate the hanging wall of the Mohawk vein and at 760 ft. the shaft entered a large vein of quartz giving low-grade assays. Farther down an ore-shoot with two feet of $50 ore was opened and the main vein is shown to be 20 ft. wide. At the 800-ft. level a large station will be cut and the vein explored. As the result of litigation instituted by the Consolidated company some time ago against the Jumbo Extension, involving apex rights to the Poleverde and other claims, an agreement was signed by the terms of which all profits from the operation of this claim are to be equally divided between the two companies. Under the same agreement the Consolidated was ceded a one-half interest in the Vinegerone Fraction and clear title to the Wedge Fraction, side-lining the Mohawk.——One of the latest developments of interest is the discovery of rich ore on the Diamondfield Black Butte where an adit has been driven 25 ft. and from a winze at the end lessee have taken 20 tons of shipping ore. The vein is over 30 in. wide. On January 15 the property was sold under execution to satisfy the claims of creditors and was bought in by the Registration Trust Co. acting as trustee for the chief stockholders. The trustee is now carrying out plans for the organization of a new company, to be known as the Diamondfield Black Butte Re-organized Mining Co., the stock of which will be assessable, and it is the intention of the men at the head of the project to build a mill of at least 50 tons per day capacity.

Satisfactory results have attended the sampling of the Gold Bar workings of the C. O. D. Consolidated Co. by the men who have secured the ground and plant under a five-year lease, and who will build a 50-ton mill early in the spring. During the month of December the total production of the Goldfield Consolidated company was 20,234 tons containing $741,668, or an average of $36.65 per ton, of which the whole was milled with an average extraction of 93.83%. The net profit to the company was $195,353.11, or $24.48 per ton. The development work consisted of 1390 lineal feet. J. R. Finlay does not report on developments and mine conditions owing to his unfamiliarity therewith and the fact that J. H. Mackenzie and H. P. Henderson are both absent. He states, however, that the development work accomplished was undoubtedly successful to the usual extent and the amount of work done was unusually large. The mill has been demonstrated to have a capacity of fully 850 tons per day. This increase of capacity has been accomplished without any loss in the metallurgical efficiency of the plant.

Goldfield, January 22.

LYON COUNTY.

(Special Correspondence).—Walter C. Orem, the general manager of the Nevada-Douglas mines and railroad, has gone to Mason City to be on hand at the opening day of the advent of the railroad into Mason City. From that point the line is to be extended some 20 miles to the mines of the Nevada-Douglas. This work will be completed early in the summer months, and then the company will commence shipping high-grade copper ore from its Ludwig mine to the Salt Lake smelters. Several years ago Frank J. Hagenbarth took an option on the purchase of the Ludwig mine from Joseph E. Cain and Max Junghandel for which he agreed to pay $200,000. Cain and Junghandel had entered into an agreement to purchase the Ludwig mine from the owners for $1,000,000 and Hagenbarth agreed to pay $200,000 for the privilege of taking over the property from Cain and Junghandel. A payment of $30,000 was made on the option and Hagenbarth had the mine examined and refused to pay more on the option. In the meantime the Nevada-Douglas Mining Co., in which Hagenbarth is heavily interested, purchased the property from the Ludwig crowd, and Cain and Junghandel instituted suit to recover the balance of the $200,000 from Hagenbarth. The Supreme Court has handed down an opinion in which it holds that Hagenbarth was not forced to carry out his option payments, and releases him from further obligations to Cain and Junghandel.——The Mason Valley Mining Co. has just completed its metallurgical work, and determined upon the best methods for treating its ores. A smelter will be erected at once, the equipment for which is now being ordered, and the foundation is about completed.——Several of the Yerington properties are in shape to begin consigning ores to the market as soon as the new railroad is ready to receive them.

Yerington, January 21.

NYE COUNTY.

The 30-stamp mill of the Tonopah Extension has been started, the entire plant having been completed in seven months. The ore is reduced to 1½ in. diam. before going to the bins, is crushed to 20-mesh by the stamps, passed to Deister tables and the sand put through two tube-mills, the tailing going to Dorr classifiers. The pulp is then classified, treated on slime tables, and cyanided in a Blaisdell filter.——The ore recently opened on the 1100-ft. level of the Belmont mine has widened to 16 ft. with an average value of $40 per ton.

OKLAHOMA.

OTTAWA COUNTY.

In the Miami camp, just south of the Baxter-Quapaw camp, a deeper ore-level is being opened up by the Miami-Yankee company. The company recently changed management, L. C. Church being succeeded by George Wolfe. The old shaft is being sunk to the deeper levels and turn-ins have already been made.——Chapman & Lennan, of Webb City, have recently sold the King Jack mine, one of the best and steadiest producers in the Miami camp. It was one of the earliest mines and its turn-ins have at times been the leaders in the field. The mill was burned down last summer, but was immediately rebuilt. Pennsylvania parties are the purchasers.

Miami, January 22.

UTAH.

JUAB COUNTY.

The Sioux Consolidated Mining Co. directors have decided to make the dividends payable quarterly in the future. It is shown that the mine is now producing a lower-grade ore from its workings at Tintic, and the owners have decided to devote some of the surplus money to carrying on deeper development work. This may necessitate several months' operation, and the dividends will be made quarterly in consequence.

SALT LAKE COUNTY.

(Special Correspondence).—The Utah Con. tram which is to be completed this summer will have a capacity of 1500 tons of ore daily, which it is estimated will reduce the cost of transportation from the mine to the smelter from 40 to 10c. per ton. The mine is under contract to deliver 1200 tons of ore per day to the smelter, and should other mines at Bingham desire to take advantage of cheap haulage, the capacity of the tramway will be increased to accommodate custom shippers.——Since the second unit of the Ohio Copper mill was started only about 100 tons of ore per day is being reduced in this portion of the mill. The capacity of the unit is 500 tons, while experiments have shown that under favorable conditions as much as 750 tons can be handled with ease. The first unit is handling about 500 tons per day and the second portion will be worked up to capacity as soon as all the adjustments are completed and some raises in the mine are connected to drain the upper workings. No new development work is to be done on the Elvina vein for the present, as it is the purpose to devote all efforts to making connections for proper drainage. When this work has been finished, a raise from the 500-ft. level of the Elvina vein will be made to the upper portion of this deposit and connections between the 500 and 700-ft. levels made in order that this ore can be dropped down the incline to the Mascotte adit. An offset will be made in the chute near the adit so that the Elvina ores can be dropped into separate bins on the adit level. This ore contains a high percentage of copper and an excess of iron. ——Daniel C. Jackling, general manager of Utah Copper, is in Arizona inspecting the Ray and Gila copper properties. He will return within two weeks, and complete the transfer of the Boston Consolidated to the Utah Copper. The present staff of Utah Copper will have charge of both properties, and few of the Boston corps will be retained. Louis S. Cates, the mine manager, will remain in charge of the Newhouse interests in Utah during the coming year, or until the return of Lafayette Hanchette from his trip around the world. Upon the return of Samuel Newhouse from Europe he will take some of his engineers to guide the affairs of his other properties in this State and Arizona. ——Utah Metals Mining company, which has taken over the Bingham Metals and Central-Standard properties at Bingham, has just ordered complete new equipment. The main working tunnel, being driven from the Middle canyon side of the range, is now in a distance of 3000 ft. It is to be continued 8000 ft. farther to get under the ore-bodies of the Central-Standard ground. The tunnel is to be double-tracked, the water developed utilized for power, and a large generating plant installed. It will cut the ore-zone in Central-Standard ground at a depth of over 2000 ft., and increase the present water-flow from 500 to 3000 gallons per minute. The tunnel will be driven through the mountain to the Car Fork side of the range, and will drain a large area.

Salt Lake, January 22.

SUMMIT COUNTY.

George W. Lambourne, general manager of the Daly-Judge Mining Co., at Park City has gone to New York. The object of his trip at this time is to confer with Eastern directors with reference to starting work on the proposed Snake Creek tunnel. Most of the machinery has been delivered, the compressor, power-house, and other buildings will soon be placed in position. The tunnel is controlled by a separate corporation. The proposed course will intersect the Daly Judge at a depth of more than 2000 ft., and drain a large area of adjacent country. It will be 4000 to 5000 ft. long, thus making it one of the most important pieces of development work undertaken in Park City since the Ontario tunnel was driven over 15 years ago.

CANADA.

BRITISH COLUMBIA.

(Special Correspondence).—Resolutions affecting the mining industry, that will be placed before the convention of the Associated Boards of Trade, which will be held at Nelson, January 25, will include one from the Rossland Board of Trade that the Government of the Dominion of Canada be requested to coin silver dollars in the Ottawa mint. This will naturally increase the amount of fine silver that the Government will buy from the Trail refinery and will prove of local benefit, provided the step is taken. Another resolution will be toward the abolition of the existing personal tax on merchandise, machinery, and such stock or plant as is carried for the general conduct of business. ——The following change in the Mineral Act becomes law on April 1: "The owner, or agent of the owner of a mineral claim for which the mining recorder's certificate under form 1 of the schedule of this act, has been granted, shall, within three months from the date of such certificate, make application to the gold commissioner for a certificate of improvement, and in default of such application being made in such time, such mining recorder's certificate under form 1 shall lapse and become absolutely void." This will compel those who have secured certificates to make application for their Crown grants without unnecessary delay.——Future improvements planned by the Le Roi No. 2, Ltd., indicate a period of steady progress ahead. The Josie shaft has just been sunk from the 900 to the 1300-ft. level, where work is now in progress.——The Centre Star group of the Consolidated company shipped over 4000 tons for the past week. The Consolidated company has paid $6000 for the Black Jack and Caberfae Fr. claims, adjoining the recently acquired No. 7 group in Central camp.——H. A. Harris, of Rossland, has bonded the Silver Cup for $40,000 and the Sunrise for $60,000, in which he owns a half interest. They are silver-lead claims situated near Hazelton, at Nine Mile mountain. ——The movement of the Granby Consolidated Mining, Smelting & Power Co. to dispose of 13,500 shares of its treasury stock, with which to pay off outstanding indebtedness, especially referring to the amount owing for the stock in Crow's Nest Pass Coal Co. acquired last year, is looked upon favorably here and many of the shareholders are availing themselves of the opportunity and taking their share of the stock at the preferred figure of $85.——Work at the B. C. Copper Co.'s mines will not be suspended on account of the trouble with the Miners' Union, the company having applied to the Government for a conciliation board under the Arbitration Act. The 'closed shop' is the issue.——A local syndicate, the Phoenix-Riverside Co., has purchased the Riverside property on the West Fork.——Surveyors are running the preliminary survey for the extension of the Great Northern railway from Oroville to Penticton.——The managing director of the Lucky Jim zinc mines confirms the report that a body of shipping ore has been struck in the lower adit assaying from 52 to 53% zinc.——It is stated that the Crow's Nest Pass Coal Co. is to resume dividends of 6%. The coal production at the mines has increased in the last six months from 3000 to 4000 tons per day.

Rossland, January 21.

Personal.

Professional men are invited to send items of their engagements and travels. Such news is interesting to friends.

L. A. Greene is at Chicago.

R. H. Campbell is at Seattle.

L. Morgan Clements was at Butte this week.

Ralph Arnold was in San Francisco this week.

A. B. Shultis has gone to Minillas, Zacatecas, Mexico.

Daniel C. Jackling is in Arizona for a couple of weeks.

W. P. Rawle, of New York, has gone to Phoenix, Arizona.

Mark R. Lamb is visiting the Lake copper mines in Michigan.

Edwin E. Chase, of Denver, is examining mining properties in Arizona.

W. F. Copeland has returned to San Francisco from Butte, Montana.

Norman C. Stines has returned to San Francisco from Hong Kong.

R. B. Nickerson has gone to Rat Portage, Ontario, to examine the Mikado mine.

A. G. Kirby is with the Nova Scotia Silver Cobalt Mining Co., at Cobalt, Ontario.

Arthur Yates is general manager of the Mijnbouw Maatschappij Ketahoen, Sumatra.

C. W. Pritchett and G. W. Gibson, of Denver, were recently in Mohave county, Arizona.

S. H. Ball has returned to New York from New Mexico, and will go to Belgium in February.

E. H. Barton is manager for the Frisco Mines & Power Co., operating near Kingman, Arizona.

F. L. Ransome will attend the Toronto meeting of the Canadian Institute of Mining Engineers.

Samuel J. Lewis is at Monterey, Mexico. He will be at Hostotipaquillo, Jalisco, about February 1.

Clifford D. Fies has left Colorado Springs and will be with the New Keystone Copper Co., at Miami, Arizona.

Alexander H. Smith, recently of Oaxaca, Mexico, is in the Porcupine district of Ontario for A. E. Osler & Co. of Toronto.

Godfrey D. Doveton, of Spurr & Cox, Inc., is at the DeLamar mine, DeLamar, Idaho, making an examination of the cyanide mill.

Edgar A. Collins is examining the Black Oak mine in Tuolumne county, California. He expects hereafter to make headquarters in San Francisco.

William E. Castle, until recently with the Chafey Mines Co., at Chafey, Nevada, is operating a property at Spring Valley in that State.

W. H. Weed, who has been examining the Ely Central, passed through San Francisco this week on his way to New York by way of Los Angeles.

A. E. Drucker has reached San Francisco on his tour around the world. He has been appointed consulting metallurgist for the Oriental Consolidated.

R. B. Lamb, of the C. L. Constant Co., has returned to New York from a professional trip to New Ontario, Canada, and has left Central America. He expects to be gone some time.

Alfred Welfhaven becomes general manager for the Oriental Consolidated Mining Co., at Unsan, Korea, in place of H. F. Meserve, who becomes managing director with headquarters in New York.

Leon M. Hall and D. C. Demarest have joined to form the firm of Hall, Demarest & Co., Inc., making a specialty of mines, mills, and power plants. Offices have been taken in the Kohl building, San Francisco.

The Mining & Metallurgical Society of America held an adjourned session of the annual meeting at New York, January 20.

Market Reports.

LOCAL METAL PRICES

San Francisco, January 27

Antimony	12 – 12½c	Quicksilver flask	$51 – $51.50
Electrolytic Copper	16¾ – 16¾c	Spelter	7¼ – 7½c
Pig Lead	6.35 – 6.50c	Tin	39 – 39½c

METAL PRICES

By wire from New York

Average daily prices in cents per pound

Date.	Electrolytic Copper	Lead	Spelter	Silver per oz
Jan. 20	13.75	4.70	6.08	52½
" 21	13.57	4.70	6.08	52¼
" 22	13.57	4.70	6.08	52¼
" 23	Sunday.	No market.		
" 24	13.50	4.70	6.08	52½
" 25	13.50	4.70	6.06	52½
" 26	13.50	4.70	6.04	52½

ANGLO-AMERICAN SHARES.

Cabled from London

	Jan. 20 £ s. d.		Jan. 27. £ s. d.
Camp Bird	1 8 6	Jan. 19.	1 8 0
El Oro	1 7 3		1 9 0
Esperanza	2 18 9		3 0 0
Dolores	1 8 9		1 8 9
Oroville Dredging	0 9 9		0 9 0
Mexico Mines	8 0 0		8 3 9
Tomboy	0 17 6		0 17 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

SOUTHERN NEVADA STOCKS.

San Francisco, January 27.

Atlanta	$ 11	Mayflower	$ 2
Belmont	1.35	Midway	27
Booth	9	Montana Tonopah	89
Columbia Mtn	5	Nevada Hills	70
Combination Fraction	33	Pittsburg Silver Peak	72
Daisy	9	Rawhide Coalition	16
Fairview Eagle	14	Rawhide Queen	20
Florence	2.65	Round Mountain	54
Goldfield Con	7.37	Sandstorm	3
Gold Kewenas	6	Silver Pick	8
Great Bend	3	St. Ives	9
Jim Butler	11	Tonopah Extension	75
Jumbo Extension	28	Tonopah of Nevada	6.75
MacNamara	27	West End	22

(By courtesy of the San Francisco Stock & Exchange Board.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices. January 27.		Closing prices. January 27.
Amalgamated Copper	80¾	Miami Copper	24½
A. S. & R. Co	92¼	Mines Co. of America	⅛
Boston Copper	20¼	Montgomery-Shoshone	⅞
B. C. Copper Co	7⅜	Nevada Con	23¾
Butte Coalition	27	Nevada Utah	1½
Cumberland-Ely	8½	Newhouse	3¼
Davis-Daly	3¾	Nipissing	10⅜
Dolores	7¼	Ohio Copper	4⅜
El Rayo	2⅜	Ray Central	3¼
Ely Central	1½	Ray Con	22⅞
First National	6¼	Superior & Pittsburg	14
Giroux	10¼	Tenn. Copper	34½
Guanajuato Con	1⅝	Trinity	9½
Inspiration	9	Tuolumne Copper	3¼
Kerr Lake	9¼	United Copper	7¾
La Rose	4½	Utah Copper	52¼
Mason Valley	2¼	Yukon Gold	4¼

COPPER SHARES—BOSTON.

	Closing Prices. January 27.		Closing Prices. January 27.
Adventure	8	Mohawk	66
Allouez	45	North Butte	40¾
Atlantic	9½	Old Dominion	14
Calumet & Arizona	68	Osceola	154
Calumet & Hecla	840	Parrot	19¾
Centennial	29	Santa Fe	2¼
Copper Range	79	Shannon	16
Daly West	8½	Superior & Pittsburg	13⅜
Franklin	18	Tamarack	63
Granby	95	Trinity	8
Greene-Cananea, ctf	9⅞	Utah Con	39½
Isle Royale	22	Victoria	4¾
La Salle	15	Winona	9⅞
Mass Copper	7	Wolverine	140

(By courtesy of J. C. Wilson, Mills Building.)

Mint Estimates of Gold and Silver Production in the United States, 1909.

The Director of the Mint has completed his preliminary estimate of the production of gold and silver by the mines of the United States for the calendar year 1909. He estimates the gold product to have amounted to $99,232,200, as against $94,560,000 for 1908; an apparent increase of $4,672,200. The output of silver is estimated to have been 53,849,000 fine ounces, an increase over the previous year of 1,408,200 fine ounces. At the average price of silver ($0.52016 per fine ounce) for the year the commercial value of the silver product for 1909 would amount to $28,010,100. Nevada shows an apparent increase in her gold product of $3,219,000, California $1,941,600, and Alaska $1,088,800. Colorado shows a decrease of $916,300, and South Dakota $892,300. The decrease in the latter State is attributable to the closing down of the works of the Homestake mine on account of labor troubles. Montana shows an increase in her silver product of 1,643,800 fine ounces, Utah 1,082,100 fine ounces, and Arizona 732,200 fine ounces. The greatest decreases in the silver product were: Colorado, 1,056,600 fine ounces; Nevada, 555,500 fine ounces; and Idaho, 503,800 fine ounces. The product of gold and silver by the different States and Territories is shown in the following table:

State or	Gold		Silver	
Territory.	Fine oz.	Value.	Fine oz.	Value.
Alabama	1,355	$ 28,000	200	$ 100
Alaska	1,013,340	20,947,600	158,100	82,200
Arizona	129,273	2,672,300	3,632,200	1,889,300
California	1,029,000	21,271,300	1,705,200	887,000
Colorado	1,062,056	21,954,700	9,093,600	4,730,100
Georgia	2,141	44,300	200	100
Idaho	67,207	1,389,300	7,054,500	3,669,500
Illinois	14	300	3,600	1,900
Michigan	.....	.....	323,900	168,500
Missouri	9	200	15,200	7,900
Montana	174,123	3,599,400	12,000,000	6,241,900
Nevada	721,195	14,908,400	8,953,000	4,657,000
New Mexico	13,464	278,300	329,200	171,200
North Carolina	1,557	32,200	500	300
Oregon	34,488	712,900	71,100	37,000
Philippine Is.	9,000	186,100	2,100	1,100
Porto Rico	30	600	.....	.....
South Carolina	169	3,500	200	100
South Dakota	331,363	6,849,900	205,600	107,000
Tennessee	179	3,700	58,500	30,400
Texas	18	400	358,300	186,400
Utah	185,993	3,844,800	9,533,400	4,958,900
Virginia	175	3,600	6,000	3,100
Washington	18,282	377,900	73,500	38,200
Wyoming	184	3,800	1,100	600
Other States	5,744	118,700	269,800	140,300
Total	4,800,359	$99,232,200	53,849,000	$28,010,100

The above estimate is based upon deposits at the mints and assay offices of the United States and reports from private refineries and smelters in the United States.

Commercial Paragraphs.

The Wood Drill Works, Paterson, New Jersey, are now represented in Colorado, South Dakota, and New Mexico by Thomas J. Barbie, 1416-1418 Wazee St., Denver, Colorado. A large stock of drills, repairs, and mountings are now on hand.

Smith, Emery & Co., Inc., San Francisco, announce the following appointments as chief inspectors in the iron and steel department: San Francisco office, W. F. Richards; Los Angeles office, E. O. Slater; Pueblo, Colorado, office, M. L. Kulp; Birmingham, Alabama, office, R. T. Miller.

The Trent Engineering Co., composed of the well known firms of L. C. Trent & Co., of Salt Lake, and the Trent Engineering Co., of Reno, Nevada, having combined, have opened a branch office in Los Angeles, California. The new company will make a specialty of L. C. Trent slime agitators and Chilean mills, and is agent for the Oliver continuous filter. This type of Chilean mill has been adopted by the Goldfield Consolidated Mining Co. at Goldfield, Nevada; and Trent slime agitators have been installed in the mills of the Montgomery-Shoshone, at Rhyolite; the Tonopah Extension, at Tonopah; Desert Power & Mill Co., at Millers, Nevada.

The Ernst Wiener Co., New York, advises that it has opened branch offices in the following cities: Petersburg, Virginia; Ocala, Florida; Toronto, Ontario; and Mexico City. Changes of address of its other offices are as follows: Los Angeles, 223 H. W. Hellman Bdg.; Philadelphia, 1103 Land Title Bdg; San Francisco, 112 Market street.

COMPANY REPORTS.

SHANNON COPPER COMPANY.

The annual report of the Shannon Copper Co. for the year ended August 31, 1909, is issued. The income compares as follows:

	1909.	1908.	1907.	1906.
Copper receipts	$2,328,467	$2,249,294	$2,994,539	$1,919,034
Silver receipts	34,899	63,508	25,147	17,824
Gold receipts	44,495	33,626	64,380	12,708
Copper inventory	321,337	316,603	313,608	275,190
Totals	$2,729,199	$2,663,033	$3,397,676	$2,224,756
*Total operating expense	2,644,861	2,574,191	2,701,759	1,891,431
Net profits	$84,337	$88,841	$695,916	$333,324

*Including construction, freight, refining, interest, and inventory.

During the year there were sales of 17,553,213 lb. of fine copper, 1744.955 oz. gold, and 87,115.53 oz. silver.

Good progress has been made during the year both as to production and development of new orebodies. The production of 307,271 tons of ore is an increase of 25,822 tons over the preceding year, and is by far the largest output in the history of the company. The mines were, at the close of the fiscal year, in the best possible physical condition, with more ore of better grade blocked than at the end of the last fiscal year, notwithstanding the fact that the production for the year was the largest in the company's history. The extraction for the year was 2.57 lb. of copper per ton less than for the preceding year, which on the tonnage treated means a shortage of about 800,000 lb. of copper, worth in the neighborhood of $100,000.

The development of ore below the ore-tunnel, at a point heretofore supposed to be non-mineral-bearing ground, opened about 80 ft. of ore which averaged 8% copper, and a streak of ore 8 ft. wide, assaying as high as 35% copper. In a winze below the ore-tunnel was 20 ft. of ore assaying 15% copper. The new development proves that the ore in the Shannon mines continues in depth and gives renewed assurance as to future production. The new high-line railroad, now being operated from the company's mines to the smelters, a distance of about ten miles, should be in operation by the first of February 1910, and will start with a freight tonnage of about 400,000 tons per annum from the Shannon company alone.

A reduction in the cost of power of $45,000 has been effected for the year, and also a small reduction in the cost of mining, concentration, and converting. In the aggregate these various reductions in costs have offset the loss of approximately $100,000 which was incurred through the lower extraction of ore for the year. There has been a decrease in the cost of smelting per ton during the past year of 32.7c., and the cost of concentrating was reduced approximately 14c. per ton.

L. Vogelstein & Co. give the following figures of German consumption of foreign copper for the months January to November 1909:

	Tons.
Imports of copper	143,988
Exports of copper	7,485
Consumption of copper	136,503

as compared with consumption during the same period in 1908 of 139,080 tons. Of the above quantity, 131,716 tons were imported from the United States.

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EDITORIAL.

THE BUREAU OF MINES bill has passed the House at Washington and is now before the Senate. Considerable opposition there is anticipated. Your Senators will be glad to know whether you do or do not favor the movement.

TASMANIA proposes to stop high-grading. A bill has been passed requiring gold-buyers to take out a license and to keep a complete record of the amount of gold bought, with the name of each seller. Any false return is made perjury.

INFORMATION has been received of action taken by the Board of Directors of the Anaconda Copper Company to effect a coalition of mines in Butte, Montana. The proposal is to increase the capital stock of the Anaconda, by a considerable amount for that purpose.

THE American Institute of Mining Engineers will hold a meeting at Pittsburg, beginning March 1. Headquarters will be at Hotel Schenley and an interesting session seems to be in prospect. An excursion to Japan is proposed for next fall, leaving San Francisco October 5, and returning November 25.

RADIUM is flanked by many close allies. Two new radio-active elements have been added to the list, one of which, called nipponium, was recently discovered by a Japanese chemist, Ogawa. It has been isolated from thoranite, remite, and molybdenite, and has an atomic weight of 100. Sir William Ramsay assigns it to a position in the periodic scheme of the elements between molybdenum and ruthenium. The other newly discovered radio-active element is ionium, which is evidently an intermediate stage in the transformation of uranium into radium. Its radio-activity is 1000 times as great as uranium, with a ratio of 1 to 0.76 as compared with radium. It is obtained from carnotite and other uranium minerals.

MINING EXPERIMENT STATIONS corresponding in character to those which have done so much for agriculture have been proposed a number of times. North Dakota has taken the lead by making official provision for such a station at its University. The especial work to be undertaken will be the investigation of the utilization of lignites and clays. It is rather striking that a State which is principally famous for its agricultural wealth should be the one to take initiative in this. In Illinois a considerable amount of work relating to mines has been carried on at the Engineering Experiment Station and in Colorado and Utah ore-testing plants are

maintained in connection with Schools of Mines. In a number of other States provision is made in one way or another for some work, but there is a field for a few Mining Experiment Stations. The effort to enlist Federal aid in establishing them has not heretofore been successful, and in any event the main burden of their support must inevitably rest on the States.

WATER-POWER policy, discussed more extensively on another page of this issue, is the subject of a bulletin just issued by the United States Geological Survey. The question is fraught with deep concern to the mineral industry. In many Western districts cheap hydro-electric power is the only means whereby some of the great mines are able to operate at a profit.

CHINESE railway development is reviewed in great detail in the November issue of *The Far Eastern Review*, just received. Railway loan agreements, in their relation to the open door, are discussed with that fairness which is characteristic of our vigorous contemporary at Manila. Mr. G. B. Rea's plea for fair play to China is refreshing in these days of emphasis on the white man's burden. It is better for everybody that each should 'tote his own load', and one of the best features of the present situation is the ability shown by the Chinese to build and operate their own lines. They need the help of foreign capital, but, except when foreign engineers have been in charge, they have shown a catholic spirit in the purchase of railway equipment.

COAL MINERS are much more generally members of labor unions than are metal miners. This is partly due to the difference in conditions, since coal mining does not afford the same opportunity for the advance of the individual miners that is offered by the leasing system and the ground open for prospecting throughout the West. Also, the coal miners have had better leadership. Mr. John Mitchell won a deserved and general popular support, and that in turn won many battles for his organization. His successor, Mr. T. L. Lewis, has still to achieve the same measure of public confidence, but in his annual report submitted recently at Indianapolis, he takes winning ground in saying: "Let us appeal to the intelligence of the operator and miner in the non-union mining districts. Perfect frankness in stating our position and sincerity in carrying into effect our declarations will do much to establish the confidence necessary to success. The application of common sense should be the basis of the new method of promoting industrial peace in the mining regions." His address as a whole is a broad gauged appeal to the members of the United Mine Workers, and it is to be hoped that the spirit which animates it will dominate the organization. The labor problem has many sides, and the West has seen more of the evil than the good side of labor unions. In view of the close relation now obtaining between the Western Federation of Miners and the United Mine Workers, operators of Western metal mines have a very definite interest in Mr. Lewis and his ideas.

Oriental Trade and American Shipping.

Americans are pleased to consider themselves aggressive and keen in trade, yet our correspondent from Tientsin, China, Mr. Thomas T. Read, sends severe ciriticism of the methods pursued in seeking foreign business. The arraignment is justifiable. The same facts have been set forth by American travelers for many years; the Consular Reports have published the story from a hundred ports; Mr. Charles M. Pepper reiterated it after a personal investigation of conditions and trade opportunities in South America made a few years ago for the Department of State. This cry has been sounded for twenty years, and Mr. Blaine used to urge American manufacturers to conform to the requirements of foreign trade in order to secure their proper share of the business. The answer has always been that domestic consumption created a sufficient demand, and that the cost of special attention to detail, as required for successful invasion of over-sea markets, was out of proportion to the benefits that would accrue. This argument was not without warrant twenty years ago, but conditions have been changing. Increase in manufacturing has been so great that the outward pressure for markets has grown more pronounced. Competitors abroad have foreseen this more clearly than our own people, and we think that there is truth in the contention of Mr. Edward P. North, whom Mr. Read criticises; obstacles are apparently thrown in the way of efforts to expand our shipping and foreign trade-relations by forces without as well as within the country. Contact with the foreigner is imperative as a means to understanding his needs, and such contact is in direct proportion to the merchant tonnage afloat under the flag. We recommend a re-reading of Mr. Pepper's contribution to this subject.

Water-Powers and Eminent Domain.

Industrial development in the West requires the utilization of its water-power. That power, furthermore, must be available to all upon equal terms, and upon reasonable terms. Monopoly of so vital a resource should be neither in the hands of the Government nor of private persons or corporations. The Government should not be able arbitrarily to limit the development of water-powers, nor should private owners be free from Governmental regulation. In Switzerland, less than three years ago, the control of the water-power of the country was transferred to the central Government by amendment to the Federal Constitution. The power will be used in part for operating the railroads which belong to the State, the estimates indicating a reduction of one-third from present costs. The current will also be sold to the cantons, cities, and smaller communities, which will distribute the power to local consumers. Swiss methods are not, however, necessarily applicable to American problems, owing to radical differences in legislative and administrative details.

At the present moment the status of the undeveloped Western water-powers is involved in doubt. The areas where water is available under head suffi-

cient to be utilized for the generation of electricity are embraced almost entirely within the public domain. The water itself, belonging as it does to the States, has been appropriated in accordance with local laws, but the United States Government by virtue of its ownership of the adjacent lands exercises control through its power to grant or withhold easement for right of way for ditches, dams, and other works necessary in the utilization of the water. Recently Mr Thomas H. Carter, Senator from Montana, introduced a bill to endow the States with the right to grant title to public lands needed for water-power development. It is interesting to note that this bill is fathered in Montana, where the State Constitution directly disclaims all rights in unappropriated public lands. It would seem that the bill in question was with a view to special difficulties experienced by private companies in Montana; in other States it is probable that such legislation would be unnecessary for a legitimate utilization of water-powers, perhaps even in the Forest Reserves—and a legitimate use is one that the courts would sustain as a public utility. In such a case the United States as proprietor is not exempt from the application of the principle of eminent domain. The public lands are held in trust by the Federal Government, not for its own benefit, but for the advantage of the people of the States themselves. As pointed out by Mr. S. C. Smith of California in a recent speech on this subject in the House of Representatives, "the United States of America is not a business institution, looking for profits and dividends; it is a government pure and simple." If the Secretary of the Interior could determine the conditions for utilizing the vital resources of such vast areas as are included within the public domain in the West, he would have it in his power to throttle the development of the States. But no dangerous authority in this matter now vests in the Secretary of the Interior. The States already possess ample jurisdiction. We believe that no need exists at the present time for a law directly conceding to the separate States a right which they already possess. It would make easier the appropriation of water-powers, which now is made sufficiently difficult to prevent abuse. A case in court is open and notorious, while a petition passing through a State bureau generally becomes known only to a limited number. Manifestly the rights of the public would be better conserved by requiring that condemnation proceedings in open court be instituted, whatever additional provisions for equitable public service might be imposed by State laws upon the rights so obtained.

That the States' right of eminent domain does apply as against the public lands of the United States is clearly sustained by decisions of the Federal Courts. In the case of the United States *v.* Railroad Bridge Company (6 McLean 517) the right to condemn Rock Island, formerly a military post, in the Mississippi river, was affirmed, and it was further held that every State has the power under eminent domain to authorize the construction of railroads and public roads, through the lands of the United States. The same opinion declared that "the proprietary right to lands in a State, held by the Federal Government, is in many respects similar to that of an individual • • • The proprietorship of land in a State by the general Government cannot, it would seem, enlarge its sovereignty or restrict the sovereignty of the State." The decision cited lays down principles directly applicable to the water-power problem in its existing status: "Where lands are reserved or held by the general Government for specified and national purposes, it may be admitted that a State cannot construct an easement which shall in any degree affect such purposes seriously. • • • The right of eminent domain appertains to State sovereignty and is exercised free from the restraints of the Federal Constitution." Again, in Jones *v.* Florida Railway Company (41 Fed. 70) the court said, "Every State has, by virtue of its sovereignty and right of eminent domain, power to create • • • easements upon all lands within its limits unless specially reserved for the purposes of the National Government and such easement would interfere with the purpose for which they were reserved."

It is apparently only necessary to demonstrate that a proposed construction is a public utility to warrant condemnation by the State to acquire easement on Government lands, and action could be initiated in a Federal court, with the precedents pointing toward a favorable decision. Definition by State statutes of what shall be deemed a public utility is one of the most hopeful and practical means of solving this problem. In the famous case of Clark *v.* Nash (198 U. S. 361) arising in Utah in 1904, the United States Supreme Court affirmed that "where right of condemnation is asserted under a State statute, we are always, where it can fairly be done, inclined to hold with the State courts." This case involved condemnation of right of way for water to irrigate the farm of an individual. Older decisions have gone so far as to permit an individual mine-owner to invoke the power of eminent domain for the purpose of obtaining a shaft-site on land held in fee, when the development of the mine rendered this necessary from the standpoint of economical feasibility. The extension of this principle has been rapid within the last few years, and the statutory declaration of water-power development to be public utilities, coupled with regulations applying to such enterprises when facilitated by the exercise of the power of eminent domain, would seem to be one clean and honest way of providing for a rational development of resources without prejudice to either State or Federal Governments. It involves only the perfecting of rights already existent, and would secure fair and open treatment. It is in line with precedent and the natural evolution of our Government. That difficulties lie in the road may be conceded. The conflicting interests of the varied States, and the unequal development of public opinion and of public conscience in regard to questions involved, make it a matter to be determined on the basis of policy, whether the existing rights of the States be perfected or some wholly new powers be granted to the central Government. Even if, however, it be held best to allow the States to handle the matter in whole rather than in part, the pending legislation is superfluous and therefore unwise.

BY THE WAY.

Mining investments were discussed illuminatingly before the Finance Forum in New York, January 19, by Mr. J. Parke Channing. From his lecture the following is abstracted:

The risks which one undertakes in mining are the same, to a certain extent, that one undertakes in agriculture. The first is the varying price of the product; the second is the sudden end of the particular ore deposit being exploited. The chance of a coal seam being terminated underground is, of course, a minimum, the main thing being to secure sufficient acreage at the time of starting. The price of coal does not vary so very much because it is really the cost of production that determines its selling value. Roughly, one may state that the profit per ton on the production of soft coal is 10 to 15c., and on anthracite probably 50c. per ton. In iron mining the risk is somewhat greater, and was markedly so until the discovery of the Mesabi iron range in Minnesota, with its enormous deposits of ore now largely controlled by the United States Steel Corporation. It is likely that they have on the Mesabi range 1,250,000,000 tons of ore actually developed by shafts and drill-holes, while on the older ranges, which have been operated for the last forty years, it is doubtful if there is actually visible more than 250,000,000 tons of ore. It is the ownership of these large tonnages of iron ore, and of the large acreage of coking coal that puts the United States Steel Corporation in such a strong position.

The next group in which the risk is greater, and, consequently, the returns should be greater, are copper mines. The average cost of producing copper is probably 10c. per pound, the minimum being 7½ and the maximum being 12½c. per lb. The price of copper has fluctuated from 11 to 25c., but one may figure the average price at from 14 to 15c. per lb. For a number of years, with the possible exception of such regular deposits as those of Lake Superior, there was a great deal of risk in copper mining, and there were violent fluctuations in the price of copper-mining companies' stocks. The geology of the deposits was not understood, the particular phenomenon of what is known as secondary enrichment having been unrecognized. It frequently happened that when a mine got below this level, large sums of money were expended in looking for the downward extension of the rich zone, which existed only in the imagination of the manager. Within the last six or seven years attention has been turned toward the so-called disseminated orebodies, and there are now half a dozen mines in this country whose proved tonnages are calculated in the millions. This type of property requires a large initial investment and considerable time for development and equipment, but when in proper shape is one of the best mining investments which is known.

Gold mining is always in a category by itself, and is a favorite of the English public. The tendency now in gold mining is toward the development and exploitation of low-grade deposits in which a relatively large tonnage is exposed and available for treatment.

Silver mining at present is rather more speculative than any other, not only on account of the tremendous fall in the value of the product in the last twenty years and the fact that a large proportion of the world's consumption is produced as a by-product in the production of other metals, but also from the fact that the strictly silver mines themselves are always irregular in occurrence. As showing this, last week there was a certain silver mining stock selling at $9 per share, which was paying a dividend of $2 a year, and a certain copper stock selling at $90 per share which was paying a similar $2 a year dividend. In each case the question of security and probable life were the governing factors in determining the price, though I think that, as often happens, the public had gone to the extreme in each case, and that one mine was selling at too low a valuation, and the other too high. Still, however, one can say that without doubt a stock paying $2 a year and selling at $9 was doing so for the reason that it was a question as to how long it would last. In this connection it is probably not improper for me to say that the mineral reserves of the world and of this country are not unlimited, and that I strongly believe in the conservation of our metallic resources as much as I do in conserving our timber resources.

In determining the value of a mine two main points are to be considered, first, the net profit in the amount of ore which the mine has developed, and, second, the possibilities of finding other orebodies. It is this possibility of finding new orebodies, or the extension of old ones, which makes a mining investment so desirable to people who know, and which holds forth such glittering possibilities to the man who first reads the glowing prospectus of the old-time promoter. If the investor will study mining conditions and mining reports in the same way that E. H. Harriman and Edwin Hawley in their early days studied railroad reports, and will get an idea of values and disregard prices, he will find that mining investments give one of the best returns that can be found. The investment of money in prospects must be left to those people who are distinctly in the mining business, or to development companies that can afford nine failures out of ten efforts.

When you come to study a mining investment look first to the question of the amount of ore which the property has developed, and the profit per year which it can make. Take into consideration the fact that if no ore were found during the five, or ten, or twenty years that the mine will exist, not only has it got to pay you back interest on your money, but to return your capital. When you buy mining stock take this into consideration, but do not let it be the whole point governing your investment. From the reports of the engineers or the manager, take into consideration the possibilities of finding further ore. If these possibilities are good, and if at the same time you consider that the price of the metal which this mine produces is going to advance, then you certainly have a good investment. One can get into few businesses and get 6% return, have absolute security, and at the same time a chance of having the business and the profits double or treble as is often the case with good mining investments.

MINES OF AJUCHITLAN, QUERETARO, MEXICO.

Written for the Mining and Scientific Press
By Samuel J. Lewis

The mines of Ajuchitlan are situated in the district of Tolimán, State of Querétaro, Mexico, about 25 miles northeast of Bernal station on the National railway, and a little more from the Central. They are reached by coach over good roads from Tequisquiapam, the little town near the railroad. The country generally is a level plateau about 6000 ft. above sea, traversed at considerable intervals by ranges of rolling hills with a general east and west

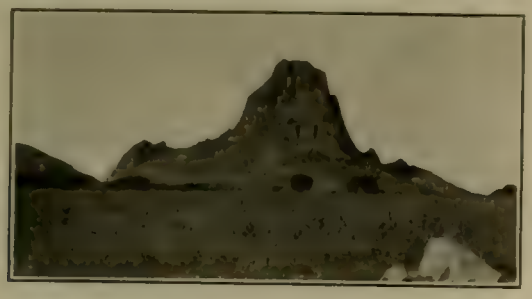


Fig. 1. Pena de Bernal.

axis. From the mines, the mountains of El Oro are in sight, about 65 miles to the southeast.

The principal mines, worked by the Ajuchitlán Mining & Milling Co. of Monterey, are near the head of a gently sloping arroyo with rather steep sides, the latter due to the bluffs of andesite-capping overlying the steeply tilted shales. These latter form the country rock, and strike generally northeast, with a dip varying from 50° to vertical. Erosion has been active. The shales are exposed below the capping for at least 1800 ft., and the andesite itself is deeply pitted. Silica nodules have been left comparatively unaffected on the surface, while the surrounding feldspar has been cut away. Cooling cracks in the capping are abundant on the tops of the bluffs. The local uplift containing the mineral veins is practically a single widely extended, many-spurred mountain, striking northwest, and evidently close to one edge of the great andesite flow that once covered hundreds of square miles in this country. Beyond this mountain, to the northeast, is visible but one important vestige of capping, the solitary butte known as the Peña de Bernal. This is a remarkable structure. The upper pyramidal portion, vertically scored with marks resembling flow-lines, is of soft red andesite, resting unconformably upon darker, more bluish andesite, the latter presenting the appearance of being stratified; the planes have a dip of 45° southwest. The same stratified appearance occurs near the top of the Ajuchitlán mountain, on the side facing the Peña. It is probably due to slow cooling and consequent more perfect crystallization. The rock of the pyramid is identical with the red andesite found on the crown of the main hill and scattered over the slopes above the 250 metre contour (Fig. 3). Below this level a much harder, more compact bluish andesite is found all over the ridges, giving a ringing sound when struck. The difference in the two kinds is so marked as to suggest two successive flows. The lower andesite of the Peña can be followed westward down into the arroyo, disappearing under vertically dipping shales, evidently much vulcanized. Detailed study might quite probably show the Peña to be a plug marking a former centre of volcanic activity. To the north of the butte, a few hundred metres, appear low red bluffs of the same upper andesite, apparently capping brown shales. This seems to be the northeasterly limit of the capping.

As the shales are followed down to the bottom of the arroyo they become soft and brittle, and undergo startling changes in color through every shade of gray, black, brown, and red. About 500 metres north of the Peña, near the Chica Roma arroyo, the confusion of dips is so great through all angles to 90°, principally near the latter, that the immediate neighborhood of a centre of disturbance is at once suggested. Near the bottom of this arroyo is the only place in the district where the basal limestone is exposed upon which the shales were laid down. It lies with a dip of about 25° to the southeast, the shales above it being only about 250 ft. thick. It is a dense, fine-grained, hard blue limestone, traversed where exposed in the arroyo by innumerable calcite veinlets. Old workings in the hill at this point, going north, penetrate the same limestone with the dip unchanged, at 20 metres distance. It is probable that the original mountain crest was here, before the overflow covered the country.

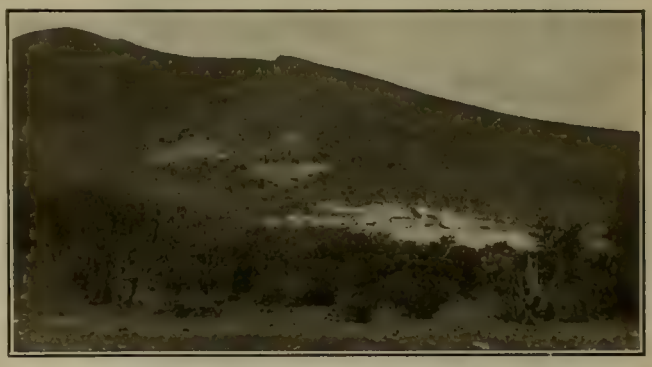


Fig. 2. Ajuchitlan Mines and Mill.

The west side of the main hill is shown in Fig. 2, with the mines of Ajuchitlán one above the other in the centre. They closely follow the dip of the vein-system. The large upper dump, to the north, marks the old Santo Tomás mine, the original discovery found and worked by the Spaniards. Remains of their old arrastres are still to be found in the arroyo, and some of their characteristic narrow low workings are intact in the mine. At this point the deposit is a flat 'blanket' going into the hill at about 15° for a distance of about 200 metres. Both the early owners and their Mexican successors goph-

ered around in it looking for rich pockets, never getting very far from the surface. Nearly everything shown by the labyrinth of old workings averages $8 to $9 United States currency in value, consisting of about 60% gold, the rest being silver. The high-grade pockets were exceedingly rich. In 1901 the Mexican owners sold the property to an American company. Development has been in progress since, coincidently with the building and operation of a cyanide mill. The latter has been running about three years, and is now being enlarged. The new owners left the old mine, after about two years' study, and began work on the quartz outcrops below it. The large dump noted below and to the south of the old mine, is the upper tunnel or new mine. This has developed very large orebodies, containing ore of satisfactory value. Below it is seen the mouth of the lower level, used entirely for tramming ore to the mill.

The upper level, 41 metres in elevation below

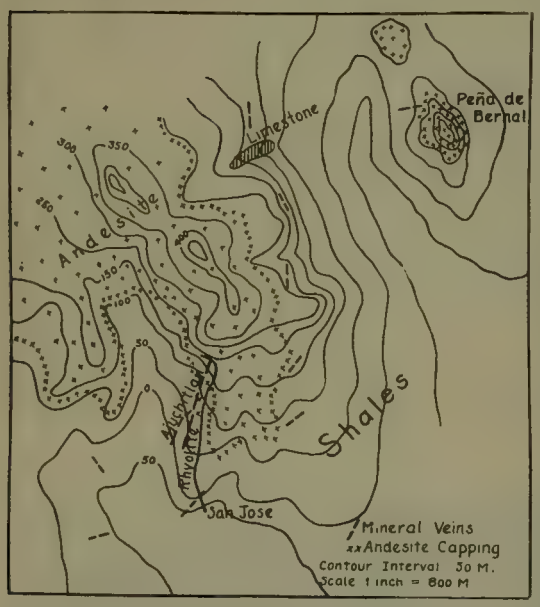


Fig. 3. Region Surrounding Ajuchitlan.

Santo Tomás, opened up the so-called Calavera vein, and led into what seems to be its intersection with the Santo Niño. The resulting orebody was large, and averaged about $8 United States currency in assay value. Here the first fault was encountered, a relatively minor disturbance, which threw the vein slightly to the west; this being related to an igneous intrusion to be described later. Assay values in the immediate neighborhood of the fault rose to $25 and more. Beyond, as work proceeded, two similar faults were encountered, with a like effect on the content and showing the same proximity to the igneous dike mentioned. From an assay value of $2 or $3 or less on the outcrop, the grade of the ore has risen steadily to about $8 in the Santo Niño vein and thence with slight variations to an average of $12, maintained now for over a year. At but one of the faults, the last, was the throw sufficient to make the picking up of the vein difficult. For the most part it has averaged a width of 9 metres. Both walls are usually well defined as highly calcareous shales dipping about 50° to the east; the foot-wall is overlaid by a few inches of barren quartz, below which is sometimes found iron-stained limy material. A similar iron-stained breccia is found next to the hanging wall, and gives high assay values occasionally. A rich stringer follows through it, re-appearing at intervals. Near the present face the foot-wall is as smooth as masonry for many metres. At other points it blends into the country.

The ore has been blocked for about 50 metres above this level, and connection has been made through barren shales with the old mine. Below the level, ore-chutes and air-connections have been carried down on the vein 55 metres in vertical distance to the level of the lower drift. This, begun after the new mine was opened, is in ore except for the first 100 metres, which pass through drift and shale, cutting the vein in the foot-wall. The total length of the level is now about 650 metres, practically all driven by hand. Air-installation is planned for the immediate future.

The grade of ore found here varies from $4 to $6, with unmistakable signs of downward leaching and secondary enrichment. Sinking has been begun near the face, following down on the vein, to reach a zone of secondary enrichment. The indications are favorable that this will be found, judging from conditions at the neighboring prospect known as the San José. The prospect, which is of great interest, lies about 900 metres to the south of the Ajuchitlán mines and lower by 42 metres at its shaft collar than the level of the lower drift. The property is small, entirely developed by an 80-metre shaft in the hanging wall. After cutting the vein at about 55 metres, water became troublesome and now fills the lowest 15 metres of the mine. Two main drifts on the vein-system at different levels have developed about 110 metres of mineralization, striking N. 60°E. Two cross-cuts totalling 40 metres, on opposite sides of the lower level, are entirely in mineralized shales, with the hanging wall well exposed and the foot-wall not yet reached. It is visible only near the mouth of the prospect, as unaltered brecciated brownish shales. Those of the hanging wall are blue, thicker, and harder. The assay values average about $3 throughout the orebody till the neighborhood of the shaft is reached, when there are sporadic but recurrent rises to $7 in value. Near the bottom of the shaft considerable $18 and $20 ore has been found, on which a small and inefficient mill was run till financial difficulties paralyzed the operations.

The notable size of this block of mineral, totalling probably half a million tons, in such a small space, with the permanent water found, indicates a drainage system of considerable extent. The nature of the formation is well shown in Fig. 4, a photograph of a portion of the outcrop of one of the two veins which intersect to form the orebody. The parallel layers of altered shales, slightly separated by bands of quartz, are characteristic of the orebody throughout the prospect. In general features, the property is closely allied to the Ajuchitlán vein-system. The only essential structural difference is in the degree of disturbance suffered here when the original water-channels formed. The latter mines seem to

have been close to the centre of uplift the fracture forming a fissure of some size in places quite open. The ore formed here is in relatively concentrated form. In the San José farther from the uplift there seems to have been merely a loosening of the shales along their stratification planes over a considerable area. Ore-bearing solutions percolating through mineralized loosened shales, depositing occasional higher-grade pockets, and meteoric waters have since leached the upper portions of the vein to enrich the lower. Since the erosion of the andesite

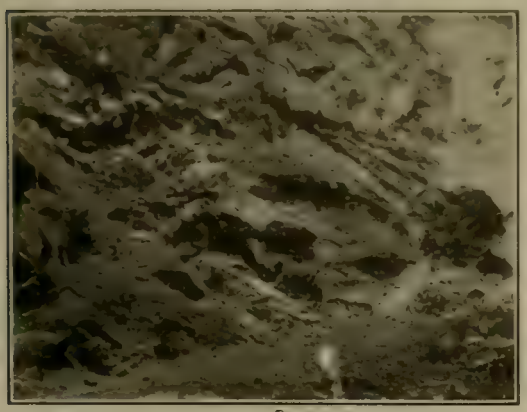


Fig. 4. Outcrop of North Vein, San Jose.

capping, leaching of this vein has certainly proceeded rapidly.

Two shafts sunk in the arroyo by the Ajuchitlán company in search of water for milling purposes, supplement this evidence. Both were successful, and from one of them, near the San José ground, all the water is pumped for the 65-ton mill and about 500 employees. The conditions seem to indicate continuance in considerable depth for both properties. The workings in the new mines of the Ajuchitlán company totalling some 1100 metres of main drifts, have developed about 250,000 tons of ore with assay values from $7 to $12. The old mine has in sight about 150,000 tons of $8 to $9 ore.

The original orebodies seem to have been formed by an uplift which fractured the shales along the line of the present veins; the shales on the opposite sides of the mountain indicate this also by their dip. The tearing apart of the strata was accompanied by much vertical oscillation, as shown by the crushed condition of most of the vein. Fig. 5 shows a specimen of characteristic breccia, assaying about $12 from the vein-stuff now being stoped. At the point where it was taken the orebody is 9 metres wide, the precious metals being uniformly disseminated. Study of the specimen at once establishes the presence of the two factors, movement and water. The whole is cemented by a lime-silica deposit. Occasional small but perfect quartz crystals in open cavities are found. Banded structure, due to successive depositions is shown, the dark bands being rich sulphides of silver, containing gold; the white between being quartz. Through the sulphide bands pass minute veinlets of green iodo-bromides of silver, where oxidation has proceeded. The vein as a whole is thoroughly oxidized, the residual sulphide nodules showing as black specks. Some fine specimens of bromargyrite have been found here, practically all the silver being in this form. Chlorides are rare, occurring only as small isolated crystals.

The extraordinary condition of the orebody in the Santo Tomás mine has made the problem of origin difficult. The thick sheet of ore found there, nearly horizontal, capped by shales, and in places horizontally parted by strata of shale, ends abruptly in the country rock, and seems a body independent of all others. The important developments which brought it into relationship with the main vein system were two: a crosscut northeast through the barren shales from the apparent end of the 'blanket', meeting the vein of the new mines at about 40 metres distance, and a drift in ore, near the northern end of the 'blanket', which follows the deposit uninterruptedly through a change from the horizontal to the normal dip of the main vein and into it. These facts establish the Santo Tomás orebody as an immense dislocated fragment of the original vein, torn bodily from the parent structure at the southern end, and moved about an axis near the northern. The shales overlying the blanket could only have come from the former hanging wall of the structure. Overhead winzes pass through them to daylight, and in the further parts of the orebody reach the broken and decomposed bottom of the andesite capping. Slickensides abound, with every angle of dip. The ore in the Santo Tomás is much decomposed as if by action of water. Great brecciation of both shales

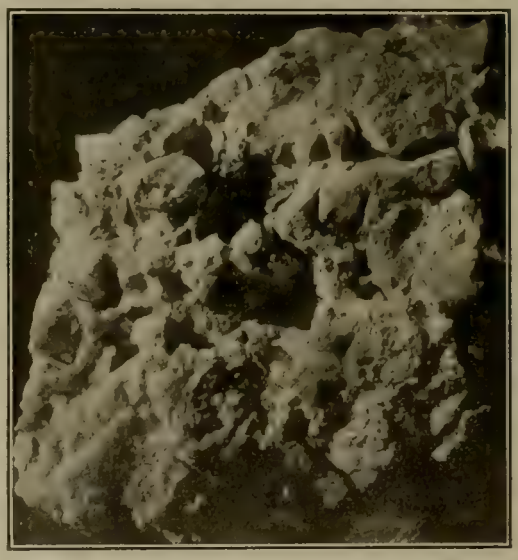


Fig. 5. Characteristic Breccia Main Vein.

and ores is found, most conspicuous in the immediate neighborhood of the parent vein. The whole orebody is out of place, and originally occupied a position fairly coincident with the vein as later developed. The origin of the dislocation is in the igneous intrusion previously alluded to, which will now be described.

Reference to the map, Fig. 3, based on my own surveys, will show what seems to have been a dike of rhyolite, which traversed the shales from north to south, opening a fracture having a present width

of one metre. It is now filled with highly decomposed gouge, in which are embedded fragments of rhyolite, some of it quite undecomposed, rounded by abrasion. The rock in fracture shows a coarse ground-mass of feldspars in which are plentifully embedded beads of unaltered glass, averaging $^{1}/_{16}$ to ⅛ in. diam. It is found as abundant 'float' on the surface along the west slope of the spur, as shown; never on the low ridges closing the mouth of the valley nor above the level of the Santo Tomás. Underground, it has been cross-cut in workings driven east from the vein, in the new mine, and as a capping in the inner workings of the old. In all cases, its presence in the new mine has accompanied slight displacement of the vein westward. In the case of the first fault, the rhyolite came in as a horizontal fold or nose, which pushed the vein westward to correspond. As the nose receded eastward, assuming its general dip, of about 60° northeast, the vein also recovered its normal dip. The dike seems to have come upward and outward from somewhere near the Peña de Bernal, paralleling the vein for some distance, and finally cutting across it completely. In the upper tunnel and drifts below it, the workings have clearly defined it at several points as curving round in a northwesterly direction. The vein is completely cut off, the contact being strongly slickensided and striated; on the other side, the drift is in a conglomerate of andesite fragments and boulders. About 30 metres have been driven on the general strike of the vein, and fragments of quartz containing payable silver and gold are being found. The vein should be picked up with little further driving, probably will be, but little dislocated. Where encountered in the workings, some 15 metres below this point, no andesite fragments whatever appear. The dike cuts across at about N.80°W., the vein being much broken and discolored for about 5 metres south. Beyond, fragments of ore and quartz clearly indicate the proximity of the unaltered vein, and help to explain the nature of the obstruction above.

Study of the surface above the face shows a slip in the capping along a line about N.70°W., closely corresponding in direction and location with the line of the dike below. The slip is local, confined entirely to what is now a little hollow behind the rugged andesite bluff above the mines, excellently shown in the general view, Fig. 2. The photograph shows the break well, contrasting with the rounded outline usually shown at the edges of the capping. The entire absence of rhyolite fragments from the surface of the capping, of itself indicates that the dike antedated the latter. It seems clear that the igneous intrusion came to the original surface, becoming itself a channel for the circulation of meteoric waters, which in conjunction with the grinding and settling along the walls of the crack, produced the rounded pieces of rhyolite we find in it today, embedded in damp clayey gouge. A unique piece of rhyolite found on the surface shows complete replacement of the ground-mass by hard smooth ivory-white quartz, banded in concentric layers, with the gas bubbles intact. The andesite flow, conforming to the topography at that time, deposited a thin sheet over the present arroyo, then the ridge, and filled more deeply the hollow places above the present vein-system. Once the thin sheet of andesite was broken, erosion on the soft shales must have been rapid and destructive, carving out the present valley and causing blocks of the capping to split off and fall as it became undermined. The process can be seen going on today, leaving cave-like openings at the foot of the bluffs. When the gradual advance of the erosive agencies reached the zone that had been fractured by the dike below the capping, a line of weakness developed along its course. The abrupt fall of a relatively large portion, taking with it vein, shales, and dike, with the original surface drift, could be only a matter of time. All the physical peculiarities of the zone clear up when referred to this slip. At the same time, there is observed on the present surface a large block of andesite which from the angles of its parting planes and its tilt is certainly not in place.

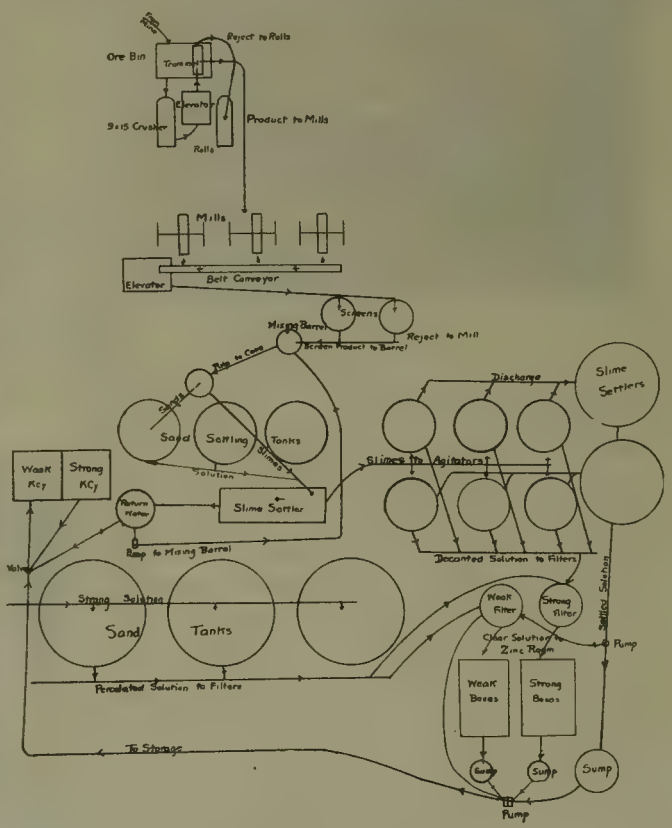


Fig. 6. Flow Sheet at Ajuchitlan Mill.

The grinding of this extremely hard ore for cyanidation has been the difficult feature of the milling practice here. The solution has been found in mills of the triple-roll and die type, which reduce the ore to about 60-mesh. The flow-sheet shows the practice in detail. After preliminary breaking in the crusher and rolls, the ore is ground, delivered by belt and bucket conveyors to the screens, and there sized on

specially designed impact screens of conical shape which have great capacity and are uniform in action. The oversize is re-ground and the finished product is delivered by belt-conveyor to the mixing barrel, where it meets the cyanide solution pumped from the return-water sump. This takes out about 40% of the metals in carrying the pulp to the classifying cone. There the sand and slime separate, going to their respective settling tanks. The clear solution with metals all goes to the return water sump, where a centrifugal pump delivers it to the mixing barrel, together with the added fresh cyanide solution. From this point the slime is treated in mechanical agitators of the rotating arm type and the sand is leached by successive washes. Precipitation is effected with zinc in the usual form, the clean-up every 10 days yielding precipitate about 860 fine. The mill-heads are kept up to about $12 United States currency, in value, and the treated sand and slime, carrying about $3, are being stored awaiting the installation of tube-mills. The present plant, having a capacity of about 2000 tons per month, is being remodeled to crush 3000, and with the installation of fine-grinding machines the capacity will be increased. Electric power is used throughout, the current coming from the line of the Cia. Hidro-eléctrica Queretaña, 25 miles across country. Separate motors drive crusher, mills, and agitators, and an electric pump furnishes the water. Costs at these mines have been kept low. At present, with the price of labor higher than a few years ago, drillers get 75cv. per day, peons, 37 to 42, mill-workers, 30cv. to P1.25. No timbering has been necessary in the mine. The ore is stoped, mucked, and trammed to crusher for about P2.10 per ton; milling costs about P3 per ton, and general marketing and miscellaneous expenses bring the total to about P6. Facilities for study of this property were courteously accorded by Cliff Crowell, the general manager.

Explosives are being used in increasing quantity and variety. They are now made at 150 plants in different parts of the country, and the product of a single year is now nearly 500,000,000 lb. Of all this material no explosive is safe in the hands of a careless or ignorant person, whether it is used in mining or otherwise. Statistics recently compiled by the railway bureau for the safe transportation of explosives show that more than 400 persons have been killed or injured, and over $3,000,000 worth of property destroyed by explosives in transit by rail. The fact that three years of co-operative effort under the supervision of this bureau have reduced these losses to almost nothing should encourage the hope that similar co-operative effort may likewise greatly reduce losses of life and property from the use of explosives in mining.

The Pachuca tunnel is a plan to run a bore about 12 miles long, at a depth of 1000 ft. below the lowest level of any of the mines in Pachuca, Mexico, and to cut them at that depth, which would be about 3000 ft. below the surface. The main veins to be tapped would be the Santa Gertrúdis, the Real del Monte, and the Barrón.

ELECTRIC DRIVE IN FOUNDRIES, WORKS, AND MINES.

Written for the MINING AND SCIENTIFIC PRESS
By HERBERT A. CARTER

The large annual increase in brake horse power in motors installed in foundries, works, and mines, in Europe and the United States during the last few years is striking evidence of the fact that the advantages of the electric drive over other means of power-transmission are rapidly becoming recognized. Where electric driving is suggested the engineer endeavors to arrive at an accurate estimate of its advantages by making a rough calculation of the number of units he will require, multiplies that number by the quoted price per unit, and in this way arrives at his total annual bill for power. This total he compares with his calculated cost of power by steam or gas-engine. A calculation of this kind is, as a rule, rendered defective by the difficulty of ascertaining exactly what horse-power the tools require. Estimates based on the horse-power of the engine should not be taken into consideration, as, owing to belt and transmission losses, and to other factors, they are certain to be greater than the maximum needed if electric driving be resorted to. It is quite as erroneous to estimate the horse-power which each machine is supposed to take and then multiply the total by the total working hours. In practice most machines work intermittently, and their actual total consumption of energy may probably be less than half what it would be if they were worked continuously at full load. With an isolated power-plant which must be kept running constantly, the benefit of that difference is not obtained, but with electric driving from the public mains the power paid for is the power used by each machine in useful work, and it therefore varies almost as directly as the load. Most power users find that the units of electricity which a works is likely to absorb in a year are much lower than expected.

In the case of iron works the argument based upon the intermittent working of machines is very strong. The cranes, rolls, drills, and miscellaneous tools may be said to be 'off and on' all day, and it will be found in most cases that the only economical way of dealing with the situation is to have a source of power which is cheap under both heavy and light loads. Steam or gas-plant is only economical at full load, while light loads are wasteful. With electric power the cost follows the actual work done. Many iron works are forced to use an isolated number of steam-plants, at times fed with steam from a central source. Although such an arrangement may be convenient it is immensely wasteful. Owing to the intermittent demands and the scattered arangement of the plant, the economies of electric driving will be appreciated by iron works. The saving effected in any fair-sized plant will in the course of a year be astonishing as to up-keep, supervision, insurance, and so on. The electric supply arrangements should be made so as to ensure continuity. A three-phase current of 10,000 volts should be conveyed to such works, and on the premises the pressure transformed down to a working level of about 400 volts. A duplicate supply, provided by means of a second connection to the trunk

mains, constitutes a great assistance to the easy continuous working of the drive. A good arrangement is to control the actual supply to the various motors from a switchboard on a lower floor at the sub-station, and to have six separate circuits, which can be labeled A, D, E, H, K, and L respectively, each of these circuits with a sub-distributing board in a convenient position for the control of a group of motors; each motor in turn to be on its own separate circuit leading up to the distributing board which controls it. This arrangement enables the supply to be regulated in whole or in detail, with perfect facility. Circuit A might consist of 7 motors, with a total horse-power of 100; circuit D of 11 motors totaling 147 hp.; circuit E of 7 motors of 135 hp., and so on. The speeds might vary from 470 to 1410 rev. per min. Spares should be included. With electric driving it is easy to test the exact amount of power which each motor or machine is using, and by this means perfect check is kept upon the behavior of the machines, and any mal-adjustment or defect detected at once. The electric drive can be made much safer than the mechanical, reducing the risk of accident; it also does away with the obstructions and makes the supervision of labor easier.

In regard to saw-mills, J. F. C. Snell, who was until recently the electrical engineer at Sunderland, England, and who has had wide experience with electric power in its practical aspects, stated that in one case where a saw-mill was driven by steam-engines the cost was over 2d. per horse-power or 2s. 6d. per unit. Seven motors were installed, ranging from 4 to 50 hp. each, with a total of 179. After one year's run it was ascertained that the total consumption was 50,785 units. The electric company furnished the static transformers and the high-tension switchboard, the low-tension switchboard and fireproof-transformer chamber being found by the user. The cost to the consumer was as follows: electricity £264 10s. 2d., oils and stores £9 3s. 4d., interest on sub-station building £12; total £285 13s. 6d., of 1.35d. per unit, exclusive of capital charges on motors and wiring.

The peculiar features in building work and kindred operations, show the advantages of the electric motor as against steam, gas, or oil engines strongly. Much of the work, as in cranes, is intermittent. The electric motor, which takes power only when required, is the only means of dealing with such work economically. Steam has to be kept up continuously no matter how often or how seldom the crane is actually used. Crane engines are not large, and require to be run non-condensing, hence they are by no means efficient, not taking into consideration the great waste of power during idle minutes. For traveling cranes, which are so important a feature in builders' yards, the electric motor stands unrivaled. In stone crushers, and other like appliances, the load varies greatly, and there is the risk of occasional heavy overloads. The electric motor can deal with these overloads without difficulty. When the load is light it will be found to run far more efficiently than the steam engine under the same conditions. Another important point is the ease with which motor-driven machines may be placed at convenient points in yards, or on building sites. The necessity of considering arrangement of shafting or of crowding plant together does not arise.

The largest sheet and wire mills for precious metals in London, and the first that were electrically equipped throughout, are those belonging to the firm of Johnson, Matthey & Co., in Hatton Garden, where 300 hp. in brush-motors is installed. The business is concerned with refining and assaying, as well as the melting, casting, rolling, stamping, and drawing of gold, silver, platinum, and other metals, and the largest gold and silver-smiths in London, Birmingham, and elsewhere, are supplied from these works. The first motors were installed in 1903 by the British Electrical Engineering Co., of Longhborough, England, and have fully demonstrated the superiority of electric driving, especially on account of the uniformity of gauge obtainable. Gold can be drawn, for example, into wire measuring $^1/_{1000}$ in. diam. in almost any length required, and this is impossible without electric driving. Similar success has been reached by electricity in rolling, flattening, and other operations.

Recent accidents in English collieries have been caused by defects in the winding machinery, and miners think that the tendency to increase the speed of raising and lowering has a good deal to do with the growth of accidents from this cause. There is a direct and simple means of making the winding engine one of the safest parts of a mine equipment. Modern electric winding-gear is so well devised that the danger of accident is practically negligible. The German Government, which is extremely careful about the safety of workmen, permits electric winding plants to haul men at the rate of ten metres per second, as against the maximum of six metres per second for steam-winding. A fact like this is of great significance to both mine-owners and miners generally. Electric plant for collieries is made enclosed to protect it from coal-dust; for other mines this is unnecessary. Many colliery owners have the same ideas about cheap coal and pit-heap refuse as engineers used to hold about water-power, namely, that it is so cheap that economy need not be considered.

With mines generally there exists the problem of transmitting the steam to the uneconomical engines which use it. It is not altogether the fault of the engines that they are so uneconomical, for the steam is frequently delivered to them so wet that it might be wondered whether they were expected to work as steam engines or hydraulic motors. Many of the steam pipes in collieries and mines, are bare, and at best imperfectly covered. The loss due to radiation even in covered pipes is considerable, while in uncovered pipes it is a most serious drain on the boiler plant. From tests made in a colliery in the North of England it was found that with steam at a boiler pressure of 100 lb. per sq. in. the condesation in well covered steam-pipes in the pit-shaft was at the rate of 1 lb. of steam per hour for every three square feet of pipe surface exposed. A pipe 3 ft. in circumference is quite a moderate size in the case of a colliery—less than 12 in. outside diameter—yet for every single yard of length the boilers must raise 3 lb. of steam per hour during the whole time the steam is turned on, in addition to that used by the engines, regardless of whether the engines are working or not. For such

a pipe carried down a shaft 1000 ft. in depth it would be necessary to raise 1000 cu. ft. of steam per hour for no other purpose than that of keeping the pipe warm. But steam pipes are often carried to pumping engines in mines over much larger distances than this, and in the case of the colliery referred to it was all that two Lancashire boilers could do to raise sufficient steam to make up for the condensation in a range of 6 in. pipes leading to the underground pumps. This meant two boilers going continuously, and probably one as a stand by, with all that this means in up keep, firemen's wages, wages of men delivering and dumping and removing ashes, cost of flue and chimney cleaning, cost of feed pumps, water, and oil, to say nothing of the cost of coal, and the fixed charges, such as interest and depreciation on boilers and chimney stack. Then the condensed steam had to be pumped up again. It appears incredible that two boilers should be used to pour water down a shaft while adjacent boilers have to provide the necessary steam to pump it up again. It is not surprising, therefore, that great economies have resulted from the adoption of electric-driven in place of steam-pumps for underground work. In one case the substitution of electric pumping plant, costing £3500, effected a saving of over £1200 per annum. In another the adoption of electric motors to drive existing pumps previously driven by wire-ropes from engines and boilers situated underground, effected a saving of £1500 to £1800 per annum, the cost of the electric installation being £3000. In yet another instance the substitution of a three-throw electric pump for one spear-rod pump and two duplex steam-pumps effected an annual saving of £3000, with a capital cost of £6000. In this case steam-pipes originally ran for about 800 yd., and one result of the electric drive was to reduce the coal consumption from 14 to 2^1_4 tons per day, and the number of men employed from 7 to 3. Such instances might be multiplied, but it would be hardly possible to bring more convincing proof of the economies which may be effected by the adoption of electric pumping in collieries and mines generally than is afforded by the above examples.

Centrifugal pumps in a large colliery in Wales, driven by two Westinghouse 3-phase, 3000-volt, squirrel-cage motors, 125 and 50 hp. respectively, have been found capable of pumping a supply of water for coal-washing purposes amounting to 3500 to 4000 gal. per minute. Two switch-panels control the motors, and both motors are coupled direct to the pump-spindles. The smaller pump works intermittently (without suction) against a head of about 35 feet. The larger pump works under suction from depths varying from 15 to 30 ft., and delivers its water in two stages.

The conversion of mines to electric working need not be carried out in one move. It may be, and very often is, done piece-meal, the experience gained with an experimental installation for pumps, ventilating fans, or haulage, being used to demonstrate the scale on which economies may be effected. The characteristic features of the mine-problem are the long distances over which power has to be conveyed, and the difficult points at which it is often necessary to install pumps, fans, and other plant requiring a considerable amount of power. A flexible electric cable is one way in which energy can be supplied under these conditions without loss. With electric power however enormous steam loss is eliminated as the loss of energy in an electric cable 1000 ft. in length is next to nothing. The electric motor is a high speed machine and its first cost per horse power is lessened as the speed is increased. Seven large collieries in Yorkshire, England, have lately adopted electricity for pumping, haulage, ventilating, coal cutting, and so on, in spite of the fact that they have an endless supply of power in the shape of coal. The same advantages apply in the case of machinery used in metal mining. The drive is noiseless, steady, and far more economical than the use of steam. The ventilating problem is similar in its general aspects to that of pumping. In both cases power has to be applied at distant and inconvenient points. Owing to the small space occupied by the electric motor it is by far the most easily installed, while it has a crowning advantage in the certainty of control from any desired point. Electric motors may be readily protected against moisture and heat, and they may, if necessary, be arranged to work when totally submerged in water. When properly designed and installed, there is no machine less liable to breakdowns.

From the point of economy there is nothing to compare with the electric fan. The loss in transmission from the switchboard to the most remote parts of the mine is trifling, and the efficiency of the motor-driven fan is high. Electric haulage presents a more intricate problem, owing to the diversity of conditions. The claim made for electric haulage is not only that it is more economical, but also that it enables a marked increase in the output to be obtained without corresponding increase in the working cost. The main feature of haulage work is the variability of the load, due to the unequal loading of trucks. The derailment of trucks may double the demand for power in an instant, and unless the capacity of a steam-engine equipment is twice the normal (a most costly and wasteful arrangement) the engine will be stalled, and time will be lost. The electric motor, on the other hand, is quite capable of taking double its rated load for short periods, and will take excess loads up to 50% for a considerable time. This enables the motor to work economically under normal conditions, and to handle overloads with ease and efficiency. With steam and other power-equipment an increase in load tends to reduce the speed of the engine, whereas an electric motor will maintain constant speed within a few per cent from no load to full load. It is this virtue of the electric motor which gives a higher average speed with a fluctuating load, and therefore increases the capacity of the haulage system. Steady speed is of great advantage with endless-rope haulage, but the electric motor has another quality which makes it also applicable to main and tail haulage where reversals occur frequently. It accelerates twice as fast as the steam engine, saving a great amount of time during the working day. The electric motor is also ready to start at the touch of a switch, and there exists no necessity for the preparations required to start a steam engine after a period

of rest. Electric driving enables the haulage gear to be fixed in the most convenient place (owing to the limited space occupied), and does away with the wasteful splitting of long drives. Portable haulage gears may also be used where required, and are available in the main-rope and endless-rope types. On the Continent the electric locomotive is coming largely into use. Power is conveyed to it by means of a flexible trolley, which takes current from overhead wires in the manner of an ordinary tramway.

The adoption of the electric drive in gold, silver, lead, diamond, and other mines will prove greater in its money-saving advantages than in those cases in which it is applied to coal mines, as it will be readily admitted that such undertakings have to pay a higher price for fuel than collieries. To this has frequently to be added special railway rates and cartage charges, together with the cost of weighing, stores, and delivery clerks. Even where collieries are still using steam-power a supply of electric current may be put to good use. This is especially noticeable in a week-end supply of electric power whereby the colliery manager is enabled to shut down the boilers, and avoid the costly banking of fires and steaming which is at times required for the ventilating fans only. The fan can be driven by motor from Saturday till Monday, and during the rest of the week the electric motor can be used as a stand-by. The same advantages would accrue in the case of other mines.

In relation to electric winding it may be said that an intermittent and rapidly varying load is badly suited to the steam-engine, and the superiority claimed for electric winding rests upon the several arrangements made for handling such a load cheaply, arrangements which cannot be applied to steam equipment. The main feature of electric winding is regeneration, by means of which a portion of the energy spent in accelerating is made use of during the period of slowing down. The arrangement may be likened to a pendulum in which the energy accumulated during the downward swing is absorbed in the upward swing which follows. The benefits of regeneration in winding are obtained by utilizing a heavy fly-wheel. Instead of stopping the cage by means of brakes it is stopped by allowing it to give up its energy to the fly-wheel, and this stored energy can be used to accelerate the cage at its next movement. By an ingenious development of this principle an electric winding gear can be driven with a motor generator, the capacity of which is equal to the average load. In all other systems the winding engine must have a capacity equal to the maximum load. Thus an electric winding plant rated at about 450 hp. is able to deal with a load which rises at times to 1200 or 1800 hp. The working economy of this system is obvious, and the problem resolves itself into that of the capital expenditure involved in electric-winding plant which is warranted by the economies resulting in operation.

A statement of the case for electric driving as it stands today would not be complete without reference to the problem as to whether users of electricity should generate their own power or take it from an outside source. They then become largely independent of the fluctuations in the price of fuel, and also of strikes, they are freed almost entirely from anxiety as regards stoppage from break-down, and in some cases the capital expenditure saved on the generating plant can be more usefully employed in productive machinery. A contract is also made for power at a fixed price, as a rule, and a power-user knows exactly what his power is costing him month by month, and year by year, machine by machine. In a mechanically driven undertaking one can only estimate the horse-power which each machine takes, and in any form of separate generating plant there is room for diversity in the estimates of the actual capital expenditure on land, buildings, and plant required for power production, and of the current cost of wages, coal-cleaning and maintenance, depreciation, and so on, of the fixed and running plant. Cheapness in the production of electricity depends upon the size of the generating station, the magnitude of the load, and its diversity. Thus a big station supplying a large number of varied demands, and so reaching a considerable and even output, can produce its units of electricity cheaper than a small station supplying only one load. Everyone agrees that the advantage lies with a main-power station. Cases arise, however, where power cannot be obtained from an outside source, and in these the question of users generating their own supply in such a manner as to enjoy to the utmost the proved economies of the electric drive comes up for consideration. Around mining properties, building operations are frequently going on, and electric stone crushers and mortar mixers can be run by electricity, with money-saving results.

Electrical apparatus when constructed in accordance with the best engineering practice is well-nigh indestructible, is subjected only to the ordinary amount of wear and tear, and even comes out unimpaired from devastating floods and fires. The following cases give excellent examples of the amount of hard usage that well made electrical apparatus will survive and still be in good working condition. In the Knight's Deep mine, near Johannesburg, South Africa, there were installed 36 15-kw. transformers and 12 3-phase 50-hp. G. E. induction motors for operating the mine pumps. Through a peculiar combination of circumstances the mine was allowed to fill with water, the motors and transformers running under 100 ft. of water for over two years. When taken out three of the motors were re-wound in the local repair shop, the others were simply dried out, and then soaked in oil. Contrary to expectations the insulation was found to be in excellent condition, and the motors were put into service, apparently none the worse for their high-pressure bath. The transformers were dried in the same manner, and shortly afterward were replaced for transformers of English make which had burned out only a short time after being installed. A railway power station near the Mississippi river was exposed to severe floods during the season of high water. Two 1500-kw. 6000-volt generators were more than half under water for nearly a week, but when dried out carried their load without giving any trouble whatever; in fact the first machine to be dried out carried the entire railway load until the second machine could be put into service.

A TARLESS OIL-GAS PRODUCER

By A. B. Davis.

*My attention was first called to the Darling producer during the latter part of January 1909, at the convention of the Indiana Gas Association in Indianapolis. I made a trip to Lima, Ohio, where an experimental plant is set up, to investigate the apparatus. In the latter part of February I made a series of tests on the apparatus. Before going into the tests of the results it will be necessary to understand the construction of the producer. Fig. 1 is a sectional

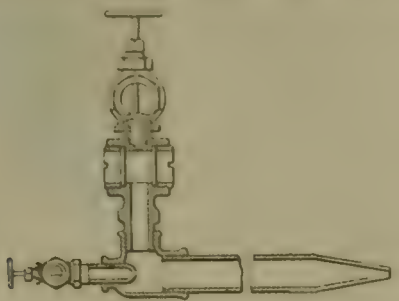


Fig. 1. Oil and Air Nozzle. Darling Oil-Gas Producer System.

drawing of one of the nozzles. Oil is fed through the upper needle-valve and air through the lower one. Both air and oil are under equal pressure. The hole through which the mixture passes is $^{3}/_{16}$ in. diam. and the air-hole $^{1}/_{8}$. A sight-feed glass is provided to regulate the flow of oil. Fig. 2 shows the

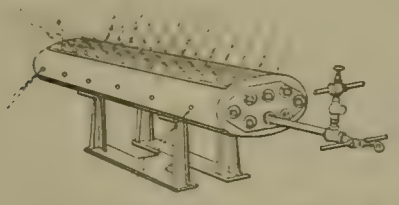


Fig. 2. Burner for Heating Retort. Darling Oil-Gas System.

burner with nozzle attached. It is an iron casting, cored so as to form eight compartments running the full length of the burner. These compartments are arranged so that the mixture enters the bottom centre one (1, Fig. 3), passes the length of the burner and enters 2, traveling back to the front end, entering the two compartments marked 3, flowing back and down into 4, forward and into 5, whence it passes out through a series of holes shown in Fig. 2 and 3. Here it is ignited, being supplied with the necessary air from the opening in the fire-box. The holes at the sides of the burner are arranged so as to direct the gases downward for the purpose of keeping the burner hot. The two upper rows of holes direct the gas upward against and between the retorts, which are placed two or three inches apart in the frame. Fig. 4 is a photograph of one of the retorts with the nozzle in place. The interior construction is similar to that of the burner itself. After the mixture passes through the various channels of one lower retort it is passed through similar channels in an upper one. Fig. 5 shows the front of a 12 retort outfit. The burner is situated below in a fire-box, and the retorts are arranged above in pairs, one over the other.

Both the burner and the retorts are fed with a mixture of air and oil, the burner being kept hot by reflex heat, and the gas formed is burned under the retorts in turn to keep them hot. The gas made in the retorts is taken off at a manifold at the top of the setting, purified and stored in a holder ready for use in any kind of gas appliance. The remarkable thing about the producer in question is that it can be operated without the production of tar, while all other processes known to the author, producing gas by the decomposition of oil at a high temperature, also produce more or less tar, some processes converting into tar as high as 25% of the total volume of oil fed to the retorts. Carburetted water-gas machines convert into tar on an average about 20% of the oil used in carburetting the gas. Several processes on

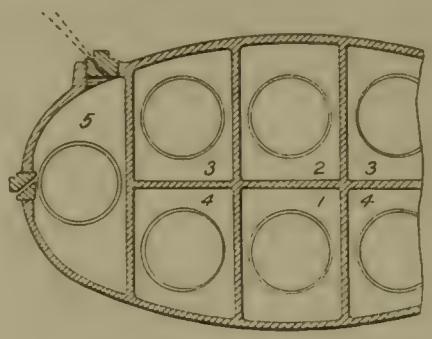
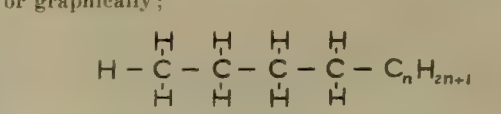


Fig. 3. Section of Burner.

the market, similar to the one under consideration, 'crack up' the oil in a hot retort in the presence of steam and produce large amounts of tar. The question arises, why is it possible to 'crack up' the oil in the presence of air at a high temperature without producing tar, while, if steam or inert gases be used, tar is produced? We well know that oil alone in the retort will produce tar, just as in the Pintsch process used to make gas for railway cars. This gas may be easily made with the apparatus described by shutting off the flow of air into the retorts, and then, as in the Pintsch process, about 20% of the oil is converted into tar. After careful study of the conditions, it has been possible for me to arrive at only theoretical conclusions, which, however, seem to explain the results obtained. The composition of crude or gas oil may be represented by the formula

$$C_n H_{2n+2}$$

or graphically;



The oil when heated to a high temperature shows a tendency to decompose into hydro-carbons of lower molecular weight, at the same time producing compounds of the olefine type from the paraffines by causing the oil to drop two hydrogen atoms at one

*Abstract from *Trans.* Ohio Soc. of Mech. & Elec. Steam Eng. Illustrations from *Engineering News.*

or several points in the chain. These olefine compounds may be represented by the formula

$$C_n H_{2n}$$

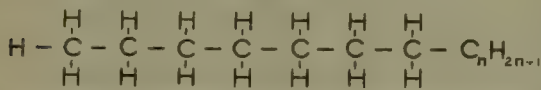
or graphically:

$$C H_2 C H - C_n H_{2n-1} \text{ or}$$
$$C H_2 = C H - C H_2 - C H_2 - C_n H_{2n-1}$$

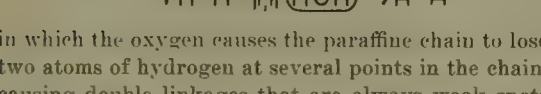
The formation of paraffine oil-tar depends on the polymerization of these high olefines, which always takes place when they are heated to a high temperature. The tar may be represented by the following graphic formula:

$$(C_n H_{2n-1} - C H = C H_2)_X$$

It may be considered a mixture of many compounds, some of which are of very high molecular weights, which have resulted from the combination of the olefines, and the compounds forming the tar may be considered to have one or several benzine rings in the molecule and with one or many side-chains on each ring, perhaps intricately connected among themselves. It has been found that the decomposition of the oil into gas takes place best at a temperature of from 1350 to 1470°F. In the presence of oxygen one may theoretically express the reactions which take place as follows: An extension of the first graphic chain formula gives



This splits up according to the following separation



in which the oxygen causes the paraffine chain to lose two atoms of hydrogen at several points in the chain, causing double linkages that are always weak spots in the chain, which is then broken up by heat into largely ethylene, acetylene, and hydrogen. The presence of oxygen in the retort seems to cause the olefines formed to break down at once into permanent gases without allowing them to polymerize to tar. As proof that such a reaction takes place, we find, from the analysis of the gas, that the latter contains 25 to 30% of gases soluble in bromine water, these being largely ethylene and acetylene, and further that the gas contains little carbon dioxide and carbon monoxide, showing that the oxygen of the air had combined with the hydrogen of the oil to form water, rather than combining with the carbon to form either carbon dioxide or carbon monoxide.

In order to settle more definitely whether or not the conclusions, that the oxygen from the air used, prevented the olefines from the oil from polymerizing, the problem was presented to J. Bishop Tingle, who expressed the opinion that the above conclusion in this matter is probably correct. William A. Noyes, of the Bureau of Standards, made the following statement:

"The explanation which you give for the lack of tar in your process is probably partly correct. I think also that, in the original decomposition by heating, the free valences of the carbon, which under ordinary circumstances caused the polymerization, are saturated by oxygen or hydroxyl, followed by the loss of water in such a manner that the resulting hydrocarbons do not readily polymerize." The importance of this letter lies not in the fact that it partly confirms the views expressed, but in the fact that Mr. Noyes apparently does not for a moment consider the production of gas from oil without the production of tar impossible.

Results of the tests made on this gas producer follow:

Kind of oil used	Lima
Time of run	1 hour
Gas made, cubic feet	1486
Air used, cubic feet, atmospheric pressure	583
Pressure of compressed air in pounds	35
Volume of compressed air, cubic feet	250
Oil entering retorts, gallons	19.0
Oil recovered from scrubber, gallons	8.5
Oil converted to gas, gallons	10.5
Oil entering burner, gallons	4.0
Total fuel and gas-oil for run, gallons	14.5
Total oil, 1000 cubic feet, gas made, gallons	9.76
Total oil used in retorts, per 1000 cubic feet gas made, gallons	7.07
Total oil used in burner, per 1000 cubic feet gas made, gallons	2.69
Cubic feet of air per 1000 cubic feet gas made, atmospheric pressure	398
Cubic feet of air per 1000 cubic feet gas made, compressed	167
Gross B. T. U. per cubic foot of gas made	844.5

CHEMICAL ANALYSIS OF GAS MADE.

	Per cent.
Carbon dioxide (CO_2)	2.0
Illuminants soluble in bromine	25.5
Heavy hydrocarbons	0.5
Carbon monoxide (CO)	1.5
Methane (CH_4)	35.0
Hydrogen (H_2)	5.5
Nitrogen (N)	30.0

If we theoretically consider that the oil used on this series of tests contained 18,200 B. T. U. per 1000 cu. ft. and has a weight of 7.2 lb. per gallon, the following efficiency is obtained:

Heat units of oil used in retorts and converted into gas, that is, 18,200 B. T. U. × 7.2 lb. of oil per gallon × 10.5 gal. used in retorts = 1,375,920 B. T. U.

Heat units in gas made: 1486 cu. ft. gas made containing 844.5 B. T. U. per cu. ft., that is, 1486 cu. ft. ×844.5 B. T. U. = 1,254,927 B. T. U., which is equal to 91% recovery in heat units.

It should be noted that no account is here taken of the oil consumed by the burner. Considering this, the efficiency is reduced as follows:

18,200 × 7.2 × 14.5 = 1,905,000 = total B. T. U. in oil used.

Recovered B. T. U. in gas, 1,254,927.

$$\text{Efficiency} = \frac{1,254,927}{1,905,000} = 0.66.$$

The question is often asked as to how the gas works in the numerous appliances on the market. On all gas engines it works perfectly, and in all types of gas lights made for water or coal-gas there is no difficulty in adjusting the lights so that the producer-gas gives excellent results, in many cases the lights from the producer gas being far more brilliant than with coal or water-gas. This is especially true of lamps with Welsbach mantles. There has been some trouble with gas-stoves owing to the

fact that the specific gravity of the producer gas is about the same as air, in some cases slightly higher. The specific gravity of coal gas is only about 0.45, and carburetted water gas 0.65, natural gas 0.55 to 0.6, so that practically all the stoves on the market are made to use a gas which is about one half as heavy as the oil gas made by this producer. According to the Bunsen's law, the rates of flow of two gases through an orifice are to each other as the square root of their gravity. Therefore, since this gas is twice as heavy, it will flow as 1 to 1.414, when compared with gas at a gravity of 0.5. For this reason and because of the large quantity of nitrogen present from the air, only the oxygen of which has been used, the small and numerous orifices in a gas-stove burner are not as a rule large enough to admit the oil-gas flowing through rapidly enough and have to be drilled out about 50% larger. Unless this is done, the flame of a rose-burner has a marked tendency to blow itself out, as any gas will do when fed to a burner under too high pressure. In all other appliances on which the producer gas has been tried, it either works well without change of adjustment, or else the appliance can be adjusted without change in construction. Since the gas is made entirely from oil it need not be purified any further than a mere tar extraction, provided the sulphur-content of the oil is as low as $^{1}/_{10}$ of 1%. The possibilities of the producer are almost unlimited, as it generates power cheaper than can possibly be done by steam, and the gas gave good results in every field in which it has been tried. A ten-retort size, producing 1700 cu. ft. of gas per hour has a floor area 4 by 5 ft. and a height of 7 feet.

Fig. 4. Retort of Darling Oil-Gas Producer.

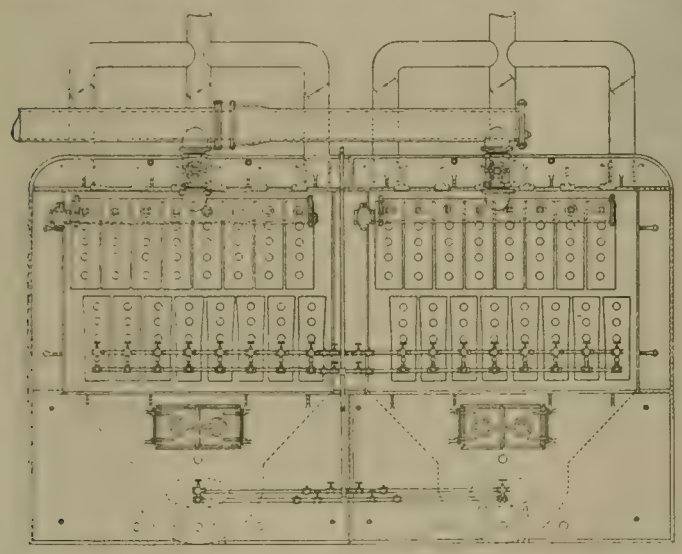


Fig. 5. Front Elevation of a 32-Retort Tarless Oil-Gas Producer, Capacity 5500 Cu Ft. per Hour.

MR MURPHY ON THE COPPER SITUATION.

"I see be th' pa-ap'rs," said Murphy one day as they were going on shift, "that since th' passage iv th' poor food law it has bin daysided that th' copper cint piece has bin wrongly la-abl'd."

"How is that?" asked McCarthy.

"Well, ye see," replied Murphy, "th' Injun sign on a piece iv copper cud be so asily misunderstood be th' thoughtless an' unha-adeful. Ye know they might jump t' th' conclushun that it was th' proper tra-ade mar-rk iv th' business, an' corrietly rapresinted what was on th' insides iv th' packa-ages they were being handed fr'm ti-me t' ti-me in th' stock exchange. This wud niver do at all ye see, as there niver has bin anny Injun characteristies such as cunning, 'r doopplicity, 'r dayceitfulness, 'r raypacity, 'r croolty, 'r bravery about anny iv th' doings iv th' la-ads who dale th' car-rds in th' copper ga-ame.

"So Rogerfeller, an' Guggenheinze, an' Colerine, an' th' ither la-ads got thegither wan da-ay an' daysided that th' poor food law was plainly being violated, an' th' Injun's head wud have t' come off. They had always fed th' public th' sthraight goods about Ama-algamated an' ither copper stocks, an' they did not want t' be li-ibled be th' Injun's prisince on a copper coin.

"After they had their minds set t' oba-ay th' law, they wud not rest contint with anny halfwa-ay maysures, but daytermined t' carry out th' spirit as well as th' letther iv th' law. They wud adopt wance an' f'r all an emblim f'r th' cint piece that wud prove how good an' pu-ure they ar-re.

"A committy was appinted, an' when it met a gra-ate dayscushun was held. Some were f'r puttin' th' Golden Rule on f'r a motto. Ithers thought 'twud be more appropria-ate t' use th' picture iv its Author. Wan la-ad finally suggested that as they all acknowledged their human origin it wud perhaps be betther to not claim compla-ate fra-adum fr'm human fra-ailties, but confess th' possibility that sometimes they might not be entirely thrue t' thimselves an' dayscind t' th' class iv th' la-ads Lincoln an' Washington."

"It that so?" exclaimed McCarthy.

"Yis," said Murphy, "an' afther further dayscushun 'twas daysided that th' la-ad Lincoln most thruely represinted thim. Ye see th' la-ad Washington was a bit austare in his morals, which ye cud not sa-ay iv th' copper bys; so thay passed th' wor-rd on t' th' Governmint la-ads, an' that's why we have Lincoln's head on th' wan cint piece."

"Ye don't sa-ay so!" was McCarthy's comment.

"I do sa-ay so," replied Murphy, "an' t' show ye how it pa-ays t' be kind-hearted an' honest an' aboveboard in ivery wa-ay, I must tell ye how th' la-ads have raycintly bin rewar-rded.

"Ye know that since th' price iv copper dropped t' th' bottom iv th' well, afther th' la-ad Rogers—who's dead now—used hayroic efforts t' kape it at twinty-foive cints, till th' public cud git th' benefit

iv th' high price be buying Ama-algamated on the strength iv it, th' la-ads have had th' har-rdest kind iv a time t' git it above thirteen cints again. Some onkind an' onsympathetic reproba-ates who desar-rve t' be choked on virdygrease have had th' ma-aneness an' th' har-rdihood t' sa-ay that th' price was where it belonged. If that was so, what wud become av all th' la-ads who can't produ-uce a pound iv th' rid metal f'r less th'n four-rteen cints. I'd like t' know! Down wid th' thra-at'rs!

"Well, t' show ye how th' good ar-re raywar-rded, some iv th' copper bys—th' A-brham Lincoln kind—got thegither an' daysided that t' give th' four-rteen cint la-ads a chanct t' live an' enjoy thimselves a bit, th' price shud go t' sixteen cints; an' that a mer-rger was th' thing t' put it there."

"What do ye ma-ane be a mer-rger?" asked McCarthy.

"A mer-rger," said Murphy, "is a benevolint insthrumint av Pr-rovidince, rayvealed t' humanity be dirict inspir-rashun in th' minds iv such grate an' good men as John D. Rogerfeller, an' Henr-ry Havymore, f'r th' pur-pose iv demonstratin' the gr-rand old truths iv th' law iv Kipling an' Darwin that only th' sthrong shall prosper an' those that ma-ake good sur-rvive. 'Tis a wondherful dayvice f'r ma-akin' this law git a move on itself.

"As I was sa-ayin', though, it was daysided be th' Lincoln copper league, that a mer-rger was na-aded an' wan shud be formed at wance. No sooner did th' general public rayilize th' troubles iv th' four-rteen cint bys, though, an' what was proposed f'r thim, thin they rushed t' th' rescue an' began t' buy copper f'r th' purpose iv boostin' it up t' th' sixteen cint mar-rk t' help thim along. I tell ye, McCarthy, th' world is growing betther each day."

"Is Sinitor Clar-rk av Montanya goin' t' hilp thim for-rm th' mer-rger?" asked McCarthy.

"'Tis har-rd t' say," replied Murphy. "Th' ex-sinitor be request, goes about with a dra-amy look in his fa-ace, an' ivery wance in a while he pulls a hair fr'm his whisk-rs an 'We'll for-rm it', he says. Afther a bit he pulls anither wan, an' 'We'll for-rm it not', says he. An' so on."

"'Twill be a tay-jous wa-ait f'r th' other bys, judgin' be his pickchures," said McCarthy, "but why don't they go ahead without 'im?"

"They're afra-aid he'll write a new declarashun iv independents," replied Murphy.

"What wud it be?" asked McCarthy.

"T' hell wid ye," said Murphy. "Ye see whin a man c'n sell his copper f'r six cints an' ma-ake money at it, th' la-ads that are thryin' t' boost th' price t' fifteen cints wud be in an awkward fix if he said that tin cints a pound was enough f'r annywan, an' backed th' pla-ay."

"I see," said McCarthy.

"But that is nayther here nor there," continued Murphy. "Th' big thing in th' copper business nowadays, is th' low-gra-ade orebody. Ye see th' la-ads in Arizona, Nevaday, an' Utah have bin makin' such a foine demonstrashun iv its value la-ately, that th' people ar-re gittin' hold iv th' idea, an' th' lower th' gra-ade now, th' betther they like it. A man with a tin per cint proposition cuddn't git a look in at a foive cint piece be wa-ay iv promoshun nowadays, but if his ore shud only run wan per cint he'd be smothered in granebacks.

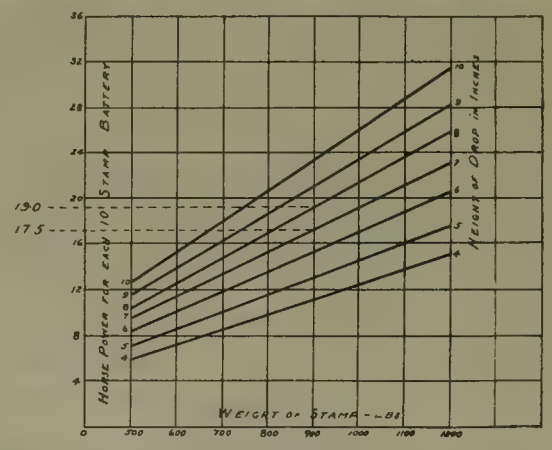
"'Twill not be long before me frind Channing 'r Mudd 'r Yeatman will be writin' raypoorts an' sa-ayin': 'I have th' honor an' th' pleashure, gintlemin, t' raypoort that ye-er engineer has most carefully examined th' Consolidatd Double Cross mine, an' ricomminds it f'r immajiate purchase. 'Tis a most phenominal orebody. Fr'm th' looks iv it ye'd think there wasn't a pound iv copper within a thousand miles. 'Tis th' hungriest lookin' rock I iver saw; an' without a parthical iv exaggerashun I c'n sa-ay it is th' lowest gra-ade yet discovered. It is so low I am forced t' th' use iv mathematical an' physical ter-rms t' properly describe it. Fr'm an averige iv all me assa-ays I c'n sa-afely sa-ay that th' ore carries minus thray an' wan half per cint iv metal. In other words, there is a copper vacuum. I c'n sa-ay no more, f'r language fails t' express me emo-oshun. I c'n only urge ye t' raise th' money at wance an' close th' dale within delay, befure th' chanct is lost. It shud be th' most successful promoshun iv th' a-age."

"Do ye mane all iv thot?" asked McCarthy.

"Well, I dinnaw," said Murphy, "'tis not so far off. Th' public wud git a betther run f'r its money than it gits par-rt iv th' time now.

POWER REQUIRED FOR STAMPS.

In a recent number of the *Australian Mining and Engineering Review* is a convenient table for calculating the horse-power required per stamp under various conditions. The following example explains the method. Required: the horse-power necessary to drive a 10-stamp battery of 900 lb. stamps, 90 drops per minute, height of drop being 7 in. Take the figure 900 under the 'weight of stamps', follow



this line vertically until it intersects the 7-in. drop-line, then proceed horizontally to the left of the diagram, where it will be found that the required power for each 10-stamp battery is 17.5 hp. Another use of the diagram is in finding the change in horse-power by varying the height of the drop without changing the weight of stamp; for example, with a 900-lb. stamp, in changing the drop from 7 in. to 8, the increase in horse-power for each 10-stamp battery is from 17.5 to 19 horse-power.

SLAG REDUCTION.

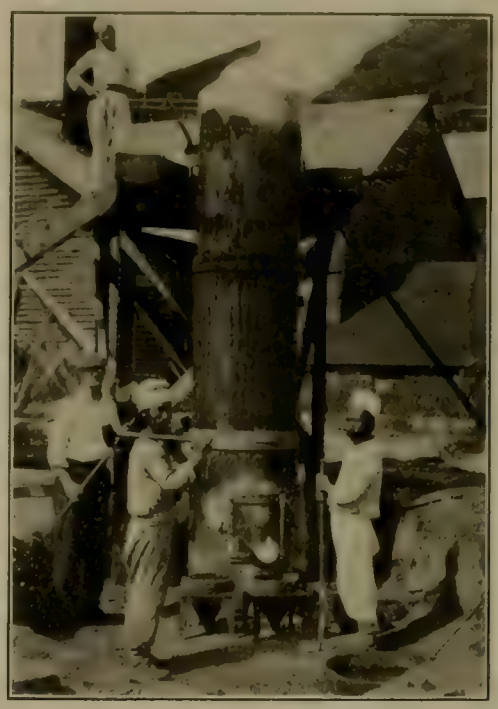
Written for the Mining and Scientific Press
By J. D. Hedges

The slags obtained from the reduction of precipitates at the cyanide plant of the Oriental Consolidated Mining Co., Taracol, Korea, amount to from 1000 to 2300 lb. per month, and assay from 0.28 to 0.70c. gold per pound. In the past we shipped these slags to a smelter on the Pacific Coast for reduction, having no facilities for extracting the metals here. The smelter returns were unsatisfactory, and after receiving returns on a shipment that ran 32% lower than the company's assays, we cast about for a method whereby we could keep that 32% at home.

A slag assay is necessarily difficult on account of the 'scale gold', so the smelter cannot altogether be blamed for playing safe. The gold remaining in the slags is not altogether represented by 'shot' gold, as one would naturally suppose, but is held in the iron matte that does not always break clean from the slag when tapping off. Drippings from the crucibles, iron scales from the roasting pan, overflow from the matte treatment, skimmings, etc., represent the balance. If shot gold alone remained in the slags, the reduction would be simple, as re-grinding in the clean-up barrel with quicksilver, followed by cyaniding the tailing, would result in a high extraction. The main objection to this method I think is, that if black lead crucibles are used in melting, a fouling of quicksilver is bound to take place in the barrel; and, if charcoal is used as fuel (as is the case here), a loss in cyaniding will occur in the leaching vat due to the precipitating qualities of charcoal. Both graphite and charcoal are generally to be found in such slags, and the percentage of extraction in this case cannot be reliably determined from a slag tailing assay.

To overcome the troubles here, I employed the blast-furnace principle, and constructed a stack 12 ft. high, in three sections of 4 ft. each. The outside diameter is 30 in., and the inside diameter is 19 in. The distance from the bottom of the brick lining to the top of the stack is 10 ft. Fire bricks 9 by $4\frac{3}{4}$ by $2\frac{1}{2}$ in. were used, being set lengthwise with the stack, having the width $4\frac{3}{4}$ in. on the radius. This gave a lining of 5 in. all around the inside of the stack. Clay was used as mortar. The shell of the stack is of $\frac{1}{8}$-in. sheet-iron. Lugs were riveted on the sides of the two top sections to facilitate handling. A $\frac{1}{8}$-in. sheet-iron door 14 by 18 in., and curved to the contour of the stack, was hinged at the tap. The door is necessary, as, at the end of each heat the residue of the charge must be drawn. The door is opened, two of the bricks are knocked out, and the residue drawn off through the hole thus made. This gives us a clean stack for the next heat.

Two tap-holes are used, the lower one, $1\frac{1}{2}$ in. diam. at the extreme bottom of the brick lining, and the top hole $1\frac{3}{4}$ in. diam., is 5 in. higher up. I made the mistake of having these tap-holes too small at first, and had to enlarge them to the above dimensions. The slag is tapped off through the upper hole, and the base metal through the lower one. The bottom 2 ft. of the stack was filled with concrete, and on this the bottom bricks were laid. These bricks slope from 6 in. below the draft hole, to 10 in. at the lower tap-hole. This slope is necessary to make the metal run off thoroughly. The draft hole 6 in. diam. was first placed at the back of the stack, and directly opposite the tap holes. In practice this gave poor results, as a back air current formed which burned out the lining over a considerable area directly over the draft hole, not visibly affecting the lining anywhere else. All efforts to shift the feed would not overcome this fault, so I finally had to divide the draft and introduce the air-blast through two $3\frac{1}{2}$-in. holes on the sides, and at right angles to the tap-holes. The air-blast through these side holes was given a slight cant toward the centre of the bottom. This



Slag Furnace at Taracol, Korea.

gave entirely satisfactory results, and caused an even wearing of the inside lining. A No. 2 Sturtevant fan, running 2600 rev. per min., gives just the right amount of draft-pressure at the stack.

After much experimenting I determined the right proportions for the charge. One-half coke, one-half charcoal, and one-eighth slag, by bulk, were mixed, and fed slowly and continuously into the stack. I would prefer to use coke alone were I closer to a source of supply, but here the cost is high. On starting, the stack is heated with coke, and allowed to run half an hour on the air-blast before commencing to charge the mixture. The stack is charged to a height of about 6 ft. from the bottom, leaving 4 ft. open. On account of the tendency of the charge to pack, this is necessary. At intervals a layer of 1 ft. of clean coke is fed to further overcome this packing tendency. Also, at intervals, slag from the assay office (high in lead content) is fed, and sufficient lead is reduced to bring down the precious metals. The assay-slag also contains a good percentage of unsatisfied flux, which helps to liquefy the charge, and to overcome the clogging tendency of the ash formed.

The metals settle quickly to the bottom through the liquid top-slag. The top-slag is tapped off frequently from the top hole, into conical molds, and at longer intervals the metal from the bottom tap-hole. The top-slag is perfectly liquid, and is low in assay value, the assays giving about ½c. per pound. The base metal is later run into bars and a bullion sample is taken. An average bullion-assay on this base metal shows fine gold 34.45, and fine silver 259.51.

The cost of treatment per ton of slag by this process is $32.89, divided as follows:

Coke	$22.50
Charcoal	2.25
Labor	3.40
Power	1.27
Iron, etc.	0.31
Fire brick	1.30
Depreciation	1.86
Total	$32.89

The one item of freight to the Pacific Coast formerly cost $20 per ton.

SELENIUM IN WASHINGTON.

The discovery of a selenium mineral in the gold-quartz ores of the Republic district, Washington State, was announced at a recent meeting of the Geological Society of Washington, by Waldemar Lindgren. The veins, which have yielded several million dollars in gold, are contained in Tertiary andesitic rocks and tuffs. The vein matter is quartz, chalcedony, and opal deposited in concentric crusts. Adularia, in considerable amount, also occurs in the gangue. Ore minerals, and particularly native gold, are rarely visible in the gangue, and the ores have proved difficult to treat. In rich ores slight black streaks indicate the presence of metallic minerals, and in a few places, in the Republic mine, a well defined black or dark gray mineral forms crusts a few millimetres in thickness. This material is exceedingly rich in gold, but contains no free metal. It consists mainly of an antimonial tetrahedrite associated with specks of chalcopyrite. A partial analysis by Mr. Palmer, of the United States Geological Survey, showed no tellurium, but the presence of about 1% of selenium, which in all probability is combined with the gold. This interesting result places the Republic veins in the rare class of Tertiary selenide veins, of which Tonopah is the only known representative in the United States. From descriptions, one of the few deposits of this kind, outside of the United States, is that of Redjang Lebong in Sumatra. No doubt the difficulties which have been experienced in the treatment of these ores are attributable to the presence of selenium compounds. Further metallographic investigations are now in progress to determine the exact character of the selenide.

Deposits of ores of vanadium, one of the rare metals, occur at several places in the western part of the United States, according to a report just issued by the Geological Survey, but none of these were mined in 1908, although 300 tons of vanadium ore was imported into this country from Peru during the year.

CORTEZ ASSOCIATED MINES.

A corporation has recently been organized in Boston which is expected to become so important in the future development of the mineral resources of Mexico as to call for more than casual mention. In fact it starts upon its career with as much promise of a brilliant future as did the ill-fated New England Exploration Co. This is the Cortez Associated Mines, which includes in its personnel many well known Bostonians. The articles of incorporation were taken out in West Virginia, the capitalization being $1,500,000, divided into 500,000 shares of $3 par value. The original operations will be in Hidalgo, Mexico, where the company owns 934 claims, amounting to 2307 acres, said to contain valuable deposits. The officers are: William G. Rice, president; Joseph Story Fay 3rd, vice-president; Philip W. Wrenn, secretary and treasurer; Olof Wenstrom, consulting engineer. The officers, with Chaucey Eldridge, George S. Baldwin, and W. Martin Swift, constitute the board of directors. The company will issue 275,000 shares, of which 175,000 will pay for the property in full, including promotion charges, and 100,000 shares are offered the public at par. The entire issue has been underwritten, and the 175,000 shares will be put in escrow for one year, leaving on the market nothing but the full paid shares. The underwriters' commission is 25 cents per share. In taking stock in payment for the property, the former owners have emphasized their faith in the enterprise, and the cash raised by the company will go into actual mining and equipment. The 225,000 shares remaining unissued in the treasury provide a valuable asset for future financing, if required. It is understood that the company will organize a number of subsidiary corporations, and that its operations will ultimately extend over many States.

The lands are in two groups, lying 4½ miles apart, near the town of Jacala, in the State of Hidalgo, Mexico. Jacala lies north of the famous mining camp of Pachuca. The lands also are not far distant from the other well known camp of Zimapan, and at Flojonales, 15 miles distant, extensive low-grade copper deposits are under development by the Robert S. Towne interests of New York. Jacala lies about midway between the City of Mexico and Tampico, and is on the line of a railway now under actual construction. The company's holdings have been selected personally, after thorough investigation by Olof Wenstrom.

The property includes many antiguas, or old Spanish-Mexican mines, there being several hundred old mines, pits, and tunnels remaining from early operations, and some of the more extensive of these have reached a depth exceeding 600 ft. The veins are in limestone with associated porphyry. Sampling of the available workings in the oxidized zone in connection with actual records of past production has given satisfactory results, showing ores containing gold, silver, copper, and lead in commercial amounts. Much work has been done on an available water-power near Jacala, including surveys, on which engineers have been employed for an extensive period.—Adapted from *Boston News Bureau.*

CONSERVATION AND INLAND WATERWAYS

By Edward P. Norton

The conservation of natural resources has two possibilities wrapped up therein, one of which is doubtful as to benefits, the other is undoubtedly bad. I refer to the intended increase in the already large number of Government appointees. With a growing tendency to have our Presidents selected by a group of high financiers whose interest in their adopted or native country is subsidiary to possibilities of immediate gain, the interests of the country make it imperative that the Executive should not have his influence and power over the legislative branch increased. The power of appointing and fostering the interests of a large body of civil servants must inevitably have a strong reflex, if not direct, influence on the acts of legislators who wish aid from their constituents, thus increasing the Executive power to an extent dangerous to the form of government under which we have lived for over a century.

The ostensible reasons for the movement for the Conservation of Natural Resources is that, first, large bodies of wooded land may be created at the headwaters of streams to increase the rainfall and retard the run-off or stream-flow in times of heavy rain. For over 30 years a comparison of rain-gauge records has increasingly shown that the rainfall is not so great over large areas of wooded land as on cleared land, though there are claims that small areas do increase the rainfall to some extent. It is also well known that in times of prolonged drought the ground is dry to a greater depth in forests than in either plowed land or meadows, and dry ground cannot, of course, afford much water to streams. It is further maintained that deforestation has increased both the frequency and amplitude of floods and the duration and intensity of low waters. Careful comparison of statistics does not prove this claim. At the Tenth International Congress on Navigation, Milan, 1905, 'The Influence of Deforestation, etc., on the Performance of the Rivers' was one of the questions discussed. This was reported on by eight European engineers, who left the matter undecided in the minds of those educated to the popular beliefs. Last fall this subject was brought before the American Society of Civil Engineers by a paper, 'Forests and Reservoirs in their Relation to Stream Flow', by Lieut-Col. H. M. Chittenden, U. S. Engineers. This paper was discussed by 23 engineers, foresters, and professors, leaving considerable latitude for the entertainment of previous or subsequent beliefs on the subject. On both occasions it was seen that engineers directing works for improving rivers were nearly unanimous in their doubts as to the advantages to accrue for either forests or reservoirs.

The second aim of the conservationists is to prevent water-powers falling into the hands of monopolists. This seems an attempt to play on the dissatisfied poor. Its success will tie up the development of sparsely populated regions, and by keeping the producers and consumers of both agricultural and manufactured products as widely separated as possible, will render the products of either of less value to the other. The aim of the protagonists of this plan seems to prevent the prompt development of water powers and the industries dependent upon their employment. Each horse-power of utilized power is understood generally to add one person to the population of the locality where it is used. The success of their plans would confine manufacturing to its present limits and methods. Neither capital nor free labor will go into work or enterprises not promising a living wage or remunerative return, and the purpose to have the general Government exact all the rent that production can bear, combined with the plan of short leases, will probably confine the extension of manufacturing to already well financed localities. In the meantime the water runs unused to the sea. Coal, which it is wished to conserve, is used at a greater cost, while the water-power is wasted and the laboring population is being increasingly congested.

Since the Dingley law was passed, which it was plainly seen would increase our wealth, a vigorous propaganda has been waged against aggregated capital. Our trade rivals know that production can be cheapened either by reducing wages or by increasing the capital employed, whether in power, machinery, or transportation. The first method is unthinkable here, but as segregated capital is powerless for large production the attack has been directed against large accumulations of capital, whether of cash or credits, which are necessary to cheapen production. Two years ago the attack was tolerably successful. When the Steel Corporation took the rail contract for the Sultan's railroad through Arabia away from Fraülein Krupp by underbidding her, the wheat growers of Minnesota, Iowa, and States adjacent, were told by their leaders that a great injustice was done them by underselling the American market. They knew perfectly that not a pound of freight for those rails was transported, nor a single rail made, except by men who ate, as an average, over 300 lb. of American-grown wheat, while they did not say that the average German per capita consumption of American wheat was about 10 lb. While the stand-patters will assert it was the tariff, and others will say it was the aggregation of capital, no one dare deny that for every week during 1906 and 1907, quotations for rails were higher at the mill-doors in England than at the mill-doors in this country, reaching in August 1907, £6 17s. 6d., or $5.54 above the American price; and if our consumers had paid the prices the British had to pay, our rails for 1906-07 would have cost us over 25 million dollars more than they did. Few can say that poorly financed and disorganized companies would not have kept the price of rails up to the British standard. If we had made no rails, or even had been unable to supply our demand, the $100 per ton to which Mr. Carnegie testified would have gone to foreign rail makers.

Possibly none of our assets has added more to the national wealth than low freight-rates, and any saving in the cost of transportation is net wealth to the community in which such saving is effected. For 30 years we have enjoyed the lowest freight-rates in the world. Our trade rivals have made American railroad finance the object of unremitting attack. In this they have been aided by personal differences with

*Abstract from the *Editorial Review*, New York.

railroad servants in addition to all the venal influence purchasable, but as the capitalization of our railroads has been increased, the cost of their services to the public has been decreased. The most valuable service of railroads is the transportation of freight. This is measured by the equivalent of the number of tons carried one mile (called ton-miles) and the cost per ton-mile. The relations between population, railroad capital (that is, stock, bonds, and unsecured debts), ton-miles, and cost of freightage, for the two years 1882 and 1907, is shown below, notice being called to the fact that 1882 was the first year for which all these items were attainable, and was before the era of consolidating competing roads into 'systems':

	1882.	1907.
Miles railroad	114,677	236,949
Capital	$6,640,493,397	$16,670,802,244
Ton-miles	39,203,209,249	233,137,507,807
Rate, cents	1.2	0.782
Ton-miles per capita	748	2717
Population	52,495,000	85,817,000

It will be seen that while our population increased 63½% and our mileage a little more than doubled, capital increased more than 2½ times, the ton-mileage nearly 6 times, and the cost per ton-mile was less than two-thirds of what it was in 1882. The difference between the actual cost in 1907 and what would have been the cost for the same service at the rate received in 1882 amounts to $11.35 per capita, or, to the estimated population of 1907, an aggregate of $974,000,000, being over 1% of our estimated wealth for 1900.

This rather large sum increased the profits of every producer and decreased the cost to every consumer of commodities carried by our railroads. The railroads undoubtedly received a reflex benefit through the larger consumption and higher standard of living which the saving in freight charges allowed. This is shown by the increased passenger traffic. In 1882 the average citizen traveled 130 miles, and paid 2.86c. per mile. In 1907 he traveled 328 miles, and paid 2.04c. per mile. Third-class railway fare in Great Britain is 1d., or 2.03c. per mile.

It is of interest to note in connection with the fact that from 1890 to 1905 the capital necessary to put a man at work manufacturing, increased from $1385 to $2065, and in farming the sum necesary increased during this period from $2110 to $2756; the economies rendered possible by the large accessions to railroad capital above mentioned have reduced the capital employed to move one ton one mile from 17.54c. in 1882 to 7.15c. in 1907. This allows the same service to the public for about 40% of the capital. If the railroads had to struggle for a capital per unit of service equal to that employed in 1882, it is a fair inference that both farmers and manufacturers would have been seriously hampered in procuring the capital necessary for increasing and cheapening their products.

The plan of the conservationists also includes preventing the monopoly of farm and coal lands, the term monopoly being understood to refer to any large holding. Both of these objects are meritorious, but withholding large areas from settlement seems an oblique way of accomplishing the first object, and experience shows that the small holder of coal land is much more apt to rob his mine than a railroad owner, which takes out all the coal on which it can make a profit either by mining or by carriage to market.

Conservation of natural resources had its genesis in the demand for a capacious and economical waterway from the Great Lakes to the Gulf. It may have been thought that the universal demand of the Central West for such increase of their wealth as would be contributed by cheaper transportation could be made to help other schemes, or that the other schemes would hinder the acquisition of Central Western wealth. Mr. Roosevelt, it will be recalled, endorsed the deep-water project with conscientious enthusiasm in 1906. In 1907 he appointed an Inland Waterways Commission, which made its preliminary report in 1908. From the simplicity and directness of this report the entire conservation policy has been developed. Why the President appointed as chairman of this Commission a Congressman who was understood to have prevented an appropriation for a survey for this deep-water project, a Congressman against whose course resolutions are said to have been introduced in the Legislatures of both Missouri and Illinois, may never be known. Whatever the animus of the appointment may have been, it has issued in delay, and will result, as far as the influence of the chairman goes, in a recommendation for such inadequate and restrictive depths as will effectually prevent an accession of wealth to the country, either from improvements of the Mississippi, or an enlarged and continuous Atlantic Coast waterway. President Taft is talking of a 9-ft. navigable channel along our coast, when even the Dismal Swamp Canal has 10 ft. This 9-ft. proposition for the Atlantic Coast-wise canal is particularly atrocious, as aside from its commercial value, a canal of warship capacity along the coast would prevent the blockading of any port unless by a fleet superior to all the ships in the home fleet. With it, American exports would go unhampered to the sea except from one, or, at the most, two, of our Atlantic ports, under any combination against us, and the necessity for warships would be reduced.

The principal beneficence of water transportation, in sufficiently capacious channels, is to allow the production and consumption of commodities of such small value as are not able to pay railroad freights, instead of extending aid in cases of spasmodic congestion. Railroads share in the benefits at each end. This is shown generally by the fact that railroads serving capacious waterways serve also the largest populations, and carry the most high-classed freight per mile.

Foreign interests will try to prevent a commercially valuable coast-wise canal or any deepening of Western streams of economic value. But the size of locks prescribed by the Illinois Legislature will prevent expenditures to keep Lake-built vessels from access to the sea, where they would carry our products directly to a market. It is my conviction that the aims of the Inland Waterways Commission, as set out in Senate Document No. 325, are hostile to the labor and prosperity of the country, and their plans should not be endorsed.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than mere commendation. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Oriental Trade and American Shipping.

The Editor:

Sir: In your issue of September 25 appeared a communication from Edward P. North which concludes in this fashion: "What sort of a chance has an American * * * manufacturer of exploiting * * * * the Orient. "Until someone opens a downright fight every corrupt influence in the American Government will give preference to foreign shippers and shipowners." The idea lying back of such a statement as this is so ridiculous, and so at variance with the facts of the case, that I cannot forbear replying, but have delayed doing so until I could collate from my own experience the records of concrete cases as illustrations.

As I take it, the idea of this writer, and, presumably, of a considerable portion of the American public (for I have often seen similar expressions in print) is that the foreign trade of American manufacturers would flourish were it not for a stupid and even criminal policy of the Government, which prevents it. Leaving out of the discussion any question as to what possible advantage it could be to either the Government or any of its employees to do this, I propose to point out that the causes which tend to prevent the growth of American trade in the Orient lie at the door of the manufacturer himself; and I make this, not as an empty assertion, but as the result of experience in placing orders both in America and Europe for a wide variety of goods.

The first reason why American trade with the Orient does not flourish better is that American firms do not make any real effort to secure orders from the Orient. Most of the larger firms have a perfunctory agency with some English or German firm which is engaged in a general export and import business. If you visit one of these firms you will probably find that they have not even any advertising literature of these American goods. Almost certainly you will not find any samples. Now the Oriental is an adept in misrepresentation himself, and thinks himself far too wise a bird to be deceived by a glittering picture into buying something that will not be as represented. Certainly you will not find anyone at the agency who knows anything about the product in question, but they will have some British or German samples to show you which they 'can assure you will be entirely satisfactory', and it is politely intimated that it would be rather unwise for you to invest in some doubtful American product when you have these others here before you and can see what they are like. The other day I was talking with the representative of a British firm which has the agency for the Lima Locomotive & Machine Co. He said that he had sold several of their locomotives to a new railway here, because the engineers of the road (Chinese educated in America) had insisted on getting them. He said he did not know much about the locomotives, and added that he thought American locomotives generally inferior to the British makes. I have not yet written to the Lima Locomotive company to congratulate them on their effective agents in the East, but I hope they will read this. The same man also mentioned that he is the agent for Fraser & Chalmers, and when I said that I should naturally prefer to deal with their American house, he expressed great surprise that they had any American connections, and ventured the remark that they must be quite unimportant.

Even supposing that some enterprising buyer learns of an American product that appeals to him, hunts up the agency, resolutely refuses to take any British or German brand and insists on having his order placed for it. Does the manufacturer promptly and accurately fill the order, and does it arrive in good condition, quite to the satisfaction of the purchaser, who then sends further orders? Unfortunately, no. Of a series of orders placed in America, only one, with a San Francisco firm, met these conditions. The trouble with most of the others was apparently a lack of ordinary intelligence on the part of the manufacturers. One firm was ordered to send a large number of small packages by registered mail. Although situated in the interior of the country, this firm packed them all in one box, sent them by freight to New York, and thence by tramp steamer by way of Suez. They arrived so many months late that arrangements had been made to get along without them, and the shipment was refused on delivery. Another firm was ordered to send some small articles by parcels post. This firm took the packages to the Post Office, not in Podunk, but in New York, mind you, and the Post Office refused to take them, on the ground that Tientsin is not a coast port. As ocean-going steamers land at our Bund, it would be interesting to know what a coast port is according to the Post Office. This firm had no recourse but to ship by express, a most unsatisfactory way, as it entails the maximum of cost and the minimum of speed. The goods have not yet arrived, eight weeks from the time of shipment. Goods were ordered of another firm in one of the Rocky Mountain States. No notice of shipment was sent, and after waiting as long as possible, about $100 was spent in cable tolls, trying to find out whether shipment had been made or not. The goods were five weeks traveling 1000 miles to San Francisco by rail, and the freight charges for this distance were just equal to what they were for the 6500-mile remaining ocean-haul.

Not less annoying to the purchaser are the little stupidities that crop up. Firms which have been instructed to draw on us at the time of shipment will send a bill instead, and continue to send monthly bills (with a two-cent stamp on the letter), quite regardless of the obvious fact that it would take three months to get a reply to their first bill. Then, several weeks after we have sent them a draft, we will get a notice from our bank that they have at last drawn on us for the amount of the bill. Not a few send letters soliciting our trade, with a two-cent stamp on the letter. Of course, as soon as we have paid the double postage, we hasten to order.

Another point is that the American goods are not so well packed. I could mention cases of this, but I pass on with the general remark that American goods are neither so well nor so carefully packed as the German and British, in most instances. Another well known fact is that the American usually pays comparatively little attention to the appearance of his goods. The Oriental likes red lacquer and gold paint on his purchases. He is lucky if he gets any paint at all on his American purchases, and if there is it will probably be battered and scarred.

In the face of all this it is remarkable that there is any American trade here at all. That there is any is due, I think, to the fact that the actual 'usability' of American goods is generally much greater than the foreign article. A newspaper received today says that President Schurman has returned from a trip to Europe with the announcement that American goods cannot compete in quality with the foreign. The good Doctor must have confined his attention to dry goods and 'wet goods', or else he is a poor business man. Everybody knows that wines and many varieties of cloth are made better abroad because climatic or other conditions give the foreign countries an advantage. But with every kind of goods with which I am familiar I can specifically deny Dr. Schurman's assertion. In almost every case the quality of the material in the American article is equally good and the workmanship (but not the finish) is superior. Far superior are the American designs. The American article is generally much better adapted to the work it is intended to perform than is its foreign competitor, but I must qualify this by adding that the American manufacturer makes absolutely no effort to find out what modifications of the home designs the foreigner wants. In this matter the Germans are zealous. Contrast also the methods of the British and Germans. They have their own agencies, manned with representatives who are familiar with the objects they are supposed to sell. Most Americans seem ignorant of the European idea that people engaged in wholesale trade are entitled to move in good society, while those in the retail business are tradesmen, and are not to be noticed. It is a fact, nevertheless, so that the representatives of European firms are generally intelligent gentlemen. The few American firms that send representatives send mannerless young cubs, or roisterous drummers who frequently earn speedy contempt from Europeans and Orientals alike. Finding themselves looked down upon, they begin to brag of things American, and so become still more disliked. The Oriental is a stickler for good form, and the first requisite for a representative in the Orient should be tact and good manners—not 'American push'. Finally, the Germans fill an order with painstaking accuracy, and the British do nearly as well. You can get an order from here to Germany in 12 to 14 days and be confident that the goods will come forward exactly as ordered. If you send one to America you have four to six months in which to wonder what new form of stupidity the shippers will perpetrate, before you get your goods. But this is, of course, the fault of our wicked and corrupt Government!

Where the manufacturer does so little to recommend himself it is not remarkable that our diplomatic representatives in the Orient do not do more. The British and German ministers are keen in backing up firms of their own nationality in their efforts to get trade, but the American representatives get the cold shoulder at the American legation. Neither is there any American commercial attaché, although every European country, even Sweden, has one. It would undoubtedly be easy to secure the appointment of one if American manufacturers should manifest any serious desire to increase their trade with China. I may be pardoned for taking up so much space, but I could not suffer the blame to be laid on the wrong shoulders, while the real source of the difficulty goes unnoticed. All loyal Americans would certainly rejoice to see an increase in American trade with the Orient, but with equal certainty it is not likely to grow unless more intelligent effort is directed toward securing it.

THOMAS T. READ.

Tientsin, China, December 9.

Metallurgical Progress in Colorado.

The Editor:

Sir—The attention of this company has been called to an article by Philip H. Argall in your issue of January 1, 1910, in which (on page 40) he makes an uncalled for and unmerited attack on the operations of our smelter at Modern, near Denver, Colorado. The article is so obviously unfair, that if it is not due to lack of exact knowledge, we might be justified in suspecting that Mr. Argall held a brief for one of the most powerful interests in this State, which considers it greatly to its advantage that our smelter should go down as a failure and that the miners of Leadville, Gilpin, and Clear Creek should become more securely fastened in its clutches—interests which, in the past, have used every means at their command to strangle all other smelting enterprises.

The ore buying of our company is not confined to Gilpin county. Half of our ore supply comes from Leadville, Redcliff, and the Salida districts, and our railroad connections are the same as those of the Globe plant of the American Smelting & Refining Co. We are treating sulphide ores, carrying gold, silver, and copper, at lower prices than can be done by any other plant in this State, and this is the reason for our existence. Other plants, which have to roast and run slags low in silica, are unable to get sufficient ores to keep them busy, while we can treat these low-grade, deep-level pyritic ores at a small profit to ourselves and to the miner. By our methods of charging, our metallurgist has absolute control of his charge, and our metallurgical results compare favorably with the best practice anywhere. We use 4% less coke, and make slags 8% higher in silica than any plant now operating in Colorado. We have made slags for days carrying only a trace of gold, 0.25 oz. silver, and 0.05% copper from charges which contained 0.5% copper. The freeze-ups which occurred during the first ten days of our operations were due entirely to minor mechanical defects which have been entirely overcome, and no freeze-up has happened since October 15. The matte,

which is very high in grade, is not sold as stated by Mr Argall, to the American Smelting & Refining Co., but is sold directly to the refinery of the United States Metals Co. of Chrome, New Jersey. We do not regard ourselves as in any way competing with other smelting companies, as we are in the market for ores which are not desirable to other Colorado smelters and which have been accepted by them in the past as an unavoidable evil and which they were compelled to treat as a by-product for their customers who were producing desirable ores. The Bimetallic at Leadville, under Mr. Nutting, was a success as a pyritic smelter, and the failures at Golden, Florence, and Kokomo, were due to special, local, or personal reasons, well understood by the metallurgists and mining men of Colorado.

THE MODERN SMELTING & REFINING COMPANY.

Denver, Colorado, January 10.

Cyanidation of Manganese Silver Ores.

The Editor:

Sir—Referring to your reprint of my paper on the 'Cyanidation of Manganese Silver Ores' in your issue of December 4, 1909, I wish to add that a mere list of the constituents of an ore has very little bearing on its amenability to cyaniding. For instance, manganese dioxide can be added to a silver ore without having any effect on the results of cyanidation. Some manganese ores are amenable and some are not, according to whether the silver is intimately associated with the manganese or not. In the instances mentioned in my article it was not possible to isolate the manganese mineral which gave the trouble, as it was so finely disseminated; consequently the manner of association can only be conjectural.

From the facts elicited from my experiments it would seem as if this were a case of definite manganese-silver mineral, though I have never come across any mention of such a mineral in the text-books. The subject offers an interesting study to anyone having the leisure and appliances for research work, and few mines are equipped for detail research work.

E. M. HAMILTON.

Lluvia de Oro, Mexico, January 3.

Graphite—An Obstacle to Good Cyaniding.

The Editor:

Sir—Regarding 'Graphite—An Obstacle to Good Cyaniding', by M. W. von Bernewitz, in your issue of December 4, there is no doubt in my mind that graphite does interfere with the extraction of gold from refractory ores. In treating slags and crucibles (crushed in a ball-mill with cyanide) I have had no trouble. As far as my experience goes, graphite ores are 'refractory', and there seems to me to be some connection between the graphite and the refractory effect. For instance, in the Ashanti Goldfields the current tailing when treated with 15% KCy solution gave a poor extraction, while accumulated tailing, after preliminary washing and alkaline treatment, gave good extraction. In both cases graphite was present in sufficient quantity to form a scum on the surface. This graphitic ore of the Ashanti Goldfields, which contains a greater percentage of graphite than does the Kalgoorlie ore, and like the latter occurs in schistose rocks, is now treated by dry crushing, roasting and cyaniding, an extraction of over 90% being obtained.

The ore is put through a revolving dryer and crushed through a 25 mesh screen in No. 5 Krupp ball-mills. From them it is conveyed to an Edwards duplex furnace, and then to cooling bins by means of a push conveyor. The roasted ore is leveled and cooled, and dampened with water in these cooling bins, and is then trucked to cyanide tanks, where it is treated with 0.25% KCy solution.

There is no separation of sand from slime. Sintering is prevented by the careful manipulation of the air-inlets close to the end fire-grate, where is the greatest heat. If the ore should chance to form lumps, the complete removal of the air-inlets will soon cause the lumps to disappear. The test for a good roast is to take a little of the discharge; let it cool; put it in a glass beaker; add clear water, and if no graphite particles float on the top, the roast is good. The roasted discharge should be tested every half hour. This can be done by the fireman.

I do not agree with Mr. von Bernewitz that "the trouble can only be minimized by carefully excluding such ore from being sent to the mills." The plant at Ashanti Goldfields, Gold Coast Colony, has been treating graphitic ore (containing more graphite than the Kalgoorlie ore) successfully for the past three years, obtaining an extraction of over 90 per cent.

DONALD F. FOSTER.

Belmont, Sutton, England, December 21.

Regenerating Copper Cyanide Solution.

The Editor:

Sir—I read with interest R. P. Wheelock's tests on the regeneration of copper cyanide solution, and I beg to say that I have made thousands of tests relative to the same, years ago. I had my method protected by patent, a part of which is controlled by a company. In fact two patents were taken out. My experiments were practically all made with potassium cyanide, and not with sodium cyanide. I claim that it is commercially feasible, although the books contradict it. In handling a cyanide solution if one cannot readily save the precious metals on zinc shaving, he can save the gold, silver, and copper with sulphuric acid, and will get the same results day after day if the acid is not used in excess, as Mr. Wheelock evidently did when the gas raised his precipitate to the surface, and caused hydrocyanic acid gas to escape. The solution should be agitated a second time after standing 15 to 20 minutes. Also a saturated solution will precipitate quicker than a weak one, and readily restore 80% or more of the potassium or sodium cyanide, as the case may be, at a cost of not to exceed 10c. per pound. The solution should be thoroughly saturated with copper, when that salt is present, before making the precipitation. The clear solution should be decanted, and the precipitate washed into the filter, before adding the second cyanide solution to be precipitated.

ISAAC ANDERSON.

Prescott, Arizona, December 20.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

A miner's inch of water is usually sufficient for each battery of five stamps, including concentrators and cyanide plant.

Delay alone, no matter how long continued, cannot impair an inventor's right to a patent, unless by reason of it, another becomes the first to give the invention to the world.

Zinc ore, under the new Mexican freight rates, may be shipped from Chihuahua to Tampico for $4.60 per ton and to El Paso for $2.97. The former rates were $4.60 and $1.89, respectively.

Churn-drill exploration on a mining claim, performed for the discovery or estimation of quantity and character of ore deposits, or for the benefit of a deposit held under a valid location, is accepted as annual assessment work.

Gold is not usually bought by the ton, but such an amount, Troy weight, is worth $496,123.20, or by avoirdupois, $602,921.93. The standard American price is $20.67 an ounce. In Japan a trifle more has been paid.

To find the diameter of pump plungers to pump a given quantity of water at 100-ft. piston speed per minute, divide the number of gallons by 4, then extract the square root and the result will be the diameter, in inches, of the plungers. This is for single double-acting pumps; for duplex double-acting pumps, divide by 8 before extracting the square root.

Mining claims in Mexico, called *pertenencias*, are subject to an annual tax of $6, or $3 gold, each. A *pertenencia* is a square bounded by sides 100 metres long, that is, it is an area of one hectare, which is equal to 2.47 acres. The above named tax is assessed upon each *pertenencia* or fraction thereof, and is payable in three annual installments due in March, July, and November.

Glass models may be marked with a ruling pen, according to E. D. North, who further suggests that the outlines of the levels should be in the same color as that used for filling. For the latter purpose he uses Winsor & Newton oil colors mixed with turpentine and japan. The latter two are mixed half and half and kept in stock and stirred in with each color as needed. It requires about 24 hours for the colors to dry on the glass.

Concrete may now be delivered on the work through pipe-lines by means of compressed air. The device used consists of an iron tank with an air-tight gate at the top and a conical bottom with outlet to the pipe system. The concrete is mixed and dropped into the tank, the gate closed, and air under 50-lb. pressure admitted through a side inlet. It forces the concrete through the pipe to the delivery point, where a nozzle consisting of a plank box with curved top, diverts it, thoroughly mixed, into forms or upon the work. A 4-in. pipe is sufficiently large, and the concrete will pass right-angled turns or even a 180° bend with a 4-ft. radius. The concrete may contain rocks up to 2 in. diam. in a 1-3-5 mixture. Air at 100 lb. pressure has been tried, but even at 50 lb. the delivery is too rapid for practical work without the nozzle described.

Hammers for hand drilling commonly weigh 4½ lb. For double-hand work, 10-lb. hammers are used. The striking face must be flat or slightly rounded, and smaller than the stock of the hammer. The hole is started on solid or squared surface with a short drill, for the longer the drill the less effective the blow. Light blows are struck first. The bit is turned one-eighth of a revolution after each blow, to insure keeping the hole circular.

Concentration occurs under ideal conditions on canvas-tables, or buddles, when the velocity of the current is uniform and is such that its carrying power is a mean between that which would move the grains average maximum density and that necessary to hold in suspension the grains of gangue. This velocity being maintained, concentration will vary with the degree of classification or sizing of the pulp and the character of the surface on which the concentrate is held by friction.

Vanadium salts are said to be favorable to the growth of plants; vanadyl phosphate acts physiologically like potassium permanganate; from vanadates and tannic acid a waterproof black ink is made; vanadium salts are used in coloring glass; metavanadic acid has been used as a substitute for gold bronze in paint; vanadium chloride is used as a mordant in printing fabrics, and the trioxide as a mordant in dyeing. Vanadium compounds are used for several purposes in chemistry.

Blocking up a column-bar for drilling should be done in stages when the bar stands on broken rock. The attempt to jack the bar up the whole amount at one time is apt to result merely in splitting the blocking. Pieces of tough wood reasonably free from knots should be used. Sawed wedges about 1 ft. long and of varying thickness at the butt are to be preferred, but blocks that are flat on the side next to the rock and rounded on the side next to the bar may be used. Most of the blocking should be placed at the jacking end of the bar if possible; a 2-in. piece properly wedged will serve at the other end, which in a vertical set-up is the upper end of the bar.

Dust-arresters of hanging wire are used, according to the friction system, at the Great Falls, Montana, smelter. There are 1,215,000 wires weighing, altogether, 608 tons. It was determined experimentally that these wires gave nearly as high recovery as baffle plates with much less frictional resistance to the passage of gases. From the entrance for 150 ft. the chamber is fully occupied by wires hanging from alternate intersections of 1⅝-in. mesh steel-wire netting, bolted to the roof. Beyond this is 50 ft. free from wire, then another 150 ft. filled as before. In the floor of the dust-chamber are more than 1000 sheet-steel hoppers arranged for drawing the dust into cars which convey it to reverberatory furnaces.

Special Correspondence.

NEW YORK.

Copper Merger Plans.—New Directors of Utah Copper.— Lewisohns Take the Wettlaufer-Lorrain Silver Mines, Limited.

The past two days has seen no little progress made toward the copper merger. The outline of a preliminary combination which is to include the Amalgamated Copper Co. and the Cole Ryan properties is announced. The first step is to be an increase in the capital stock of the Anaconda company to $150,000,000. The merging of all of the important properties is to be made through purchase by the Anaconda, which will take in at present the Boston & Montana, Butte & Boston, Parrot, Butte Coalition, South Butte, and the smelters controlled by the Amalgamated. In the announcement just made setting forth the plans, one of the reasons given for the step taken is the avoidance in the future of costly and troublesome apex litigation. The meeting of the stockholders to ratify the proposed increase of capital stock, is to be held in Anaconda, Montana, March 23. Presumably, later this company will also absorb the Cole-Ryan properties lying outside of Butte, the Giroux at Ely, the Greene Cananea in Sonora, Mexico, and possibly the Calumet & Arizona, though it is rumored that Mr. Cole is now entirely out of the latter property.

It is not, however, in regard to Butte properties alone that copper merger affairs have been making progress. The New Jersey court has dissolved the temporary injunction forbidding the combination of Boston Consolidated and Utah Copper, and today the board of directors of the Utah Copper Co. was increased by the addition of seven new members, the following gentlemen being elected: Daniel Guggenheim, Murray Guggenheim, S. R. Guggenheim, F. A. Schirmer, Ernst Thalmann, of Ladenburg, Thalmann & Co., Eugene Meyer, Jr., and T. W. Lamont, vice-president of the First National Bank of New York. The company also filed its amended certificate with the Secretary of State of New Jersey, certifying to an increase in its capital stock from $7,500,000 to $25,000,000. Stockholders are to have the right to subscribe for one share of the new stock at $50 for each ten shares held. While there is no obstacle now to prevent the consolidation of Boston Con. and Utah Copper, the original plan of taking Nevada Consolidated in, remains in abeyance because of the attitude of James Phillips and the stockholders who stand with him. The Utah Copper Co., has, however, today notified the secretary of the Nevada Con. that a part of the increased capital stock of the Utah Copper Co. will be held in reserve to comply with an agreement made with certain shareholders, whereby the Utah Copper Co. offers to give one share of its stock for 2¼ shares of Nevada Con. The Utah Copper Co. will hold this offer open up to and including March 5, and any Nevada Con. shareholder making the exchange is also to receive subscription rights. The attitude of Mr. Phillips is unchanged, and it is evident that Nevada Con. is not to go into the combination without a bitter fight. The purchase by Phelps, Dodge & Co. of the Arizona Copper Co. is reported, but denied. While the various steps detailed seem to pave the way for the larger company which was to be formed to dominate the copper industry, a good deal of doubt is expressed in the East as to when the new flotation will be brought out or whether it will be made at all. One prominent authority discussing the matter, said to me that he thought the copper merger would, for the present at least, resolve itself into the formation of several large groupings and a 'gentlemen's agreement'. This view of the matter is due to the political situation. The fact that so many of the large combinations are either under fire or being investigated and that an attack may be made upon them, does not tend to create an atmosphere in which it would be wise to offer to the public a new industrial trust. From the present attitude of the administration it might be very safely anticipated that the new trust would be branded as an outlaw before fairly going.

A controlling interest in the Wettlaufer-Lorrain Silver Mines, Ltd., has been purchased by the Silver Mines Exploration Co. The latter is the proprietary company through which Adolph Lewisohn and his associates carry on their operations in Canada and through which their great success has been made in Kerr Lake. The Wettlaufer has a shaft down 152 ft. It has been a small producer and shipper for some time and is considered the best developing mine in the South Lorrain district. The company has $100,000 in its treasury, as well as 125,000 shares of stock in reserve.

LONDON.

West African Mines.—Ashanti Goldfields.—Cinnamon Bippo. — The Sulphide Corporation Recovers.

The gold mines of West Africa are now attracting increased attention. The discoveries during 1909 were interesting, and the introduction of new capital and improved methods by two of the leading South African houses has had an important influence on the history of this field. The time is therefore opportune to give some details about some of the leading mines. I will take as examples the Ashanti Goldfields and the Cinnamon Bippo.

The Ashanti Goldfields Corporation, Ltd., was started fourteen years ago by Frederick Gordon, who was a pioneer in the founding of modern hotels in London and elsewhere. One of his chief financial backers was J. B. Maple, the great furniture man of Tottenham Court Road. In its earlier days the company had varied fortunes. In 1908 a discovery at Justice's not only added to the company's assets, but directed attention once more to the possibilities of the ore deposits in West Africa. A year ago the known deposits at the Ashanti mine were such that W. R. Feldtmann, the consulting engineer, considered the deposit to be low grade and recommended that it be worked on a large scale. Additional plant was therefore erected. During this past year a remarkable change has come over the mine, especially in the orebody under the old Obuasi workings. Here great bodies of high-grade ore 8 ft. wide and exceeding 3 oz. per ton are being developed, and the whole complexion of the undertaking has changed. The extended extraction plant will not now be used on low-grade ores, but it will be available for the treatment of the high-grade ore on a large scale. The company's report for the year ended June 30 shows that 70,345 tons of ore yielded 41,014 oz. gold valued at £174,368, with a gross profit of £85,260. After royalties of £8718, London expenses £5101, debenture interest £5412, and allowing £13,893 for depreciation and £9154 for mine development redemption, a net profit of £44,792 was made. Mr. Feldtmann's report shows that during the year November 1908 to October 1909, 79,010 tons yielded gold to the value of £201,287. With regard to the metallurgical processes, the most important item is that amalgamation was entirely abandoned in September. This method of extraction was never a success, even when the oxidized ores were being treated. In the lower levels sulphur and arsenic came in, and also graphite, so that the extraction became still worse, and some other method of extraction had to be sought. Dry-crushing in ball-mills, Edwards furnaces, and leaching by cyanide was adopted, and the first part of the plant was erected early in 1907. This was doubled in 1908, and at the present time an entirely new plant to supersede these is being erected. By this method an extraction of 90% is obtained. At Justice's the metallurgical problem is different, for the ore is soft and contains clay instead of consisting of quartz. The method of treatment is to crush in the stamp-mill, using a cyanide solution, and subsequently separate the sand from the slime, the latter predominating. The sand is treated by percolation and the slime is treated by agitation and filter-pressing. The sulphide ore at Justice's requires much longer roasting than the quartz sulphides, and the best treatment will be investigated when the completion of the new plant releases the old one and leaves it free for experiments and investigations. This will happen next June. The ore reserves at the end of October totalled 519,300 tons averaging 18.2 dwt. Of this, 88,000 tons were in the Obuasi shoot and averaged 47 dwt. per ton.

The Cinnamon Bippo Co., Ltd., owns property two miles

long in the northern part of the Tarkwa banket reef, and the control has lately been taken over by the Consolidated Gold Fields of South Africa. The operations conducted recently have consisted entirely of development work. The deposit has been proved to be of rather lower grade than the other parts of the Tarkwa deposits, but on the other hand the content is more regular. Over the whole property the outcrop is found to be auriferous. Walter Broadbridge, who was recently appointed manager, estimates that the ore so far developed contains 213,000 tons, running from 5.2 to 9.8 dwt. per ton, and averaging 8 dwt. The consulting engineer, H. H. Webb, considers that ore containing less than 6 dwt. could not be profitably worked, and has revised the estimate to 133,000 tons averaging 9.3 dwt., and 80,000 tons of unpayable ore averaging 5½ dwt. Trouble has been experienced from the inflow of water, and extra pumps have been provided. Mr. Broadbridge has advised that a new main incline shaft will be required. The question as to the size of the mill is still in abeyance. Henry Hay has been appointed as a joint manager with Mr. Broadbridge of all the properties in West Africa under the control of the Consolidated Gold Fields.

The recovery of the Sulphide Corporation has been one of the features of the past year. Floated in 1895 by the Exploration company, of London, and Gibbs, Bright & Co., of Melbourne, to work the Central mine at Broken Hill and treat the ores by the Ashcroft process, the company has had a chequered existence, and full justice has never been done to the fine body of ore, which is equal to anything in the district. The Ashcroft process was not a success and soon fell out of use. The dressing plant has during the last two years been entirely re-built, and the plant for treating the zinc tailing by the Minerals Separation process has been greatly improved recently. The consequence is that the company is now able to pay a dividend on its ordinary shares. The capital is £962,500, divided into 550,000 preference shares of £1 each and the same number of ordinary shares of 15s. each. There are also £79,600 of 5% debentures. The preference shares are entitled to a non-cumulative dividend of 10%, and after 10% has been paid on the ordinary shares, both classes of shares rank equally for any further distribution during each year. The dividends paid so far have been: for 1898-9, 10% on both classes of shares; for 1899-1900, 15% on both; for 1900-1, 5%; 1902-3, 5%; 1903-4, 7½%; 1904-5, 10%; 1905-6, 10%; 1906-7, 10%, and 1907-8, 10%; and 10% on the preference alone. For the year July 1, 1908, to June 30, 1909, both classed received 10%, it being the first time for nine years that the ordinary shares have participated in the profits. The year gave a profit of £153,382, out of which £96,250 has been distributed as dividend. The amount of ore treated during the year was 195,332 tons, from which were obtained 42,354 tons of lead concentrate in the jigs and 67,981 tons of zinc concentrate in the flotation plant. The lead concentrate assayed 60% lead, 9.9 zinc, and 32.3 oz. silver, and the zinc concentrate 42.5% zinc, 11.4 lead, and 16.6 oz. silver. In addition, 40,684 tons of old zinc tailing was treated, producing 14,464 tons of concentrate. The slime plant was re-started on June 14, and up to the end of that month 2179 tons were treated, yielding 1109 tons of zinc-lead concentrate assaying 32.5% zinc, 21.4 lead, and 28.2 oz. silver; this awaits further treatment, and no doubt if Horwood's new roasting process is a success it will be applied for this purpose. Of the lead concentrate, about one-half was smelted at the company's smelter at Cockle Creek and the remainder sold locally. The smelter also treated about 60,000 tons of purchased ores. Practically the whole of the zinc concentrate was sold. It was found impossible to distill the zinc concentrate on the spot, and the zinc smelting plant was closed in December 1908. The company controls the Central Zinc Co., which recently erected a distilling plant near Hartlepool, England. This is not yet in working order. The development of the mine at the 1100-ft. level disclosed unexpected ore at some distance from the main orebody. The total reserves are 2,803,920 tons, which is a figure slightly greater than when the company started operations 13 years ago, put it is not expected that the reserves will be maintained in the immediate future.

KINGMAN, ARIZONA.

Mines Active.—Details of Mills.—Needles Smelter to Resume.

The Arizona Gold Mines Co., controlled by A. and H. E. Denio and E. M. Lamont, has 100 acres of mineral ground situated 3½ miles southwest from Kingman, in a formation of granite-porphyry, with intrusions of diorite. This includes one principal diorite dike, over 2000 ft. in length, from which there are deflecting branches. An area 510 by 750 ft. has been tested and explored within the last two years, and, according to data obtained at the property, the granite-porphyry and diorite are both gold bearing, though the richer ore is that obtained close to the contact of the two. The tests made in 100-ton lots with a 10-stamp mill on the ground are said to have shown an average recovery of $4.92 per ton by plate amalgamation. The battery screens are 14-mesh; the pulp, after passing over one section of plates, is re-ground in a Huntington mill having 80-mesh screens, then passed over a second section of plates, thence over a Pierce amalgamator. This saving is claimed to run from 86 to 92% of the assay value of the ore. The mill has been operated about a year on ore quarried from the surface to an average depth of 20 ft. The prospected area above specified will have an average depth of 40 ft., measured from the surface to the present trackage level. The ore to this depth, or lower, carries some hematite, all oxidized. The gold is disseminated through the gangue, partly in coarse and partly in fine particles. In sinking a shaft not far from the open-cut work sulphide ore was obtained at a depth of 100 ft., but even in this the gold is said to be mostly free and amenable to amalgamation. The 10-stamp mill was built for prospecting and testing purposes, the site being on the main line of the Santa Fe railroad. Mr. Lamont, who is manager, states that results justify the construction of a 40-stamp mill, and various machinery houses are now bidding on the required equipment in accordance with plans already made. The new mill is to be erected close to the old one, and it is anticipated that it will be ready to operate before July 1. The plan contemplates stamp crushing, plate amalgamation, re-grinding in Huntingtons, followed by plates and Pierce amalgamators. A crusher will be installed to reduce the ore to a better size for the batteries, the crushed ore to be conveyed to the mill-bins by a bucket elevator. Water for mill work is obtained from wells, 1600 to 3000 ft. away, and is pumped into a large tank near the mill-site by electrically driven Deming pumps. The mill machinery and air-compressor are steam driven, fuel-oil being used under the boilers at a cost of $1.885 per barrel at the property. In the last year's operations it is stated that the cost of mining and milling has been $1.30 per ton. One 2¼-in. Sullivan drill has been sufficient in mining 35 tons per day.

The Golconda mine, owned by the Union Basin Mining Co., is in Cerbat district, four miles from Mineral station on the Kingman-Chloride railroad. The principal stockholder is John Boyle, Jr., who is also manager. The property was opened less than two years ago, and a body of ore was found that ran high in zinc, together with some gold and silver. Shipments of this ore to a plant of the American Metal Co., in Oklahoma, during 1909 aggregated 7000 tons, and averaged 47% zinc. The gross value of the ore was $25 per ton, about 5 to 6% of this being from gold and silver. Shipments are now running 35 tons per day. In connection with this about two tons of milling grade are being accumulated for every ton that is shipped. On the payroll are the names of 110 men.

The Gold Road Mining & Exploration Co., J. L. Phillips superintendent, with Daniel Bosqui in charge of the mill, is mining and milling 230 tons per day of $10 ore, at a cost of $4.50 per ton. The orebody is 4 to 16 ft. wide, in an andesite formation, the ore consisting of a gold-bearing quartz, accompanied by some calcite. The gold occurs in free particles, but of exceeding fineness. The ore is hoisted by a double-drum electric hoist, Denver Engineering Works make; and Leyner drills are used in the stopes. The air-compressor, having the capacity of 1800 cu. ft. of free air per minute, is driven by a 200-kw. Westinghouse motor. Water for mill and domestic uses is obtained from a well

five miles from the camp, and is forced by electric pumps through a pipe line to tanks at Gold Road. Electric power for all purposes in this camp is derived from the Kingman power plant, the transmission line, 28 miles long, carrying 40,000 volts, and this is transformed to 440 volts for mill and mine power. The mill has 40 stamps, 1050 lb. each, dropping 100 per minute, crushing the ore in cyanide solution, through 16 mesh screens. The pulp passes from them to classifiers, the overflow goes to settlers and the underflow to tube-mills, of which there are two. The tube-mill sand that runs below 120 mesh passes to percolating sand vats; that which is finer than 120 goes to Butters filters. The slime product is sent to collector vats, thence to Pachuca tanks, each 17 ft. diam. by 45 ft. deep. Of the 230 tons of ore crushed per day, 180 tons are treated as slime and 50 tons as sand. In separating the coarse sand from the slime, as these come from the tube-mill, a Dorr classifier is used. The Butters filters, of 120 frames, are in a steel tank 45 ft. long by 11 ft. wide. In these filters 180 tons of slime are treated in 15 hours. The solution, slime, and vacuum pumps, all installed in one room, are operated by two 40 hp. electric motors. The precipitation is by means of zinc dust in the gold solution, the precipitates being collected in a 30 frame filter press. Mr. Bosqui states that the consumption of cyanide in these milling operations amounts to 0.4 lb. cyanide to one ton of ore; also ½ lb. zinc and 5 lb. lime to the ton of ore. It is understood that the final tailing assays 20c. per ton. It may be noted that the two tube-mills, of Allis-Chalmers make, have a special iron lining, in sections, devised by F. L. Bosqui and Edgar Collins, and which is to be made by the Allis-Chalmers company.

The Tom Reed Gold Mines Co. has 14 claims two miles southwest from the Gold Road camp, covering a lode which parallels that of the Gold Road mine, the two being less

Tom Reed Mine.

than a mile apart. The Tom Reed lode strikes northwest through a chlorite-andesite country. It has a width of 5 to 20 ft., the gangue being a gold-bearing quartz, partly free-milling, and the rest well adapted to cyanidation. The mine is opened by a 350-ft. incline shaft, sunk in the foot-wall. The lateral development on the vein, including two main levels, amounts to 2400 ft. The mine equipment consists of a steam-hoist, Norwalk air-compressor, Ingersoll-Rand drills for driving, and Shaw drills for stoping. About 37 tons per day are being hoisted and run through the old 10-stamp mill that has been in operation two years. In this experience 40 to 60% of the gold content was recovered on the amalgamating plates, the pulp being afterward cyanided. A new mill, however, has just been completed which will be in operation February 1. It has 10 stamps and combines amalgamation with the all-slime process of cyanidation. Clear water is to be used in the batteries, and the screens are 30-mesh. The pulp passes from the plates to classifiers, the oversize from the latter to a tube-mill. The undersize from the classifier unites with the tube-mill product and both go to another set of classifiers. The resulting oversize and undersize are carried to different sets of settling cones, the underflow from the finer settlers passing to an Oliver revolving filter; then the dewatered pulp is mixed with cyanide solution and passed to Pachuca agitating tanks, and this is followed by filtration in a 48-frame Butters filter. It is intended to operate the new mill to the limit of its crushing capacity and at the same time cyanide some of the old mill tailing. The mill machinery, which was erected by the Young Construction Co., of Los Angeles, is to be operated by electric power. According to results obtained by operating the old mill the ore of the Tom Reed runs $20 to $30 per ton. S. S. Jones, the company's manager, is assisted in the metallurgical work by H. L. Lunceford. Charles Grimes, president of the company, is a Pasadena man. John Hays Hammond is the owner of a considerable amount of the stock.

The Needles Mining & Smelting Co., a subsidiary of the United States Smelting, Refining & Mining Co., whose plant at Needles, California, has one lead and one copper furnace, is putting the equipment in condition to begin operations in a few weeks, and within the next three or four months a new lead furnace will be installed, and a 100 ton concentrating plant is to be erected to prepare certain classes of low grade ore for smelting. This mill is to have facilities for separating the zinc from other minerals, the zinc concentrate to be shipped to zinc plants East. The additions and improvements planned will bring the smelting plant up to a capacity of 400 tons of charge per day. This company has a number of groups of mining properties, partly developed, at Chloride and Stockton Hill, Mohave county, including the Tennessee, Banner, and Champion, on each of which a small force of miners have been put to work. L. D. Godshall, general manager for the company, anticipates getting sufficient lead and copper ores from the company's mines and from custom mines to keep all the furnaces in blast as soon as the plant is ready.

The Carter mine, in the Gold Road district, is opened by a 250-ft. shaft. At the 150-ft. station a cross-cut was driven to the ore, consisting of gold quartz, assaying $25 per ton. The Carter is entirely in control of Mohave county people. R. E. Zuver has done 900 ft. of lateral driving and some sinking on the Navy group of claims through which the old Hardy vein runs, in Silver Creek section.

O. B. Amsden and associates are doing systematic development on the Gold Bug mine, in River range, west of the White hills. The work includes a 500-ft. shaft; on the 300-ft. level is a body of free-milling gold ore of good grade. This is 60 miles northwest from Kingman. The Frisco Mines & Power Co., for which E. H. Barton is manager, is developing a gold mine at Union Pass. Extensive work, with power equipment, is contemplated. The Enterprise mine is developed by about 4000 ft. of work, opening a vein carrying lead, silver, and gold, with some copper. This vein is between diorite and porphyry. The property is in Malapai mountains, 18 miles east from Kingman. W. A. Mensch is manager. The Kingman-Chloride railroad will soon change from tri-weekly to daily trains, and the chloride end of the track is being extended up to the Tennessee mine.

BRITISH COLUMBIA.

Slocan District.—Output.—Zinc Mining.—Winter Development.

The tonnage of ore obtained from mines in the Slocan district during 1909 was approximately 90,000 tons, of which fully 60,000 tons was put through concentrating mills. This statement of output does not include the production of the Blue Bell mine, which, being situated on the east side of Kootenay lake, is not usually regarded as a Slocan district mine. The output from the Blue Bell was nearly 60,000 tons, which was concentrated into about 5000 tons of lead-silver concentrate, besides a zinc-iron product which was not marketed. The chief producers were the Van Roi, Whitewater, and Whitewater Deep mines, each having a production of approximately 28,000 tons. Other fairly large producers were the Selkirk Mining Co.'s Cork mine, 15,000 tons; Lucky Jim, in excess of 5000 tons; Richmond-Eureka, 3300 tons; Standard, 3000 tons; Ruth-Hope group, ore to an amount not ascertained but which yielded 1850 tons of concentrate in the proportion of two-thirds silver-lead and one-third zinc, and the Rambler-Cariboo, which shipped 680 tons of crude silver-lead ore and 350 tons of concentrate. Shipments, ranging in quantity from less than a carload up to 770 tons, were made from some 30 other properties, including those situated in Ainsworth mining division, which is being included in this notice of the Slocan district.

The year 1910 opens with a distinctly promising outlook. Long deep-level adits have been driven on three properties,

with results on two that have induced the owners to continue operating the mines, while on the third arrangements are being made to raise to old workings above so as to connect the 2000-ft. adit with known ore-bearing ground. In Whitewater camp the chief work in progress is on the several mines known, respectively, as the Whitewater, Whitewater Deep, and the low-level workings of the Deep Mines, Ltd., all of which are being operated under the management of John L. Retallack. Some 50 or 60 men are employed in mines and concentrating mill, and the properties are in better condition for regularly maintaining ore-production than for several years past.

The Lucky Jim is the largest zinc mine in British Columbia. No ore-production is being made at the present time owing to the refusal of the railway company to accept it for transportation during the winter months when frost and snow make its handling difficult. Pending a resumption of production, another adit is being driven to give about 250 ft. more stoping ground. A concentrating mill is planned to bring production up to a total of 1500 tons of zinc ore and concentrate per month. The quantity of milling ore now available is estimated at 60,000 tons, containing from 8 to 10% lead, 25 to 30% zinc, and 10 oz. silver per ton. The Rambler-Cariboo is in better condition at present than at any previous time for a year or more past. Ore has been found down to the tenth level, and several productive shoots of ore have been opened in different parts of the mine, so that the normal production of approximately 100 tons of silver-lead ore per month can easily be regularly maintained. At the Rio, which is situated just above the Rambler-Cariboo, levels are being driven to get under ore-shoots known to occur above, and it is expected production will be practicable next summer. In the neighborhood of Sandon the Payne, Slocan Star, Richmond-Eureka, Hope-Ruth, Surprise, Sunset, and Noble Five, are the chief properties now being worked. Ore has been found in several parts of the Payne mine, which years ago paid dividends to a total of $1,363,000. The diamond-drill has been used in prospecting by the Sandon Mines, Ltd., which plans to resume the operation of the Payne concentrating mill next spring. Meanwhile ore-shoots are being opened, some 25,000 tons of ore having been blocked out ready for stoping. On the Slocan Star group the winter's operations are being restricted chiefly to driving two tunnels to the extension of the big shoot of ore that for some time past has been productive on the neighboring Richmond-Eureka ground. It has been estimated that fully $500,000 worth of silver-lead ore will be found in this part of the Slocan Star ground. The litigation over extralateral rights which led to a cessation of operations in the old Slocan Star workings, on the opposite side of the gulch, having been finally settled, it is intended to resume mining and milling. The Richmond-Eureka and the adjoining Summit claim, which are being worked conjointly by the Consolidated Mining & Smelting Co. of Canada, Ltd., is being developed, the intention being to increase ore-production substantially in the spring. Ore from these properties is conveyed to the Canadian Pacific railway at Sandon, and taken thence by rail and barge to the company's smelter at Trail, to which, by the way, practically all silver-lead ore and concentrate produced in the Slocan district is shipped for reduction.

About Cody, near Sandon, mining operations are in progress on the Reco, Surprise, Sunset, and Noble Five, all neighboring properties. The long adit driven by the owners of the Surprise is 1100 ft. vertically below the surface and the vein cut by it is as strong and well mineralized as it was a thousand feet above. Some clean galena has been found and further exploration is under way to develop this shoot of good ore. The Sunset, which several years ago was a regular dividend payer to the syndicate owning it, is being developed at greater depth by a cross-cut adit to cut the ore-shoot below where it was productive nearer the surface. The Noble Five had been idle for six or seven years, but it is being worked now and may be expected to ship ore next season. In the vicinity of Slocan lake eight or ten properties are being worked. Near New Denver the Mollie Hughes is producing ore in which native silver occurs freely. Mining is being done on two levels, drifts being run both ways from cross-cut adits which cut the vein. At the Standard mine, above Four-mile creek, drifts on No. 4, 5, and 6 levels are being extended. In one of these there is a fine showing of ore, about 14 ft. in width, much of it clean shipping ore running high in both silver and lead. Gray copper occurs freely in the galena, and contains considerable silver. Work is also being done on the Emily Edith, situated immediately below the Standard and owned by the same men. On the other side of Four-mile creek, also in what is known as Silverton camp, the Van Roi Mining Co. is opening several levels, some from the east side of the mountain and some from the west. Two veins are known to occur on this property, but only one is being worked at present. The ore is milled at the Wakefield mill, on Four-mile creek, and from 140 to 160 tons per day are sent down by aerial tramway to the mill. This company is preparing to erect its own concentrating mill, as the owners of the Wakefield mill will require to use it next summer for ores concentrating from the Lorna Doone and Hewitt group, which are being developed by the Silverton Mines, Ltd. Some large shoots of ore are being blocked out in these latter mines and more will be developed as the three adits now being driven shall pass under the ore-shoots already opened. Ruby silver and gray copper occur freely in the ore which, so far as developed, is a distinctly dry ore, though more lead may be found when greater depth shall have been reached. The same company is also prospecting the Hamilton, on Twelve-mile creek, and has already found pockets of high-grade ore in the workings. The Ellis Silver Mining Co. is further developing the Eastmont, in the vicinity of Ten-mile creek.

JOHANNESBURG, TRANSVAAL.

Gold Output.—Technical Education. — Ferreira Deep.—Gold Fields' Reports.—Stope-Drill Competition.—Rotary Extractor.

With the declaration of the gold output for November, a statement of production for the year can be estimated with confidence of useful accuracy. At the same time there will doubtless be many gold reserve adjustments made in the December declaration, tending to abnormal figures. It will probably be found that more gold has been taken from, than added to the reserve this year. From present data it appears that the value of the year's yield for the Transvaal will barely exceed $150,000,000, won from a mill tonnage of 21,300,000 tons. The working profits have averaged $5,000,000 per month. The number of stamps at work has risen from 9464 at the beginning of the year to about 9700 at the close, and the stamp duty from 6.5 tons per head per full 24 hours to 6.9 tons. There are 150 tube-mills at work in December, as compared with 120 in January 1909 and 72 in January 1908.

The rapid strides made in the provision of facilities for the acquisition of technical knowledge by workers along the 'Reef' reflect great credit upon the staff of the Transvaal University College. As a residential university for graduating students, it will be a long time before this institution can bear comparison with the American, English, or Canadian colleges. To justify its expense it must popularize itself. Evening classes have attracted a most gratifying attendance during the last year or two. The zeal shown by students, coming into town at the end of a hard day's work, was so far appreciated last year that a course of lectures on mining was delivered at various points in the East and West Rand by Prof. Yates to meet the requirements of distant workers. The principle thereby established has now been commendably extended by Prof. J. A. Wilkinson, who has started a vacation course of lectures in chemistry and physics at suitable centres in the East Rand (10 to 15 miles from Johannesburg). To suit the convenience of men engaged in the various shifts, morning lectures are duplicated in the evening. They are followed by classwork and examination. A nominal fee of $5 is charged for 12 lectures. In this excellent scheme, the college is receiving keen support from the mines.

The Ferreira Deep is one of the most prosperous deep-level mines on the Rand, though it should be added 'barring accidents', for there has lately been a serious crush at the

foot of its No. 2 vertical shaft, resulting in a temporary reduction of the tonnage mined. During the year ended September 30, 1909, the Ferreira Deep milled 414,057 tons for a yield of £948,577 and a profit of £609,878. Working costs totaled 16s. 2.4d. per ton milled. Underground costs, being representative, are of general interest. They stand: stoping, 4s. 1.6d.; shoveling and tramming, 1s. 3.5d.; pumping, hoisting, etc., 3s. 0.3d.; and development, 1s. 1.7d. per ton mined.

It is sometimes alleged that the Consolidated Gold Fields of South Africa are unwisely reticent in their reports and that they would gain more support if they took shareholders into their confidence. There may be justice in this criticism upon occasion, but it cannot be said that details are always ignored. The firm controls among its divers interests the Carolina Asbestos Co., which almost represents the Transvaal asbestos industry, and is far from prosperous. During the last financial year, 207 tons of asbestos was recovered, and a loss of £630 recorded. One looks in the annual report for some information as to the extent of asbestos rock explored or developed. Even the record of operations and results is meagre and vague. But we are told that "In the early part of the year a native hospital costing £10 ($50) was erected." Who can now declare that the Consolidated Gold Fields are secretive with any base motive, when we find them thus deliberately exposing the weakness of gross extravagance!

It is time that the country be given detailed informa-

Drill in Rand Stope.

tion regarding the results of the stope-drill competition to date. It has now been proceeding for several months, and although we hear a good deal through unofficial sources, we are told nothing of value. The figures occasionally published—without authority, it would seem—throw no light on the position, except by way of showing which machines still survive the tests. It is at least certain that only five drills are still competing, namely, the Siskol, Holman 2¼ in., Chersen, Holman 2¾ in., and New Century, placed in the order of merit which, I suggest without prejudice, will be that eventually determined by the judges.

A paper is promised by two cyanide men of the East Rand Proprietary Mines (Messrs. Lloyd and Rand) upon a new type of rotary for use with the zinc precipitation process. Experiments have been proceeding for some time and are reported to have produced satisfactory results. There are three or four compartments used, in which are slowly revolving rotors carrying the zinc. As full details are to be published shortly, it is only necessary here to indicate the lines on which experiments have been undertaken. If some method, allowing a speedier and less 'messy' clean-up than that seen in ordinary practice can be cheaply devised, and one doing away with the trouble of the white precipitate at the head of the boxes, it will soon gain popularity. Precipitation methods on the Rand are certainly receiving critical attention, especially as there are now advocates of zinc-dust precipitation, wishing to test its applicability with these solutions.

MEXICO.

Big Transaction at Santa Eulalia. — Real del Monte. — Guanajuato Production.—Zacatecas Revival —El Oro District.

Following on the heels of the Santa Gertrudis deal is a report that the American Smelting & Refining Co. stands ready to purchase the mines of the Chihuahua Mining Co. and the Potosi Mining Co. in the Santa Eulalia district of Chihuahua for $8,000,000, or ₱7,000,000 in excess of the Santa Gertrudis purchase price. The two companies are American, and the principal stockholders are Grant B. Schley, of New York, and Dennis Sullivan, of Denver. The Potosi mines rank among the greatest silver-lead producers in the world, and are among the most important zinc producers of Mexico. The mines of the Chihuahua company also rank high in silver-lead production. It is said that the negotiations will be terminated, one way or the other, before April 1. Two properties in the Santa Eulalia district, the San Gregorio and the Esmeralda Anexas, have just been purchased by the Exploration Co., Ltd., of London, represented by R. M. Raymond. They adjoin mines owned by the American Smelting & Refining Co. The Exploration Co., Ltd., has still pending an option to buy the properties of the Reforma Mining & Milling Co. in the State of Guerrero for ₱20,000,000. If this deal is made it will set a new mark for Mexican mine transfers.

The largest dividend in the history of the Cia. Real del Monte y Pachuca, ₱200 per share, was declared in January. This amounted to approximately ₱600,000. As is well known, the Mexican company is controlled absolutely by the United States Smelting, Refining & Mining Co. of Boston, and the dividends paid to date have about equalled the purchase price of the properties, which was ₱4,401,000. Possession was secured by the purchase of practically all the stock of the company at the rate of ₱1500 per share, and the deal has proved one of the biggest bargains in Mexican mining history. The holdings comprise a total of 72 mines, and the majority of them have not yet been touched by the present owners. Two cyanide plants are in operation, handling from 600 to 700 tons per day, and a third plant is now planned. C. W. Van Law recently succeeded E. P. Merrill as general manager of the properties.

According to statistics given out from week to week on shipments of ores, concentrates, and bullion from the Guanajuato district, the total production in 1909 was ₱14,188,100. The low price of silver had no effect on milling in the Guanajuato district, the big mills continuing to operate steadily during the year. A recent report by Finance Minister Limantour, covering the fiscal year 1908-9, shows that the production of silver in the 12 months, 2,191,199 kilograms, was the greatest in the history of Mexico. However, due to the decrease in the price of the white metal, the value of ₱77,109,742 was about ₱8,000,000 less than that of the preceding fiscal year, when the output was not as large. It is estimated that the silver production of the calendar year 1909 exceeded that of the fiscal year.

The old Zacatecas district, which has a record of immense production since its opening in 1546, appears to be on the eve of a mining and milling revival. The most important plant will be that of the Zacatecas Mining & Metallurgical Co., a concern recently launched by M. E. MacDonald, of Guanajuato, to work the San Cristóbal and Zacatecas groups of mines in the gold-belt. Mr. MacDonald is widely known as one of the men prominently identified with the mining and milling revival in the Guanajuato district, and as the man who engineered the deal that gave the United States Smelting, Refining & Mining Co. possession of the Real del Monte. A milling plant now at the San Cristóbal mines, consisting of 30 stamps, Frue vanners, and amalgamating plates, will be overhauled, and a cyanide annex of 150 tons capacity will be installed. It is planned to devote two-thirds of the capacity of the plant to custom ores. The Veta Grande Metallurgical Co., organized in Mexico City, has purchased the old Refúgio plant, and will remodel it for modern concentration and cyanidation of custom ores. The capacity will be 60 tons per day. The San Luis del Oro Mining Co., owning the San Luis del Oro properties in the gold belt, has been reorganized, and with the resumption of milling

will do some custom work. A 50-ton custom plant, erected just north of Zacatecas by a company of which the State Government has a fifth part, will be soon in commission.

While figures are not yet complete, it is known that the 1909 production of the four big producers of the El Oro district—Dos Estrellas, El Oro Mining & Railway, Esperanza, and the Mexico Mines of El Oro—did not fall for below ₱20,000,000. Statistics for 11 months of the calendar year give a total production of ₱18,185,802, and total profits of ₱8,029,620. The Dos Estrellas was by far the most important producer of the four.

GOLDFIELD, NEVADA.

Consolidated Dividends.—Poleverde.—Black Butte.— Yellow Tiger.

In the Clermont workings of the Consolidated Mines Co. the vein has been penetrated on the 1000-ft. level. The formation at this depth is pronounced by the management to be identical with that shown 100 ft. nearer the surface, and another week's work should determine the character of the vein in the deepest workings of the district. On the 750-ft. level it is said that the vein exceeds in size anything taken into account at the time the last annual report was compiled. Stoping is now in progress at the 750 and 900-ft. levels. No interruption in operations was caused by the recent fire which destroyed the carpenter and machine shops, involving a loss of less than $10,000, and the January output of these mines will be greater than for any prior month. On January 31 the Consolidated company paid dividend No. 6, consisting of the regular quarterly distribution of 30c. per share together with an extra payment of 20c. Accompanying the dividend checks the following statement of receipts and disbursements covering the last quarter of 1909 was mailed to stockholders: Cash balance, October 1, 1909, $1,897,086.84. Receipts—October, $693,867.40; November, $606,674.64; December, $899,356.34; total, $2,199,898.38. Disbursements—October, $158,035.72; November, $197,790.05; December, $263,554.57; total, $619,380.34. Net receipts—October, $535,831.68; November, $408,884.59; December, $635,801.77; total, $1,580,518.04. Less dividend No. 5, paid October 30, 1909, $1,067,594.10. Cash balance December 31, 1909, $2,410,010.78.

This indicates that after the payment of the regular and special dividends the company's balance on hand January 31 was not less than $1,500,000. Official returns show the output for December to have been over $160,000 in excess of estimates, and the year's production was greater by this amount than indicated by figures published a month ago. During December development consisted of 4390 ft. The new manager, J. R. Finlay, announces in his report for the month that the mill has been demonstrated to have a daily capacity of fully 850 tons and that the increase in capacity has been accomplished without any loss in the metallurgical efficiency of the plant.

An advance has been made in the average of mill-heads by the Florence Goldfield to between $25 and $30 per ton, and the management claims a saving of the gold content of the ore equal to that being effected by the Consolidated. Ore reserves have been increased materially during the past few months and company officials claim a sufficient tonnage in sight to occupy the 40 stamps for over a year. The recent discovery of ore at a depth of 770 ft. in the Annex shaft on the Poleverde claim has been supplemented by cutting a parallel vein while sinking, the two veins being close together and carrying about 4 ft. of ore of shipping grade, the average being around $50 per ton. The shaft has passed the 800-ft. level and has entered the latite. There is a strong flow of water in the shaft. A large station is being cut at the 800-ft. level. From the trend of the vein, nearly east and west, it is thought to be independent of the Clermont or other known veins of this immediate neighborhood. The lower vein carries less copper than that above. Assays from 2 ft. of ore in the first vein cut returned 23% copper, $40 gold, and 15 oz. silver. The double-compartment shaft will be continued to at least the 1000-ft. level, near which depth it has been expected to cut the Clermont vein on its dip to the east. The Grizzly Bear shaft on the Jumbo is down 900 ft. and will be sunk to cut the Mohawk vein near the 1000-ft. level, as indicated by the dip above. Three shifts are working with machine drills. From the Diamondfield Black Butte, lessees have been shipping rich ore taken from a winze at the end of a 75-ft. adit driven into the butte. The vein is 36 in. wide in the winze and the ore occurs in a contact between porphyry and quartzite. Assays have varied from $40 to $400 per ton, the first shipment of 10 tons returning $200 per ton from the mill and but little sorting has been done. The reorganization of the company is now in progress, and after April 1, when assessments on the stock will be due, the officials of the company expect to have sufficient funds to begin active development and later will build a mill. L. L. Patrick, who is at the head of the concern, is having surveys made and prospecting the old workings. Lessees on the Daisy are saving some good ore for shipment and small production continues from the Goldfield Belmont. Small quantities of high-grade ore have also been shipped from the Gold Coin claim of the Jumbo Extension Co. near Diamondfield.

The reorganization of the Yellow Tiger company, with John F. Campion, of Colorado, at its head, will shortly result in the resumption of extensive work from the 750-ft. shaft sunk by the Elks Consolidated lease. The lessee company has opened over $100,000 on the claims and has now set aside a fund of $50,000 for further work to be carried on below the 600-ft. level.

AUSTIN, TEXAS.

State Mining Laws.—Difficulties in the Way of Prospectors.

Another effort will be made at the next session of the legislature to secure the enactment of a new mining law. The fact that several million acres of public domain of Texas are in what is known as the mineral-bearing territory creates a need for a law that will cause a systematic exploitation. The present mining law is looked upon by prospectors as a barrier for the reason that it imposes burdens that no one cares to assume. Since the law went into effect several years ago all prospecting upon State lands ceased. At the last session of the legislature a new mining law was passed. It was drawn to meet the views of men who are interested in the mineral development of the public lands and at the same time to afford ample protection to the State's rights. The Governor held one of the provisions of the bill to be unconstitutional and he vetoed it for that reason. It was too late in the session to secure a re-enactment of the bill with the objectionable provision eliminated. Under the existing law no minerals, as such, can be bought from the State, but the land may be purchased under its official classification of the State Land Office as 'mineral-bearing land'. The procedure to acquire a claim is this: The claimant files with the county surveyor of the county where the land is situated, an affidavit stating that he has gone upon the land for the purpose of buying it for its minerals. This affidavit is sent to the State Land Office, and the land is not subject to be sold to any one else until the lapse of one year. During that time the locator has the right to prospect the land and buy it if he so concludes. When he applies to buy it he has to pay whatever price the State Land Commissioner may fix upon it, the minimum price being fixed by the law at $25 per acre. The acreage of one claim cannot exceed 21 acres. The purchaser is allowed to pay one-fifth cash and one-fifth annually thereafter until the entire price is paid when a patent is issued. While a prospector may make a good showing of ore upon his claim during the year that he is allowed to work it before buying, there is nothing in the law to hinder the Commissioner from placing a prohibitory price upon the land at the expiration of that period.

In the Terlingua quicksilver district, in the southern part of Brewster county, there is much activity in mining on private lands, while upon adjacent sections of land that are owned by the State no prospecting or development is going forward. This is also true of the region where the Shafter silver mine is situated. It is well known to mining men that much of the public domain is rich in minerals, but no one cares to carry on any work of exploitation under the present mining law.

General Mining News.

ARIZONA.

COCHISE COUNTY

At the Bisbee Sonora Mining Co.'s property near Paradise the company has opened the ore by two upper adits and has now started a lower one that will give 600 ft. of backs. The work at present is being done by hand, but it is the intention of the company to build a concentrator and power plant as soon as the lower adit cuts the ore. At the Morrow & Chamberlain group, in the Paradise district, the shaft is down 160 ft., and drifts are started on ore that contains a good percentage of copper with some gold and silver. Money has been raised for further work on the group and a hoist and power plant will be installed this spring.

GILA COUNTY.

(Special Correspondence.) The adit from Keystone gulch, being driven to tap the orebody opened by the lateral work from the Joe Bush shaft of the Inspiration Copper Co., is in over 50 ft. Pending the installation of the 185 hp. air compressor, double hand drilling is being done. The adit is driven northeast and will be over 2000 ft. long. At the Scorpion shaft, a cross-cut at the 275 ft. level has been driven south 130 ft., opening the ore cut by the shaft which assays about 3% copper. Thomas Tighe is superintendent and T. R. Drummond manager. The No. 4 shaft of the Miami Copper Co. is now nearly 500 ft. deep. From it one of the two main haulage ways is being enlarged so electric motors can be used for hauling the ore from the mine. The depth of the present main level is 420 ft. Exploratory drifts are being driven from the main part of the mine, the longest one running southwest toward the Captain claim, where the churn-drills have recently opened a sulphide orebody about 200 ft. thick. Over 40,000 ft. of underground work has been done at this property since January, 1907.

Globe, January 28.

GRAHAM COUNTY.

Arrangements have been made by the New England & Clifton Copper Co. to raise funds to carry on further development and settle its present obligations. A small amount of ore will be shipped to the smelters for converter lining, but the main efforts of the company will be directed to blocking out a large tonnage. Harry Armstrong is manager.——A break-down of the drill on the Celtic group caused a delay of a few days in the prospecting. Operations have been resumed and the drill has cut copper ore at a depth of 180 feet.

MOHAVE COUNTY.

The power-plant at the Tennessee mine, in the Chloride district, has been started and the mine is being unwatered. There are approximately 20,000 tons of ore on the dumps that assay $4.50 gold with 16% zinc which will be shipped to the Needles smelter as soon as the spur which the engineers of the Santa Fe are surveying is completed.——New gasoline hoists are being installed at the Rainbow and Craft mines in the same district.——F. M. Drescher, representing Prescott interests, has secured a bond on the Just claims, adjoining the Carter mine, near Oatman. A hoist will be installed and a shaft sunk 300 feet.

PIMA COUNTY.

The Tombstone Consolidated Mining Co. has unwatered the shaft below the 800-ft. level. The work is proceeding slowly from that point as there is a heavy flow of water in the mine. The company is anxious to get the new machinery installed and the water lowered to the 1000-ft. level as ore of shipping grade was opened there before operations were suspended.

PINAL COUNTY.

Daniel MacFarland, of Los Angeles, has secured a bond on the claims of S. J. Tribolet and associates in the Ray district. The bond has been set at $46,000 and runs for a year from next July when the first installment of 10% is to be paid. There are seven claims in the group which will be prospected by churn-drilling.

YAVAPAI COUNTY

(Special Correspondence.) The Humboldt smelting plant, which has passed to the control of the Consolidated Arizona Smelting Co., is being remodeled, improved, and enlarged under the direction of R. H. Bennetts, general superintendent M. J. Heller, consulting engineer, and Theodore L. Genter, construction engineer. The two reverberatory furnaces, for which crude oil is to be used as fuel, are being rebuilt, their flues enlarged and a new stack erected, giving each furnace the capacity of 200 tons per day. A new blast furnace for copper ore, 48 by 170 in., purchased from Power & Mining Machinery Co., is being installed. A Connersville blower has been ordered. The two stands of converters, which were a part of the original plant, are being put in order. The converter building is of sufficient length for additional converter stands. The matte will be handled by a 30-ton electric crane, which is already in position. The slag will be dumped at the brink of Agua Fria canyon from slag cars drawn by an electric locomotive. The power plant contains two 450 hp. Nordberg engines for driving electric generators, and a Nordberg blowing engine to supply the blast for the converters. One of the principal changes at the plant relates to the economical handling of the ore by mechanical devices. The ore is brought to the receiving bins in bottom dump cars. These bins have the inverted V bottom, whereby the ore can be discharged from both sides through chutes into 2½-ton cars, the tracks for which make a continuous circuit of the receiving bins, sampling mill, and storage bins from which the furnace charge is made up. These cars are drawn by an endless cable, the latter operated by a 25 hp. motor and winding machine, running at a speed of 250 ft. per minute, carrying five cars which are sufficient to handle 600 tons of ore per day. The storage bins, 48 in number, are each 15 by 15 ft., 20 ft. deep, having hopper bottoms, through which the ore drops into charge cars, and these are hauled by an electric locomotive to the charge-floor of the furnaces. A trestle is being built from the coke yard to the charge-floor, to support tracks over which the coke required for the charge will be delivered. The water-supply for the plant and for domestic use is pumped from wells in Chaparal gulch to a 100,000-gal. tank. The water from the blast-furnace jackets, and that from the condensers in the power-plant, is carried to a storage pond through a 12-in. wooden stave pipe, the latter going through a 260-ft. tunnel that serves to cool the hot water. This pond water, after settling and filtration, is pumped into the main distributing tank again. The greater tonnage of ore required to operate this plant is to be brought from the company's Bluebell mine, three miles from Bluebell siding on the Santa Fe branch. The ore is conveyed from the mine to the railroad over a Broderick & Bascom aerial tramway. The mine is operated through a 500-ft. incline shaft that will now be sunk 100 ft. deeper. This intersects the vein at the 200-ft. station. A 2-ton skip is operated in the shaft by a 75-hp. electric hoist. Other equipment consists of a 9-drill air-compressor, the drills being 3½-in. Ingersoll-Rand. The plan is to draw a considerable tonnage of custom ore from mines in the vicinities of Mayer, Poland, Crown King, Chaparal, Cherry, and other camps of the county. The equipment at Humboldt includes a concentrating mill, in fair order, and the question of operating this later is to be considered. Besides having a machine shop, the company has a foundry, pattern shop, and cupola iron furnace. While the plant is well equipped for steam-electric power, it is probable that the necessary power will be purchased from the Central Arizona Power Co., one of whose transmission lines extends from its Fossil creek plant to Humboldt.

Humboldt, January 27.

The Federal Mining & Milling Co. is installing an 80-hp. boiler and 6-ft. Huntington mill in its plant in the Cherry Creek district.——At the Dividend the 10-stamp mill is running one shift per day crushing 20 tons of ore.——The Humboldt Mining Syndicate is opening a vein of vanadate of lead. A hoist is to be installed at the property at once.——Operations have been resumed at the Baumen properties.

YUMA COUNTY.

C. C. Burger, representing New York interests, has purchased the Muderbach group of 23 claims ten miles south of Bouse from the Excelsior Gold & Copper Mining Co. There have been two shafts sunk on the claims for about 100 ft., opening a fair grade of copper ore with some lead and gold. New machinery will be installed and the property thoroughly prospected.——At the Shamrock property, nine miles from Vicksburg, the shaft is down 115 ft. on the vein. The ore contains a high percentage of silver and copper, and shipments to the smelters from that taken out while sinking, have paid the running expenses of the property.

CALIFORNIA.

EL DORADO COUNTY.

(Special Correspondence).—W. H. Knowles has secured a bond on the Georgia Slide mines, near Georgetown, which have been worked continuously since 1853. In this property there are belts of slate from 25 to 50 in. wide, with numerous small seams of quartz which have a high gold content. The miners follow these quartz seams, take out the quartz, crush it in a hand mortar by a 10-lb. pestel on the end of a swing pole, and recover the gold by panning. The slate is broken down and thrown into sluice boxes laid on a steep grade. In the bottom of the boxes are round blocks of wood which acts as riffles and collect the gold. From these sluicing operations for so many years, an enormous tailing dump has accumulated, containing 2,000,000 tons of ore that averages $3.50 per ton. There is probably as much more in the mines, and the deepest workings are 50 ft. below the adit, which is run in from the base of the mountain. In addition to the mine and dump, there is a ditch which is a part of the holdings of the owners, and will furnish water to operate a 1000-ton mill. The local water company furnishes water for power at 15c. per miners' inch.

Georgetown, January 29.

MARIPOSA COUNTY.

A $900 pocket was opened at the Hornitos mine in the Hornitos district while doing the assessment work. Nothing but the labor necessary to hold the ground has been done at the property for the last 30 years, but the finding of several rich pockets has attracted attention to the district and it is probable that work will be resumed at the property in a more energetic manner.

NEVADA COUNTY.

The stormy weather has delayed the work at the Colling property at Rough and Ready, but the boiler, hoist, and pumping-plant has been hauled to the mine and will be installed at once.——The Sierra de Ore Mining & Development Co. has secured a 20-year lease on the claims of the Washington Mining & Milling Co., in the Washington district. There is a 20-stamp mill on the Giant King claim and a large orebody opened by three adits. The company owns an excellent water-right and one of the conditions of the lease is that the new company build a complete electric plant to furnish power for the mine and mill.——George E. Fitz Gerald, the manager for the new company which has taken over the Champion properties, is expected from the East shortly. It is planned to unwater the Champion shaft to the 2400-ft. level. New machinery will be installed and a new central shaft may be sunk to open all the properties of the group.——D. M. Stevenson and B. Barns have secured a bond on the Canada Hill mine, in the Nevada City district, and are putting the machinery in order for operation. It is estimated that it will take six weeks to unwater the property, when work will be started on the nineteenth level to open the St. Louis vein and the south drift extended along the Canada Hill vein on the twentieth level. ——Harry B. Gray, superintendent of the Grover-Murphy mine, has made arrangements to secure air for power from the Mountaineer plant and resume sinking at the 300-ft. level. A gasoline engine has been ordered and will be installed at the property to furnish power for drilling and hoisting.

PLACER COUNTY.

George H. Chadeayne has purchased the Enterprise mine, in the Meadow Lake district, from A. S. Cook, and has made a number of tests on the ore to determine the most advisable method of treatment. The property was located in 1865 but has never been thoroughly opened. The new owner will probably build a mill and cyanide plant.

SIERRA COUNTY.

The drift at the Monte Cristo gravel mine has followed the channel for 95 ft. in a northerly direction and a cross-cut has been started for the west rim. A cross-cut will be started shortly for the east rim and the main adit driven to the limit of the claim.——A lower adit at the Good Faith claim, near Downieville, cut a 5-ft. vein of milling ore.

SISKIYOU COUNTY.

The Manley Lumber Co. has secured the contract to furnish the lumber for the new mill being erected at the Oom Paul mine and is delivering the timber to the company. The foundations have been laid and work has been started on the main building. Timbers for the mine have been delivered and a crew of surveyors are running a line for the power company's wires.

TRINITY COUNTY.

D. H. Lane has secured a bond on the Knob mine, in Eastman gulch, with an option to purchase the property for $35,000, the option to expire May 1. Paulsen & Collins and Wilson & Siligo have leases in the mine that will run till May. These lessees have shipped considerable ore from the property that assayed as high as $700 per ton.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—A 4-in. streak of ore has been opened in a vein just intersected by the Ramsdell adit that assays 23 oz. gold per ton. This vein is supposed to be an extension to the west of the Homestake where ore is being mined that contains 32 oz. gold and 37 oz. silver per ton. G. W. Teagarden is manager.——Work has been resumed in the advance of the Paragon adit.——W. Kramer, has uncovered a 6-in. streak of 350-oz. silver ore on the Lost Treasure property, situated on Columbia mountain. The ground is being prepared for stoping and regular shipments are to be started.——The shaft on the Sporting Times mine, Alpine mountain, is being cleaned out and retimbered. There is said to be a body of ore exposed on the lower level that is from 8 to 10 in. wide that will mill from $80 to $85 per ton gold and silver. A. H. Colburn is the owner.——The Waldorf Metals Co. has secured a lease on the property of the Wilcox adit workings, with the exception of a small block of ground 5000 ft. from the entrance, where a raise is now being put through to connect with the upper workings.

Georgetown, January 29.

(Special Correspondence).—More men are employed at the Shafter mine, on Bellevue mountain, than at any time during the last six months. The Hudson mill is running night and day treating the product and a reserve of 500 tons has accumulated in the bins. A. H. Roller is manager. ——Increased development has been started by the General Consolidated Mining Co., operating a large group of claims. Lumber is now on the ground and large ore-bins are being constructed preparatory to starting shipments. C. L. Jaynes is manager.——Shipments of concentrate were started this week by the Tanquay Mining Co.——A rich discovery has just been made on the Big Horn property, operated through the Cymric adit. The streak is 6 in. wide with a fair content of wire silver.——The Cincinnati mine, in Hamlin gulch, is working a 4-in. streak of ore that is worth from $40 to $60 per ton. N. M. Galloway is the owner.

Idaho Springs, January 28.

GILPIN COUNTY.

(Special Correspondence).—The Pine Comb Gold Mining Co., operating in the Wide Awake district, is preparing for extensive development. E. Shoush is manager.——Three feet of ore has been cut on the hanging wall of the Sayre-Mammoth vein at the 500-ft. level of the Cook shaft that is worth $24 per ton. T. B. Bassett is manager.——A shipment of two carloads of ore from the King Bee mine, op-

erated through the Newhouse tunnel were settled for at the rate of 5.26 oz. gold and 71 oz. silver per ton. ——Sherr & Co., leasing on the 1000-ft. level of the Old Town, are sending out three carloads of ore per week that is worth on an average of $35 per ton. ——Hughes & Davis, lessees of the Champion mine, have started shipments, the ore being sent to the custom mills at Black Hawk. ——Harris & Co., operating on the 100-ft. level of the Russell mine, are sending out heavy shipments, the concentrate being worth $27 per ton. Occasional shipments of smelting ore assaying 2 oz. gold and 23 oz. silver per ton, with 5% in copper, are made.

Central City, January 28.

LAKE COUNTY.

The Spring Steel adit, in California gulch, which is being driven to open the Lillian property, is in 500 ft. and will be continued 400 ft. more to cut the main veins of the mine. Several stringers have been intersected and a raise started on one of them. J. Clarence Hersey is in charge of the work on this property and a similar undertaking at the Lovejoy group on Printer Boy hill.——The Breece Hill Mining & Development Co., operating several leases in Adelaide park, have completed a shaft on the Dolomite claim and have commenced shipping ore.——A station is being cut at the 200-ft. level of the shaft sunk in the St. Louis adit, and as soon as this work is completed the shaft will be sunk another 200 ft.——A new 1200-hp. electric hoist has been installed at the Cleveland mine and operations resumed.—— About 400 tons of sulphide ore per month is being shipped from the Adelaide property which is being worked through the Yak tunnel.

OURAY COUNTY.

A new electric hoist has been installed at the Thistledown. The mill and tramway will soon be in working order and a larger crew will be put to work in the mine.——The lessees of the Wedge mine shipped the third car of high-grade silver ore.——At the Black Diamond property, north of Ouray, the operators are blocking out the ore and storing that taken out in the development on the dump. This will be shipped to the pyritic smelter as soon as the furnace is ready for operation.

SAN JUAN COUNTY.

Lumber is being hauled to the Silver Lake mine from Silverton and the terminal which was destroyed by fire a few months ago is being replaced. The mines have been idle for over a year but it is understood that operations are to be resumed this spring. As there are about 200 claims in the group with some 18 miles of underground work the resumption of work will mean a great deal for the district.

SUMMIT COUNTY.

M. A. Wright and Louis Lipp, operating the S. B. Wright property on Gibson hill under lease, have opened a body of carbonate ore and made several shipments to the smelters.——A small force of men is working at the Wire Patch and the management expects to cut the vein within the next 100 ft.——Regular shipments of high-grade zinc ore are being made from the Sallie Barber and Little Sallie mines.——The drift on the adit level of the King Solomon mine, at Frisco, opened a shoot of high-grade lead-silver ore containing some copper and gold. The vein is 9 ft. wide, but the shipping ore is only from 10 to 14 in. The adit intersected the vein at a vertical depth of 2000 feet.

TELLER COUNTY.

Allen L. Burris, manager for the El Paso Consolidated Gold Mining Co., has directed letters to the lessees stating that the leasing system would be continued in the company's mines the coming year, and that applications for leases should be filed with the company before March 1.——The Roosevelt deep drainage tunnel cut a 30-ft. vein of milling ore when in 12,245 ft.——E. Edison, operating a lease on block 152 in the Crescent mine, on Womack hill, opened a body of shipping ore at a depth of 120 ft.——A new set of rolls has been placed in the Trilby mill, increasing its capacity to 70 tons per day, and operations resumed. Recent work on the eleventh and thirteenth levels in the mine have opened two shoots of good milling ore.——A rich shoot has been cut by the lessees in the Orphan Belle mine and a shipment sent to the mills that will average about 2 oz. per ton. ——The Vindicator Consolidated Gold Mining Co. has declared a dividend of 3c. per share, payable February 15. ——The shaft of the lessees at the Gold Dollar mine cut a body of $30 ore when down 18 ft., and shipments are being made. ——A crosscut has been driven to the Modoc vein on the eleventh level of the Modoc mine on Bull hill and a raise started in the ore. The vein is from 18 in. to 8 ft. wide, and assays as high as $60 per ton.

IDAHO.

IDAHO COUNTY.

S. R. Gayton, manager for the Penn Dixie company, has purchased the Dixie townsite of 153 acres near Dixie and will build a power plant utilizing the power developed by the water of Crooked creek. At the mine the company is to add six stamps and a cyanide plant to the equipment in the near future.——The Majestic company is installing a new 60-hp. boiler, engine, and compressor. ——A 20-ton mill is being erected on Hazlitt & Trader's Oliva property.——Operations are to be resumed at the Dixie Royal property this month.

KANSAS.

CHEROKEE COUNTY.

(Special Correspondence).—In the Baxter Springs camp many companies are making preparations for the enlargement of the mills already on leases or the erection of new mills. The Mission plant of 500 tons is now completed and has started operations. The Omaha-Petersburg company is making plans for the erection of the most costly plant in the camp, the plans having already been accepted and the contract will be let at once. Many new devices for the saving of the sludge and fine will be installed. The plant will be completed by May 1.——The capacity of the Okla mill is being increased to 400 tons by the installation of new machinery, including crushers, boilers, and jigs. Oil burners are being placed under all the boilers, the fuel bill being thus reduced 30%.——The capacity of the Mason mill is being doubled by the installation of new Faust jigs and the tables will no longer be used.——The Tennessee Metal Producing Co. has taken over the lease and mill of the Quivera Mining Co., and the 10-acre lease of the old Mascotte mine and will erect a tramway to the mill from the Mascotte shaft. Shafts are in ore on both properties and the lessees will begin active operation at once.——In the Galena camp the Big Four Co., operating a 30-acre lease in the Cave Springs camp adjoining the Herald mine, is taking out good ore from the shaft at 90 ft. Drifts have been run at this level. Hand jigs have been installed for the cleaning of the fine ore but the coarse rock is piled aside awaiting the erection of a mill. There is considerable quantity of the fine ore in the bins as the company has made no sales as yet.——The find made recently on the Foster land continues to improve as work advances. After penetrating the ore at the upper level the drill entered barren ground at 80 ft., continuing to 85 ft., after which a fine run of ore was again struck. The ore is of high grade, assaying more than 62% zinc.

Galena, January 28.

MONTANA.

SILVER BOW COUNTY.

(Special Correspondence).—The new year starts off very badly for the Butte district, so far as copper production is concerned, and while January will show a production larger than that of December, it will still be far below the normal for the district. While the Butte output is restricted, all evidence goes to indicate that within the next year or two Montana will again take the lead as a copper producer. This condition will be brought about by the contribution from the Corbin-Wickes district. Three or four companies operating in that district will be producing copper in considerable quantities within a year.——The Boston & Corbin Copper Co., of which N. L. Amster is president, has already blocked out, ready for the concentrator, no less than 234,000 tons. This company is installing a large and complete electrical equipment.——Stephen R. Dow, president of the Corbin company, says that company has blocked out

sufficient tonnage of copper ore to justify the installation of a large concentrator, and it is understood that orders have been placed for the machinery for a mill by the company. Another important company, and which will shortly be ready for production, is the Robert Emmet Copper Co., which probably has the most completely equipped property in the district. The plant is completely operated by electricity.——The board of directors of the Butte & New York Copper Co. has been reorganized and the Butte & Superior company now has six members on the board, the last of the old directors to retire being H. E. Mittenhal, of New York. ——The British-Butte Mining company has made an annual report of its financial condition showing a gross indebtedness of $221,580, its capitalization being $5,000,000.——The Rarus mine of the Butte Coalition company, the West Colusa of the Boston & Montana, the Parrot mine of the Parrot company, and the Moonlight of the Washoe company, are still idle. Some changes are being made in the shaft of the West Colusa and it will be several months before that mine is operated again.

Map of Butte District.

Butte, January 28.

NEVADA.

CLARK COUNTY.

The new station-pump has been installed at the 300-ft. level of the New York property in the Searchlight district and sinking will be continued to the 500-ft. level. A power-drill has been purchased by the company and sinking by hand abandoned.——The Knight custom mill has been completed and is to start operations in a few days.——The west cross-cut on the Duplex Extension ground has opened a number of stringers of fair ore.

ESMERALDA COUNTY.

The shaft of the Goldfield Annex opened five feet of $50 ore just after passing the 775-ft. point, and is again in similar material at a depth of 805 ft. The ore dips at an angle of 30°, and is in a highly metamorphosed and silicified latite. A considerable amount of copper sulphide is present in the ore.——J. O. Buckley and associates have formed the Queen Consolidated Mining Co. and secured a lease upon blocks 10 and 11 of the Union Jack claim of the Atlanta estate, the ground being part of that which was at one time held by the Nevadan & Eastern Leasing Co. The two blocks adjoin the old June Atlanta lease, which was operated by Mr. Buckley and associates, and are close to the Precious Metals, Cherokee, and LeMance claims, all of which are now operating. The June Atlanta shaft will be used by the new lessees, the lease being granted under condition that the June Atlanta shaft, now 400 ft. deep, would be sunk to 750 ft., with two shifts, and a lateral cut from the 750-ft. level to the ground secured by the lessees. Work upon the new lease began February 1. The old June Atlanta shaft is double-compartment, well timbered, and equipped with a 60-hp. electric hoist.——The Grizzly Bear shaft reached the 900-ft. point with no change in formation, and sinking will continue till the extention of the Clermont vein is opened. The formation is latite, highly silicified and containing some iron sulphide, the value, however, being so low as to be neglible. Wallace McGregor, the manager of the Grizzly Bear, does not expect to open the ore until the 1000-ft. level is approached.——Work on the Nevada Eagles property, to the west of Goldfield, is progressing steadily. Some ore is being sacked, and development work is going ahead regularly, drifts being run on the veins in order to prove their value. The ore-shoot contracts and widens, the value being somewhat erratic. When a little more is learned about the formation the vein will be tapped at the 400-ft. level and explored.——The recent discovery at the Campbell lease, on the Diamondfield Black Butte property, continues to improve. Two shipments totaling about 25 tons have been forwarded and assays of grab samples taken from 25 sacks averaged $500 per ton. The vein is now 3 ft. wide, and the ore is sorted at the mine before it is shipped.

LYON COUNTY.

A 75-ton continuous Hunt filter is being installed at the Phillips mill at Silver City. It is expected to effect a considerable saving as this will do away with the previous system of storing the tailing. The filter is to be completed some time this month and later in the spring the whole mill will be overhauled and repaired.——Sinking has been stopped at the 800-ft. level of the Overman on account of the heavy flow of surface water. A good vein has been opened at that depth and in the spring the shaft will be unwatered and sinking resumed at that level.

NYE COUNTY.

(Special Correspondence).—A. C. Eisen, president of the Mayflower Consolidated Mining Co., has agreed to the authorization of a call for a special meeting of the stockholders at Rhyolite on February 5. A new directorate is expected to be chosen and it is believed that the difficulties of the company will be adjusted. Mr. Eisen has decided not to press his claims against the company.——The production of the Montgomery-Shoshone for the past four or five months shows a falling off from the previous records. ——The Sunrise Pioneer Leasing Co. is pushing work on the K. K. lease. The adit discloses low-grade milling ore. ——The Johnnie Mining & Milling Co. has passed into the hands of A. D. Meyers, T. A. Johnson, L. J. Christopher, and associates. L. J. Christopher has been elected president, M. S. Gregory, treasurer, and T. A. Johnson, manager. The property is equipped with 16 Nissen stamps and a Lane mill, with the daily output exceeding 100 tons. The new manager states that the capacity of the mill will be increased to about 200 tons per day. Another Lane mill will probably be installed. The ore assays from $4 to $15 per ton, and is handled at a cost of $3.50 per ton.——As a result of the intensely cold weather at Manhattan most of the placers have been forced to close. The Wilson lease, on Wolftone Extension, the Bisell lease, on September estate, and two or three others are working whenever the weather permits.——The Manhattan Milling & Leasing Co. is shipping ore from lease 14, on Union No. 9, to the Canyon mill. It averages about $30 per ton.——The Gold Crest has finished its prospect shaft in the main placer gulch and is said to have opened pay gravel. O. B. Steen and associates are working on the Fulkerson, Price & Weedman and Allison claims. The company has acquired two miles of East Manhattan gulch and will thoroughly test the gravel.

Rhyolite, January 27.

STOREY COUNTY.

The Comstock-Phoenix company has completed the installation of its new electric hoist and power-plant at its

property in the Brunswick district and are sinking a winze on the ore at the adit level. This is down 90 ft. and it is the intention of the management to erect a mill if the value continues the same. The Charles Butters Co., Ltd., purchased the Monte Cristo property at the junction of Six and Seven for $20,000 and are installing an electric hoist and No. 5 Cameron sinking pump. The shaft was sunk 150 ft. in early days and over $1,000,000 worth of ore taken from the surface workings.

WHITE PINE COUNTY.

(Special Correspondence.) The re-timbering of the Giroux shaft is progressing at the rate of 17 ft. per day, and it is expected to have it in working order about the middle of March. Sinking has been resumed and it is reported that work will be continued until the 2000 ft. level is reached. The inside dimensions are 18 by 18 ft. It is reported that the company is contemplating the sinking of two new shafts, one of which will be on Rickard Ely group.

Ely Resurrection is pushing work on the Rattler adit where a 4 ft. body of medium grade ore has been opened. A Star drill, capable of going to a depth of 2000 ft., has been ordered and will be placed in operation before March. It is intended to sink a 2 or 3-compartment shaft when the drilling has been completed.

Ely, January 29.

OREGON.

MULTNOMAH COUNTY.

(Special Correspondence.)—Considerable interest is manifest here in the proposed United States National Fair. This project is under the auspices of the United States Agricultural & Industrial Exposition Co., which is incorporated under the laws of Delaware, with a capital of $1,000,000. The purpose of the incorporation is to hold an annual national exposition in one of the Western States. It has not yet been decided in what city of the West the first fair will be held, but this question is to be decided soon. The directors of the company are: Albert E. Brown, Syracuse, I. D. Graham, Topeka; George S. Walker, Cheyenne; Joseph E. Wing, Mechanicsburg; B. F. Dixon, Raleigh; Charles W. Bush, Wilmington; James Handly, Quincy; Robert P. Lyon, Hartford; and E. Alexis Taylor, director general, Hartford. The management has announced its determination to give the mineral industry of this country a strong representation at the exposition.

Portland, January 29.

SOUTH DAKOTA.

LAWRENCE COUNTY.

The 240-stamp Amicus mill and No. 1 cyanide plant, together with 200 stamps in the Homestake mill, have been started.——The Wasp No. 2 mill, at Flat Iron, was set on fire and completely destroyed from a spark from a fire that was built to dry out one of the tanks preparatory to painting it. The loss amounted to between $50,000 and $75,000 and was partly covered by insurance. The company will re-build the plant at once.

UTAH.

SALT LAKE COUNTY.

At the annual meeting of the stockholders of the Black Bird Copper-Gold Mining Co., held at Salt Lake, a considerable majority of the outstanding stock was represented, and B. N. Lehman was elected treasurer and general manager. It was decided at the meeting also to continue the development of the company's claims, situated on territory adjoining the property of the South Utah Mines Co., formerly the Newhouse company, in southern Utah, by means of core-drills. This work was started last spring and continued until late fall, when the severe weather forced the suspension of active operations. One hole is already down a considerable distance and a second one is well under way, and as soon as possible the work will be continued.——Recent developments in the property of the Utah-Apex company at Bingham Canyon have so increased the reserve of ore that the management has decided to increase the plant to handle 500 tons of ore per day. On a recent shipment to the smelter the assay was 11 oz. silver per ton with 37% lead and 1.6% copper.

SUMMIT COUNTY.

The Utah First National Mining Co. is to commence operations this spring on the group of claims recently acquired in the Deer Valley district. At the property which is north of Park City, the shaft is down 225 ft., but had to be abandoned on account of the heavy flow of water opened at that level. It is now understood that as soon as the weather modifies enough to allow material to be hauled to the mine an adit will be started farther down the hill that will tap the vein at a depth of 700 ft.——Work has been temporarily suspended at the American Flag mine.——At the Ontario H. M. Crowther and associates are shipping regularly from their lease on the upper levels and are employing 25 men in the work.——An assessment of 5c. per share has been levied by the directors of the Wabash Mining Co., payable before February 21, and work is to be resumed at the property.

WASHINGTON.

FERRY COUNTY.

Alfred H. Stiles is driving an adit on the Good Ore mine that will cut the vein at a depth of 75 ft. There is a quartz vein on the property that is 3 ft. wide and assays well in gold and silver.

SNOHOMISH COUNTY.

(Special Correspondence.)—Jacob S. Hett has been appointed receiver of the Atlas Corporation of Maine, which is operating the Wayside mine at Granite Falls, this action being taken to facilitate reorganization of the company. Work on the lower levels continues to be retarded by the excessive flow of water. Since the commencement of the switchmen's strike, a portion of the crew has been kept cutting wood to take the place of coal for fuel.——There will probably be no train to Silverton for about two months on account of the washouts between that point and Robe as a result of the recent floods. One bridge will have to be partly re-built. These conditions will retard mining operations along the Monte Cristo branch of the Northern Pacific.——The Bunker Hill Mining Co. is operating two diamond-drills in exploration work at its property at Reiter. The smelter will not be blown-in unless larger orebodies are opened or the price of copper advances.——A gasoline locomotive for use on the narrow-gauge line which was completed last fall between the Apex mine and the Great Northern, near Berlin, is on the way from the Eastern factory. This line is six miles long and the cars at present are hauled by a team of horses. The ore goes to the Everett smelter, where it is run through the arsenic plant and afterward sent to the Tacoma plant. There are 20 men on the Apex payroll.——The Seattle-Cascade Mining Co. has just completed the installation of a water-power plant and a 5-drill compressor. It is driving a 300-ft. cross-cut which is expected to intersect the main vein 800 ft. below the upper workings. This company has seven to ten feet of ore uncovered, assaying high in gold, silver, copper, and lead.

Everett, January 29.

MEXICO.

HIDALGO.

The Real del Monte y Pachuca company has declared a dividend of $200 per share which is the largest dividend declared by this company.——The Maravillas y Anexas paid $4 per share January 26, and the San Rafael Anexas properties paid dividends on January 27 as follows:

SAN RAFAEL AVIADOR.

San Rafael	$16
Sorpresa	24
Soledad	8
	$48

SAN RAFAEL AVIADO.

San Rafael	$16
Sorpresa	30
Soledad	10
	$56

The San Rafael company is considering plans for increasing the capacity of the mill.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

POPE YEATMAN has gone to Chile.

C. G. CAHILL has gone to Tepic, Mexico.

W. H. KNOWLES is at Georgetown, California.

BENNETT M. CAHILL has gone to Wonder, Oregon.

C. D. KAEDING has gone to Minas Prietas, Mexico.

S. FRAZIER has gone to Chicago from Bristol, Tennessee.

HORACE V. WINCHELL is examining mines in Arizona and Mexico.

JOHN D. HOFFMANN has gone to Guadalupe, Zacatecas, Mexico.

P. H. MCLAUGHLIN has gone from Las Vegas, Nevada, to Kingman, Arizona.

F. D. GROSS, of the Colorado Iron Works, was at Jerome, Arizona, last week.

MIGUEL DE LAVEAGA has arrived in San Francisco from San Dimas, Durango, Mexico.

E. C. B. HEDEN is with the Konieh Mercury Syndicate, Ltd., Konieh, Turkey, in Asia.

J. H. MORELAND, of Kansas City, was in San Francisco, on his way to Parral, Mexico, this week.

EDWIN E. CHASE, mining engineer, Denver, Colorado, has been in Yavapai county, Arizona.

EDWARD G. ACHESON was presented the Perkin medal at a meeting of the Chemists Club at New York, January 21.

H. P. HENDERSON has resigned as superintendent of the Goldfield Consolidated and gone East on personal business.

LAFAYETTE HANCHETT and W. H. WILEY, with their families, sail from San Francisco today on the *Cleveland* for a vacation trip around the world.

ALBERT SPIES has retired from the editorship of *The Electrical Review* to take charge of the *Foundry News*, a new monthly to be published in New Rork.

T. N. STANTON has resigned from the service of the Old Dominion Copper M. & S. Co., and is superintendent for the Magistral-Ameca Copper Co. at Ameca, Jalisco, Mexico.

FRANK A. ROSS, who made the final report on Cinco Minas, Jalisco, Mexico, for the Estate of Marcus Daly, has returned to his headquarters at the Spokane Club, Spokane, Washington.

R. A. CONRADS has resigned from the Esperanza Mining Co., El Oro, Mexico, and has formed a partnership with A. S. PERRIER. His address will be Ixtlán del Rio, Territory of Tepic, Mexico.

GELASIO CAETANI has resigned the position of mill supertendent to the Bunker Hill & Sullivan M. & C. Co., becoming consulting metallurgist to that company with headquarters in San Francisco.

J. B. TYRRELL has been spending some time looking over the new gold finds near Porcupine lake in northern Ontario. He is now delivering lectures on the 'Structure and Origin of Placer Deposits' at McGill University.

Obituary.

A. F. WUENSCH, who died at Albuquerque, New Mexico, December 19, had a high and deserved reputation as a mining engineer. He was best known in Colorado, the scene of most of his life's work. Coming to Leadville in the early days of that camp with some knowledge of mining, he took up the newspaper work and was for many years the best known newspaper correspondent in the district. At a later period, deciding to go into mining work, he prepared himself by a course at Freiberg, returning to Colorado to become examining expert for D. H. Moffat. In this position he obtained wide experience and had an important influence on the development of the State. Still later he began to operate on his own account and was successful in this as in other things, amassing a comfortable fortune.

Market Reports.

LOCAL METAL PRICES.

San Francisco, February 2.

Antimony	12—12¾c	Quicksilver (flask)	51—51½
Electrolytic Copper	15¼—16½c	Spelter	7⅞—8¼c
Pig Lead	4.95—5.90c	Tin	36—37½c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver per oz.
Jan. 27	13 56	4.70	5.97	62¼
" 28	13.56	4.70	5.92	62¼
" 29	13.50	4.70	5.87	62¼
" 30	Sunday.	No market.		
" 31	13.50	4.70	5.83	62
Feb. 1	13.50	4.70	5 83	61½
" 2	13.50	4.70	5 83	61¾

Review of January Copper.

By MISHA E. APPELBAUM.*

The beginning of the new year found copper firmly intrenched upon a 14c. delivered 30-day basis for electrolytic and 14⅛ for Lake, with the bulk of the requirements of most of the consumers covered for the months of January and February. Outside of a slight March inquiry there was little demand for copper during the month, the only exception being for wire-making, which industry continued to show improvement and caused the wire companies to buy additional supplies for early delivery. The statistics made public on January 10 showed a net decrease on this side of 11,000,000 lb., being principally due to decrease in production. It must be remembered, however, that the curtailment of output, as well as interference with production due to the strike and weather, was not expected to make itself felt during the month of December, since a reduced output at the mines in December means a corresponding reduction in the refined output sixty days later. The heavy curtailment should be shown in the statistics for the months of January and February and published on the 10th of each month. The figures for January should show a decrease of at least 20,000,000 lb. and those of February of about 25,000,000 to 30,000,000. About January 13, and again between January 24 and 26, due principally to the heavy declines in securities, several concerns which had heretofore held for higher prices, pressed copper for sale, and this, together with the anxious selling by second-hands, caused recessions of ¼ to ⅜c. per lb. Apparently this had little influence on the London market. As soon as the latter would display a firmer tendency, the metal would again be quoted here at figures mentioned in the first paragraph. Toward the end of the month, on the announcement that the Anaconda would increase its capital and that this would be the first principal step toward the eventual amalgamation of the principal copper properties, the London market showed considerable strength and the domestic consumers displayed more anxiety to cover some additional March requirements. They would have gladly taken copper at the same figures for April and May, but found few sellers.

From all available information, I am firmly of the opinion that we can figure with safety on a domestic consumption of a minimum of 70,000,000 lb. per month for at least the first six months of the present year, and that we can also rely on Europe to take about 50,000,000 lb. per month, so that it will be rather easy to account for deliveries of 120,000,000 lb. per month. The production for the first three month of the present year should be in the neighborhood of 100,000,000 to 110,000,000 lb. per month, and I believe that the statistical position of the metal is favorable to maintaining, at least, the present prices. It is, however, natural to assume that some of the copper producers will not sell all of the copper produced, but that they will withhold a portion of their production for higher prices, as it is the concensus of opinion that within a comparatively short period sufficient independent mines will combine, to give the market the stability in price desired by all.

*President of the New York Metal Selling Company.

MARKET REPORTS.

ANGLO-AMERICAN SHARES

Cabled from London

	Jan. 27 £ s d.	Feb 2 £ s d.
Camp Bird	1 8 0	1 7 6
El Oro	1 9 0	1 8 0
Esperanza	3 0 0	2 19 6
Dolores	1 8 9	1 8 9
Oroville Dredging	0 9 0	0 9 0
Mexico Mines	8 4 9	8 5 0
Tomboy	0 17 6	0 17 6

(By courtesy of W P Bonbright & Co., 24 Broad St., N Y.)

COPPER SHARES—BOSTON

	Closing Prices. February 2		Closing Prices February 2.
Adventure	9	Mayflower	1⅝
Allouez	45	Mexican Con	4
Arcadian	7	Michigan	7
Arizona Commercial	42¼	Mohawk	67⅛
Atlantic	9	North Butte	65
Black Mountain	25	Old Dominion	45
Boston Con	19	Osceola	154
Butte & London	21	Parrot	19⅛
Cactus	5½	Quincy	84
Calumet & Arizona	70	Raven	55
Calumet & Hecla	630	San Antonio	7
Centennial	28	Santa Fe	2⅛
Chemung	13	Shannon	16¼
Con. Mercur	10	Superior Copper	54½
Copper Range	76¼	Superior & Boston	14⅛
Corbin	20	Superior & Pittsburg	13⅜
Daly West	8⅛	Tamarack	63
East Butte	10⅛	Trinity	8⅛
Elm River	1¼	U. S. Smelting	46½
Franklin	20	U. S. Pref'd	50
Granby	93	Utah Con	39
Greene-Cananea, ctf	9½	Victoria	4⅞
Hancock	25	Winona	9⅞
Helvetia	4¾	Wolverine	140
Mass Copper	7¼	Wyandot	2¼

(By courtesy of J. C. Wilson, Mills Building.)

SOUTHERN NEVADA STOCKS.

San Francisco, February 2.

Atlanta	$ 14	Mayflower	$ 2
Belmont	1.20	Midway	24
Booth	10	Montana Tonopah	89
Columbia Mtn	5	Nevada Hills	60
Combination Fraction	32	Pittsburg Silver Peak	70
Daisy	8	Rawhide Coalition	15
Fairview Eagle	12	Rawhide Queen	20
Florence	2.47	Round Mountain	54
Goldfield Con	7.50	Sandstorm	4
Gold Kewenas	5	Silver Pick	8
Great Bend	3	St. Ives	11
Jim Butler	11	Tonopah Extension	70
Jumbo Extension	23	Tonopah of Nevada	6.00
MacNamara	27	West End	23

(By courtesy of the San Francisco Stock & Exchange Board.)

COMSTOCKS.

San Francisco, February 2.

Alpha	$ 11	Justice	$ 24
Alta	24	Kentuck	15
Andes	25	Lady Washington	15
Belcher	1.12	Mexican	1.70
Best & Belcher	85	New York Con	5
Bullion	24	Occident	32
Caledonia	49	Ophir	2.02
Challenge Con	31	Overman	68
Chollar	29	Potosi	70
Confidence	1.50	Savage	47
Con. Imperial	7	Scorpion	10
Con. Virginia	1.82	Seg. Belcher	10
Crown Point	1.10	Sierra Nevada	73
Exchequer	25	Silver Hill	17
Gould & Curry	37	Union	86
Hale & Norcross	63	Utah	12
Julia	16	Yellow Jacket	1.30

OIL SHARES.

San Francisco, February 2.

Associated Oil	$47.00	Palmer	$ 1.05
Bay City	2.00	Paraffine	1.45
Blue Moon	30	Premier	1.17
Chicago Crude	11	Producers	2.00
Claremont	2.05	Record	6.00
Four	40	S. F. & McK	27.00
Illinois Crude	55	Sauer Dough	2.40
Junction	40	Sesnon	8.00
Mascot	2.00	S. W. & B.	45.00
Monte Cristo	1.52	W. K. Oil	2.25

(Courtesy California Stock & Oil Exchange.)

MINING STOCK QUOTATIONS—NEW YORK

(By wire from Catlin & Powell Co., New York.)

	Closing prices. February 2.		Closing prices February 2
Amalgamated Copper	81	Miami Copper	24⅛
A S A R Co	40⅛	Mines Co. of America	⅛
Boston Copper	19⅛	Montgomery Shoshone	1
B C Copper Co	7⅛	Nevada Con	23
Butte Coalition	25⅛	Nevada Utah	1⅛
Cumberland Ely	8	Nipissing	10
Davis-Daly	3⅛	Ohio Copper	4⅛
Dolores	7⅛	Ray Central	4⅜
El Rayo	2⅛	Ray Con	23⅜
Ely Central	1⅞	South Utah	⅛
First National	5	Superior & Pittsburg	14⅛
Giroux	10⅛	Tenn. Copper	34⅛
Guanajuato Con	1⅝	Trinity	9⅛
Inspiration	9	Tuolumne Copper	⅜
Kerr Lake	8⅞	United Copper	7⅛
La Rose	4⅜	Utah Copper	50⅛
Mason Valley	2⅜	Yukon Gold	4⅛

Monthly Statement of Dividends Paid by Active Listed Oil Companies to January 31, 1910.

Company.	No. of Div.	Date paid	Amount per share.	Amount of dividend.	Total paid to date.
Alma	14	Jan. '10	3	11,400.00	$159,600.00
Amalgamated Oil.	28	Jan. '10	1.00	50,000.00	1,100,000.00
Amer. Petroleum.	7	Jan. '10	1.00	122,785.00	803,225.50
Apollo	2	Mar. '05	1	2,000.00	4,000.00
Associated Oil Co.	4	Mar. '07	1.50	446,055.00	1,548,368.55
Bay City	3	Dec. '09	30	30,000.00	70,000.00
Brookshire	45	Jan. '10	1	5,000.00	442,500.00
Carbon	57	Jan. '10	25	20,175.75	660,180.24
Chicago Crude	2	Mar. '07	0½	5,000.00	15,000.00
Claremont	56	Jan. '10	2	10,000.00	305,000.00
Coalinga Pacific	18	Dec. '09	10	6,500.00	107,250.00
Columbia	35	Jan. '10	0½	1,996.31	254,811.63
Del Rey	3	May '09	0½	3,927.50	11,782.50
Esperanza	26	Dec. '09	2	3,200.00	49,450.00
Euclid	35	Jan. '10	1	3,500.00	117,000.00
Four	67	Dec. '09	1	3,000.00	210,000.00
Globe	20	Jan. '10	1	6,000.00	81,000.00
Hanford	12	Jan. '06	2.00	4,000.00	80,000.00
Home	A15	Jan. '10	2	2,000.00	470,000.00
Homestake	44	Dec. '09	10	1,000.00	76,250.00
Illinois Crude	35	Jan. '10	1	2,000.00	84,000.00
Imperial	67	Jan. '10	60	60,000.00	1,940,000.05
Junction	8	June '09	1	2,500.00	20,000.00
Kern Oil	2	Nov. '09	22	22,000.00	42,000.00
Kern River	39	Feb. '09	10	2,000.00	98,000.00
Linda Vista	18	Nov. '09	1	3,838.50	65,254.50
Lucile	16	Dec. '09	10	2,670.44	42,727.04
Mex. Petroleum	41	Jan. '10	1 1/21	85,616.70	3,306,010.14
Mecca	6	July '09	3	12,675.00	71,825.00
Monte Cristo	58	Oct. '09	3	15,000.00	340,000.00
Nevada County	3	Oct. '08	1	10,000.00	40,000.00
Palmer	8	Jan. '10	1	18,020.05	214,320.80
Paraffine	3	Jan. '10	1	3,000.00	9,000.00
Peerless	77	Sept. '09	6	6,000.00	801,000.00
Piedmont	6	Aug. '09	1	3,890.00	22,987.30
Pinal	5	Jan. '10	10	14,992.00	857,117.50
Pittsburg	10	Nov. '07	24½	58,800.00	124,800.00
Record	7	Jan. '10	7½	7,500.00	40,000.00
Reed Crude	11	Dec. '09	12	12,000.00	1,124,000.00
Rice Ranch	16	Jan. '10	1	3,000.00	93,000.00
Royalty	14	Jan. '10	2	400.00	8,000.00
S. F. & McKittrick	21	Jan. '10	30	15,000.00	310,000.00
Sauer Dough	47	Jan. '10	2½	4,987.50	507,328.50
Sesnon	6	Jan. '10	15	15,000.00	90,000.00
Silver Tip Oil Co.	3	Dec. '09	10	7,500.00	22,500.00
Sovereign	17	Jan. '10	1	5,000.00	90,000.00
Sterling	22	Dec. '09	25	62,500.00	747,000.00
Superior	10	Nov. '09	1½	7,500.00	52,500.00
S. W. & B.	7	Sept. '09	1	3,770.00	41,470.00
Thirty Three	58	Sept. '09	30	30,000.00	670,000.00
Traders		Jan. '10	1.00	14,000.00	157,186.50
Union	162	Jan. '10	50	124,813.00	6,118,629.15
United Petroleum	101	Jan. '10	50	10,375.50	2,098,208.93
Wabash	25	Jan. '10	1	3,000.00	114,000.00
West Coast (pfd.)	3	Nov. '09	2.00	20,816.00	62,148.00
Western Union		Dec. '07	2.00	20,000.00	484,951.00
West Shore	47	Dec. '08	5	5,000.00	235,000.00

Total dividends paid to date $28,010,682.78

Total dividends paid by the above companies for January 1910 ..... 652,561.81

Geological Survey Review of Gold and Silver Mining in 1909.

Compiled by WALDEMAR LINDGREN and H. D. MCCASKEY.

Gold mining in the United States progressed satisfactorily in 1909. The year was marked by increasing recovery from depressed conditions and by general advance in the development of proved mines and districts; although there was a generally increased production of the base metals, and as a consequence an augmented gold output. From the preliminary figures of the Director of the Mint, published last week, it is estimated that the output of gold for 1909 reached the unprecedented total of $99,232,200, an estimated increase of $4,672,200 over the production for 1908. In spite of serious drawbacks, first in one mining camp, then in another, the production of gold has increased more than $4,000,000 in each of the last two years, and the outlook indicates, unless present abnormal conditions in the Black Hills should continue or curtailment be shown elsewhere, a production of over $100,000,000 in 1910. However, so important are some of the great mines that a prolonged continuation of the present labor difficulties at the Homestake mine in the Black Hills, for example, even with conditions elsewhere normal, might easily reduce the output to less than $95,000,000 for the current year. Although the industry has been generally progressive in 1909, the increased production has resulted chiefly from operations in six States and Territories, and preliminary figures indicate a decrease in actual production from fourteen others. It is possible, however, that later figures may shift the distribution to some degree.

The most notable increase in production was that in Nevada, where the preliminary figures indicate a gain of $3,219,000 and where mining was active, particularly at Goldfield and Tonopah. At Goldfield the large new mill of the Goldfield Consolidated Mines Co. was steadily operated, partly on a grade of ore that had been shipped in 1907 but stored throughout 1908. Nevada generally had a prosperous year.

The next largest increase, of $1,941,600, is indicated in California, where lode mining has been continuously productive and where dredging for gold has been of growing importance. For Alaska an increase of $1,088,800 is indicated, and Montana and Arizona show gains in production, partly due to a greatly increased copper output. On the other hand, a decrease of $916,300 is indicated in Colorado, chiefly at Cripple Creek, where production will probably not greatly increase until the completion of the Roosevelt deep drainage tunnel. Gold mining was otherwise generally progressive in Colorado. A decrease of $892,300 is shown in South Dakota, whose great Homestake mine has been closed since November 23, 1909, owing to labor difficulties. A marked decrease is indicated for Oregon, but the production of gold from Utah and Idaho remains practically as in 1906. A decreased output is indicated from the Philippines, where an increase was expected, as it had been understood that the dredging operations at Paracale and the deep mining in Benguet have been increasingly productive.

General decreases are indicated for the Southern Appalachian States. The small annual contributions of gold from Tennessee, Texas, Wyoming, and Porto Rico have remained practically unchanged. In general, gold production increased mainly from placers and the mining of silicious ores, and to a smaller degree from copper ores, from which gold is a by-product.

According to estimates from the Bureau of Statistics, the United States imported in 1909 gold valued at $13,510,513 in foreign ore, $26,233,368 in foreign bullion, and $6,059,313 in foreign coin, and exported gold valued at $498,822 in domestic ore, $43,021,545 in domestic bullion, $86,803,265 in United States coin, and $2,717,725 in foreign coin, the excess of exports over imports thus being $87,238,323. In 1908 there was an excess of exports over imports valued at $30,939,163. The imports in 1909 were made up chiefly of ore and bullion from Mexico and to a smaller degree from Canada and South America. The exports consisted largely of coin and went chiefly to South America, though large amounts of gold were sent to Japan, the United Kingdom, and France.

During 1909 the silver-mining industry suffered from low market prices for the metal and for copper and lead, from whose ores nearly 60% of the annual production of silver is recovered. The average price of silver in 1908 was 53c. per fine ounce, but it declined in 1909 to 52, or 25c. below the average for the last 30 years, a value not sufficiently attractive to justify the mining, under ordinary conditions, of low-grade silver ores. Notwithstanding the low market prices of lead and copper, however, the output of these metals was greater in 1909 than in any previous year, and it was chiefly for this reason, more especially on account of the increase in copper output, that the production of silver was maintained at about the same figures as in 1908, and at about 3,500,000 fine ounces above the average output for the last 30 years, even though the value was over $10,000,000 less than the average for this period.

The preliminary figures of the Director of the Mint give an estimated production in the United States in 1909 of 53,849,000 fine ounces of silver, valued at $28,010,100. This indicates an increase of 1,408,200 fine ounces in quantity, but a decline of $40,500 in value from the figures for 1908. The most notable increases of production in 1909, as compared with 1908, were in Montana, Utah, and Arizona, which are large copper producers and where the smelting industries were generally active in 1909. The indicated increases are 1,643,800 fine ounces in Montana, 1,082,100 in Utah, and 732,200 in Arizona. In Colorado there was little profit in mining and smelting low-grade ores, and a heavy decrease of 1,056,600 fine ounces, or about 10% of the output of 1908, is indicated. In both Idaho and Nevada decreased output is indicated, amounting to more than 500,000 oz. in each State. Smaller losses are attributed to Alaska, Missouri, New Mexico, Texas, and Washington.

The market for silver in 1909 offered little encouragement, as a largely increased foreign output, especially from the Cobalt district in Canada, was in competition with the domestic production. The failure of India to buy as largely as usual was only partly offset by better sales to China.

From estimates of the Bureau of Statistics the imports in 1909 were valued at $30,332,088 for silver in foreign ore, $12,431,150 for silver in foreign bullion, and $2,967,768 for silver in foreign coin. During the same year exports of silver were valued as follows: Domestic ore, $640,647; foreign ore, $68,278; domestic bullion, $54,336,904; foreign bullion, $1,223,426; United States coin, $170,258; and foreign coin, $570,831. The value of silver in excess of total exports over that of imports in 1909 was therefore $11,279,338. The imports of silver were chiefly in the form of ore and bullion, and came largely from Mexico and Canada, about twice as much from Mexico as from Canada. The exports consisted almost wholly of ore and bullion, and went chiefly to the United Kingdom, although important shipments were made also to Hongkong direct and to France.

Oil Wells Drilled in 1909.

The record of wells drilled in the Eastern States in 1909, as compiled by the *Oil City Derrick*, is given below:

Field.	Comp.	Dry.	Gas.
Alleghany	459	22	25
Bradford	571	27	15
Middle Field	510	57	17
Venango and Clarion	1,981	177	37
Butler and Armstrong	487	151	39
Southwest Pennsylvania	319	107	38
West Virginia	1,858	361	357
Southeast Ohio	2,281	718	108
Northwest Ohio	872	75	10
Indiana	305	65	23
Kentucky-Tennessee	158	69	...
Illinois	3,151	488	70
Kansas	563	110	356
Oklahoma	3,257	355	156
North Louisiana	110	23	20
Totals	16,882	2,805	1,271

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS

PRESUMPTION AS TO OWNERSHIP OF MINERALS

The presumption that an owner of the surface of a mining claim owns all minerals beneath it ceases when it is shown that a vein found beneath the surface has its apex in a claim belonging to another person. But the burden of proving ownership of such apex vein and its dip and descent to and underneath another claim in order to overcome the presumptive ownership of the surface owner is on the person who asserts ownership of such apex vein.

Keely v. Ophir Hill Consolidated Min. Co. 169 Fed. 691, Apr. '09.

TITLE TO MINERALS—ADVERSE POSSESSION

A person claiming title to minerals as surface owner after a severance from the surface ownership, must show actual, notorious, exclusive, continuous, peaceable, and hostile possession of the mine, independent of his possession of the surface, in the same manner as a stranger. Such actual possession may be shown by opening and operating the mine, and the possession is continuous if the operation is carried on at such seasons as the nature of the work permits or the custom of the community requires, if there is some proof to possession during an interval to connect the operation, when resumed, with the prior operations.

Gordan v. Park, (Mo.) 117 Southwest. 1163, April '09.

OIL AND GAS LEASE—FORFEITURE.

An oil and gas lease recited that if no well was sunk within 12 months, the lease should be void, unless the lessee should pipe gas to within 100 ft. of the premises of the lessors and give them free gas until the well was drilled. Subsequently an assignee of the lessee piped gas to the premises of the lessors as required by the lease, and the lessors commenced and continued to use the gas according to the terms of the lease and until the trial of a case brought by them to forfeit the lease; but the court decided that the use by them of the gas constituted a waiver of the right to forfeit the lease on the ground that no well was drilled within the 12 months.

Duntley v. Anderson, 169 Fed. 391, March '09.

OIL AND GAS LEASE FORFEITURE.

An oil and gas lease provided for drilling and operating oil and gas wells, and on failure to do so, the lease was to pay an agreed sum per day to the lessor for such failure or delay; and on failure to drill, operate, or to pay the agreed sum, the lease should be void. In an action that involved the forfeiture of the lease and the respective rights of the parties, it was decided that the provision that the lease should be void was for the benefit of the lessor, and that on a breach of the lease he might declare and receive forfeiture by proper notice, or waive the forfeiture and proceed against the lessee for failure to perform the covenants of the lease and that the title did not revest in the lessor immediately on the lessee's default.

Perry v. Acme Oil Co., (Ind.) 88 N. E. 859, June '09.

OIL AND GAS LEASE—RE LEASE.

A gas and oil lease which provided that if no well was completed within 15 months, the lease should be void unless the lessee paid $1 per day for each day's delay, and that the lessee should drill an additional well each 60 days or pay $1 per day for each day's delay until three wells were drilled; and it also provided that the lessee should have the right at any time to cancel the contract or any part thereof if he drilled two wells on a certain part of the leased premises; but on failure to drill any well on the other part of the premises, he could not claim the right to retain the lease on the part of the premises on which the wells were drilled and cancel it as to the part on which the wells were not drilled and escape liability for failing to drill the three wells.

Ramage v. Wilson, (Ind.) 88 N. E. 862, June '09.

The Prospector.

This department makes a charge of 25 cents to a dollar (here not in arrears and $2 to non-subscribers for each determination. To ensure promptness in publication of the determinations payment must be forwarded with specimens.

V. E. F., Jamestown, California. Oxide of manganese with limonite.

E. W. S., Crown King, Arizona. Hornblende schist or amphibolite.

W. A., Reveille, Nevada. An aplite with streaks and grains of iron oxide.

Tubalcain, San Francisco. Ferruginous shale containing considerable hematite.

J. M. M., Kemmerer, Wyoming. Altered fine grained granite.

J. S., Bearmouth, Montana: No. 1, galena in quartz; No. 2, largely clay derived from a feldspathic rock.

C. d'A. I. L., Wallace, Idaho: No. 1, metamorphosed feldspar; No. 2, altered volcanic rock, too decomposed for determination.

E. S., New York, New York: Crude sample mixture of lime and sodium sulphate. The precipitated powder is purer sodium sulphate.

C. O. O., Boise, Idaho: No. 1, andesite; No. 2, quartz speckled with oxidized pyrite; No. 3, muscovite granite; No. 4, porous mass with limonite formed from the decomposition of pyrite.

Publications Received.

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

THE COST OF MINING. By J. R. Finlay. 8vo, pp. 415, index. McGraw-Hill Book Co., New York, 1909. Price $5.

This book is the result of a discussion started some six years ago by T. A. Rickard, and continued by W. R. Ingalls, J. R. Finlay, and others. Mr. Finlay's wide experience has enabled him to contribute to the discussion from a number of different points of view, and he has fittingly rounded up the whole discussion in the book before us. It is the first attempt in a large way to reduce the factor of cost to a common basis for coal, iron, copper, lead, zinc, gold, and silver. The attempt is ambitious, and in many places Mr. Finlay has had inadequate data. The results are none the less extremely interesting, and will be widely useful. It is a book to read and to keep for reference. We hope it may convince certain 'secretive persons' at whose secrets Mr. Finlay was obliged to 'rashly guess', that the publication of cost-data is helpful rather than the reverse. If it does this, and also attracts deserved attention to the value and nature of adequate reports, it will have accomplished much of what the Secretary of the Mining & Metallurgical Society is trying to do outside of as well as in the book.

In a work so large as this there are necessarily many things where there is room for difference of opinion. For example, in the discussion of labor costs in coal mining, I believe Mr. Finlay underestimates the artificial conditions fixed by railways and labor unions. Coal trade is, as he notes, competitive to an unusual degree. The selling price of any individual coal may, and often does, have no relation to natural costs. The market price at a competitive point being determined, the fixed charges known, the railway rate and mining rate are then adjusted so as to allow the coal to enter the market. As the railway rate goes up the pick rate goes down, as may be easily verified by an examination of rates in Illinois, for example. The artificial element, of course, is introduced in the arbitrary determination of what coals are to be allowed to enter a given market. This is practically determined by wage-agreements and traffic alliances. On the other hand, Mr. Finlay is entirely

right as to the present low profit in coal mining, though even here the high resulting profit to certain railway lines needs analysis, and in his conclusion that in this industry some form of monopoly will, despite the name, make for better results. His defense of smelting charges and smelter deductions appears less convincing, though it is the best defense yet made. Placing Leadville in the third class of lead ores, rather than the second, may also be questioned. It is difficult to see so great a difference between Leadville, as it has been recently, and Broken Hill. The camp is now sustained by low-grade zinc and iron ores. Much of the ore taken out within the last year depended on its 18% zinc-content for its chief value. Ore running as low as 13% zinc is now mined and shipped. However, it is captious to pick out minor points for difference when the book as a whole is one of whose value and wide usefulness there can be no question.

UEBER DIE MEDIZINISCHEN FOLGEZUSTANDE DER KATASTROPHE VON COURRIERES. By Edward Stierlin. Pamphlet. Pp. 188. Berlin, 1909. ROYAL COMMISSION OF MINES. Report of a committee appointed by the Royal Commission on Mines to enquire into the causes of and means of preventing accidents from falls of ground, underground haulage, and in shafts. Quarto. Pp. 182, ill. London, 1909. SECOND REPORT OF THE ROYAL COMMISSION OF MINES. Quarto. Pp. 298. London, 1909.

The careful attention now given to the study of mine accidents is well exemplified in the report listed above. In the first, Dr. Stierlin makes a careful medical study of the effects of the disaster. The Royal commission, on the other hand, is more concerned with causes and prevention, and what they have to say by no means concerns coal mines alone. The discussion of mining machinery, hoisting engines, hoisting ropes, speed-controlling devices, and cages is of general interest. The suggestions regarding the care of ropes and guides, of acceleration, of safety catches, of signalling devices and indicators, to mention only a few topics, are worthy of careful attention. It is unfortunate that much of the material is likely to be overlooked because of the form of the publication.

AMERICAN MINING CONGRESS. Report of Proceedings of the Twelfth Annual Session, Goldfield, Nevada, September 27 to October 2. Denver, 1909.

This volume of 460 pages includes an unusual number of popers of wide interest. A number of them have already been given notice in the MINING AND SCIENTIFIC PRESS, but we have by no means exhauted the list. The meeting was especially notable in the attention devoted to mining laws and public policy, and the papers on mine inspection, land laws, the Forest Service, and assessible mining shares, are particularly interesting. In addition there are descriptions of present conditions in Manhattan, Yerington, Bull Frog, Round Mountain, Good Springs, and other districts. The volume will be very useful and reflects great credit on the Congress.

Commercial Paragraphs.

The ARTHUR KOPPEL CO., announces that hereafter the name of the firm will be ORENSTEIN-ARTHUR KOPPEL CO. The same interests control the business, and the policies of the old firm will be continued.

PETER E. MEAGHER, who is well known to the engineering and contracting firms, will sell the Wood rock drill in the vicinity of Duluth, Minn. The Wood Drill Works will carry a large stock of machines and repairs at Duluth for immediate shipment.

A. F. BLAIR, formerly chief engineer for the Northwestern Improvement Co., and O. S. WAKELING, formerly with Caldwell Bros., have formed a partnership under the name of BLAIR & WAKELING, for practice as mining and mechanical engineers. The offices of the new concerns are at 616-617 Mutual Life Bdg., Seattle, Washington. It has the northwestern agency for the Philips Mine & Mill Supply Co., Pittsburg, Pennsylvania.

The PRIMOS CHEMICAL CO., PHILADELPHIA, is installing at its property at Newmire, San Miguel county, Colorado, a Hendryx combination agitator and filter for treatment of vanadium ores. The equipment is furnished by the Hendryx Cyanide Machinery Co., of Denver.

The SMITH-BOOTH-USHER CO., Los Angeles, California, are lessees of the patent on the International-Amet oil-gas producer and have secured the right to manufacture and sell the device. They advise that this producer has been in practically continuous operation in two large plants for about three years, and has proved all the claims made for it. The above company is now ready to estimate upon the installation of oil-gas producer plants.

Special Risdon Dredge Buckets.

The accompanying illustration gives an excellent view of a recently installed bucket-line on the Gold Run dredge at Oroville. It represents the best modern practice. The buckets are made of cast manganese steel, and during continual service for six months they have not worn at any point more than $^1/_{16}$ in. They differ from other buckets of the close-connected type in having the bottom made separately from the links, so that when the links become worn they may be renewed without discarding the heavy bottom. This bottom is made of cast steel, with a manganese steel lip. The links also are of manganese steel. The pin is fixed, but has a square head which can be turned, thus lengthening its time of service. The pin is made of bushed manganese steel. So far as the design of the bucket is concerned the purpose has been to secure a form that will have a lower digging point, thus reducing the digging strain, while the capacity of the bucket is maintained by giving it somewhat greater width. The effort has been to embody in this bucket the desirable features of both the open and close-connected types.

Risdon Dredge Buckets.

Catalogues Received.

THE DENVER FIRE CLAY CO., Denver, Colorado. 'The Case Hydro-Carbon Burner'. A concise description of this new hydro-carbon burner. Illustrated. 3½ by 6 in. 4 pages.

THE JEFFREY MFG. CO., Columbus, Ohio. Booklet No. 33. 'Conveyers'. Illustrated. 3½ by 6 in. 24 pages. Booklet No. 34. 'Elevator Buckets'. Illustrated. 3½ by 6 in. 24 pages.

MURRAY IRON WORKS CO., Burlington, Iowa. Catalogue No. 65. 'Corliss Engines and High-Pressure Boilers'. An unusually handsome and complete catalogue. Illustrated. 8 by 11 inches. 84 pages.

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EDITORIAL.

COPPER is not the only thing being merged. *Industrial Engineering* and *The Engineering Digest* have joined forces and will be published hereafter at New York under the editorship of Mr. Robert Thurston Kent, with whom will be associated Mr. William Kent.

AN OFFER of fifty cents per ton royalty on certain Alaskan coal lands has been made to the Government. It is coupled with provisions as to railway rights and coal contracts which, while they may afford no reason for rejecting the proposal, do take it out from the class of royalties proper.

WITH the January number *The Mining Magazine* began a second volume. A general international review of mining has long been needed as is proved by the instant success of our London contemporary. Necessarily in such a publication reviews, digests, editorial, and special correspondence take first place, but we are glad to note that these are splendidly supplemented by high-class technical articles. Mr. W. J. Sharwood's studies of the 'Measurement of Pulp and Tailing' are particularly welcome.

CONSERVATION legislation makes slow progress at Washington. The Senate Committee, however, has agreed to recommend a bill giving the President unequivocal rights to withdraw public lands for forestry, water-power sites, irrigation, classification, and other public purposes. Such withdrawals are to hold till revoked by the President or by Congress and are to be reported at the beginning of each regular session of Congress. W. B. Heyburn, of Idaho, and C. D. Clark, of Wyoming, lead the opposition.

MINOR amendments were made to the Bureau of Mines bill in the House at Washington. The only one worthy of comment is that reducing the salary which it is proposed to pay the Commissioner of Mines to $5000 per year from $6000, the amount paid the Director of the Geological Survey, the Director of the Census, Superintendent of the Coast and Geodetic Survey, and others. This is an excellent commentary on Congressional opinion as to the importance of mining engineers. Civil engineers, and others on the Panama Canal commission are paid $10,000 to $15,000 per year and furnished quarters. The lately ventilated Immigration Commission furnished several favorites with $10,000 jobs, and in one case is reported to pay $7500 to a man who simultaneously draws $10,000 from other sources. In the light of these facts the argument that the Commissioner of Mines should not be paid more than the

heads of numerous other Government Bureaus loses force. It will be unfortunate if a Commissioner of Mines is appointed who either must supplement his official salary by work for private companies or must rely upon personal income which in such a case would almost inevitably be drawn from mining investments. A man competent to fill the position is worth a much better salary than the Government is likely to pay in any event, but that is no reason for cheese-paring to the point of niggardliness. The matter is now in the hands of the Senate.

ILLINOIS has taken the lead in a formal resolution adopted by the General Assembly endorsing the bill introduced in Congress by Mr. Frederick Lundin and proposing a committee to investigate systems of old age pensions. Whatever may be finally determined as to the best and most economical means of providing for old age, it is certainly wise to start fore-armed with complete information regarding existing systems of insurance, annuities, and pensions, and their operation. Money can be well spent in such an investigation. There is a growing belief that adequate measures must be provided, in order to insure continued industrial prosperity.

PHILIPPINE gold dredging has been attracting much attention this year and we are glad to present on another page some details regarding the work at Paracale. In Manila there is almost a boom in the shares of dredging companies, those of the Paracale Gold and the Stanley-Paracale having both gone to premium. The two companies have done well and while the operations are on a small scale the richness of the ground has enabled them to make good returns. The Philippines Gold Dredging Company has acquired ground in the district and is preparing to begin. The Paracale Extension Gold Dredging Company, Limited, has taken options on 230 acres in the district and is planning to put two dredges at work, the first, by August this year. The dredge master, Mr. William Kane, estimates profits on a basis of a gold content of ₱1.05 per yard through a thickness of 26 feet, with a saving of 75 per cent, at a cost of 5½ cents per yard. We suspect that this cost is too low. While no figures based on Philippine experience are available it may be noted that Mr. Kane, with the Paracale Gold Dredging Company's boat, was only able to achieve 15 per cent of the digging capacity, and stoppages are a most important cause of mounting costs. In a group of more than a dozen dredges working in California in 1908, only three worked at costs as low as those estimated by Mr. Kane, and these had actual digging records for the year of 2824, 3138, 1406 cubic yards per day. Capacity is, of course, not the only factor in dredging, but is a large one since with buckets equally well adapted to particular ground the cost decreases in inverse proportion to the size of the bucket. The 5 cubic foot buckets planned are of only moderate size and do not in themselves warrant expectations of particularly low costs. Except in the possible matter of labor costs it is difficult to see where dredging in the Philippines will be cheaper than in California, and labor constitutes normally but 20 to 25 per cent of the total dredging expense. The richness of the Paracale gravel, however, assures returns at costs which would be prohibitive elsewhere.

SPEED MANIA constantly claims its tribute of human life. The latest victims were at Kelvin, Arizona, where a motor car containing seven men was blown to pieces by a delayed blast in a railway cut. The men killed were W. H. Freeland, Denver, Colorado; Walter Crentz, Berkeley, California; R. P. Coleman, Salt Lake, Utah; J. H. Joyce, Lewistown, Maine; J. C. Griffin, Phoenix, Arizona; A. S. Bieber, Cleveland, Ohio; H. H. Lyle, Los Angeles, California. With the exception of Mr. Lyle these were all mining engineers working for the Ray Consolidated Mining Company. They were young men, at the threshold of their professional career, and their death emphasizes the fact that of all the wastes in our industrial life that of the lives of talented and prepared young men is the one we can least afford.

Patents in Australia and Elsewhere.

In Australia the Federal Parliament has just passed a law, modeled on the English statute and designed to force the manufacture within the Commonwealth of all goods which are patented under the local laws. By its terms foreign patentees must arrange for local factories or else, after due notice, anyone will be permitted to manufacture the goods without regard to the patents. While this legislation, at first glance, seems harsh and likely to provoke retaliation, there is an essential element of fairness in it. *The Australian Mining Standard* quotes the Attorney-General as announcing the principle that "if a man secures a particular monopoly he must discharge his obligation in regard to it here." There can be no question as to the soundness of the principle, but in the past the requirements have been thought to have been met by the payment of customs duties on the imported goods. Australia, however, needs population, and local manufacturers are well calculated to attract working men. Under these circumstances Parliament falls back on the inherent right to nominate the terms upon which patents will be granted. In practice the difficulties are not likely to be great. Where there is a large demand local plants will be established, and where the demand is small, licensed manufactories will answer the purpose. In any event the high cost of manufacture will prohibit competition in neutral territory, and the extra burden on goods sold at home will be as cheerfully paid by the Australians as we pay the extra cost of 'protected' articles in America.

The principle announced by the Attorney-General calls attention to another phase of the matter of widespread importance, namely, the purchase of patents for the purpose of suppressing them. This is a general practice and in some measure defeats the very purpose of the patent laws, which are designed to stimulate invention in order that the public may realize the benefit of the improvements. The provision of temporary protection to the invention is incidental merely to the larger purpose, and while there often are, from the point of view of the manufacturer, excellent business reasons for suppressing

a rival patent, the public suffers deprivation of benefits in order that old machinery may be worn out. We have had in America repeated instances of this in metallurgical as well as in other industries. Patenting an article imposes obligations as well as grants rights, and some way should be found to meet the case. In Australia it seems that "the inventor, as a rule, is such a luckless wight that his case can scarcely be made worse," and this cynical comment by the *Standard* might be equally well applied to many American inventors. Our patent laws and the system of their interpretation and administration, are notoriously in need of revision. The examiners at Washington have no laboratory facilities, and must of necessity rely upon literature in examining claims. This leads to magnifying technicalities, and practically the man who gets a patent buys little more than the right to defend himself in court. This is not such a valuable right when it is remembered that a large part of a patent attorney's business is concerned with the ways and means of 'getting around' a patent, and when, too, cases may be originated in any of the United States District Courts. Appeal from an adverse decision need only be considered by the Supreme Court at its option, and in practice is an inadequate remedy for the contradictory decisions of the District judges.

The Copper Game Again.

Discussion concerning the merger of Nevada Consolidated and Utah Copper continues, but the situation is still far from clear. We commented upon the matter in our issue of January 29, and so far have nothing to retract. From the meagre information given out it appears that the exchange of stock would be in the interest of the Utah Copper Company, without corresponding benefits to the Nevada Consolidated. Before our criticism shall prove to have been in error, conditions must come to light that will give faith in the philanthropy of capitalists. After that we shall look for the millenium. The demand for facts concerning ore reserves and costs of production has evoked no satisfactory response. Circular letters have been issued by Mr. Charles M. MacNeill, president of the Utah Copper Company, and by Mr. Pope Yeatman, consulting engineer for the Nevada Consolidated, transmitted under date of January 31 to the Nevada Consolidated stockholders by Mr. W. E. Bennett, secretary of the latter corporation. In none of these communications are the vital facts given. So confused is the whole situation that a Chicago stockholder in Utah Copper is protesting at the exchange as unfair to Utah, which constitutes a minority report. In the public letters favoring the deal there is no argument, no reasoning from fundamental data; only expressions of favorable opinion, suggestive of mere deference to the wills of controlling minds. They were followed by another letter from Mr. James Phillips, Jr., vigorously attacking the scheme, and incidentally throwing into strong relief some of the evils which befall the great productive enterprises of the country when they become tributary to Wall Street. He points out that one result of the recent merger of Utah Copper with Boston Consolidated was the payment of legal toll amounting to $775,000. This vast sum is abstracted for the paltry service of arranging the details and effecting the transfer. It is a burden which rests heavily upon the enterprise, and which will bear proportionately upon the Nevada Consolidated if that company should be merged with Utah Copper. Mr. Phillips pertinently asks whether the fee for effecting the larger combination will be at the same rate. That would involve a payment of $7,750,000, sufficient to finance a copper mine of the first magnitude. Mr. Phillips also asks whether it be advisable to link fortunes with a company which is defendant in litigation involving millions of dollars; whether the smelter contracts with the Utah Copper are sufficiently understood; and whether it be warrantable to submit to the drain of existing transportation contracts, and the need of betterments at mines and mills, which collectively involve the absorption of large sums of money. The Nevada Consolidated will also need to enlarge its operations, and since no lessening of costs can occur from the merging of the two concerns it is not clear why each should not independently work out its own salvation, if each can, as its friends vociferously declare, confer such benefits upon the other.

These queries emphasize the lack of information given to the stockholders. The truth is that the merger is put through in order to secure control for a certain group of financiers rather than for any reasons based on increased economy of production. The attention of the public has been drawn away from the physical features to the stock-market possibilities of the situation. Meanwhile manipulators are seeking to anticipate the profits through a little juggling with 'securities', while the rank and file are told to treat stocks in a mining enterprise as if they were gilt-edge Government or municipal bonds.

The financing of mining properties through Wall Street is an evil which should be discouraged by all who have the welfare of the mineral industry at heart. It means the division not only of profits, but of original capital, with those who contribute nothing. The most expensive part of the equipment of a mining company launched through Wall Street agencies is often the underwriting plant. Direct appeal to the public for capital on the other hand leaves the stockholders in control of the assets. High-finance underwriting has become a guarantee of devious stock-jobbing methods past finding out by the man in the street, rather than of sound economic bases for industry. Instead of giving confidence of financial safety, the system has been converted into a trap for the unwary. Ideally, underwriting should provide safe utilization of capital and assure the investor that the project has been adequately investigated. Because it is supposed to do so the public has heretofore blindly followed the lead of the underwriters, trusting in their reputation. The merging of great corporations should prove a means to greater economy and efficiency in operation. There is a sound basis for the system, and these instruments of modern finance have their origin in the need of regulators of industry, but as yet we have found no reliable method of regulating the regulator.

Matte Smelting at Denver.

Written for the MINING AND SCIENTIFIC PRESS
By H. FOSTER BAIN.

That smelting in Colorado as a business is just now in unstable equilibrium is well known. The review of the year contributed by P. H. Argall to the January 1 issue of the MINING AND SCIENTIFIC PRESS presents the case as a whole. The simultaneous closing, however, of the Argo smelter, the starting of the Modern, and the projected re-opening of the Golden plant, all of which are designed to treat the same general class of ores, warrants special attention.

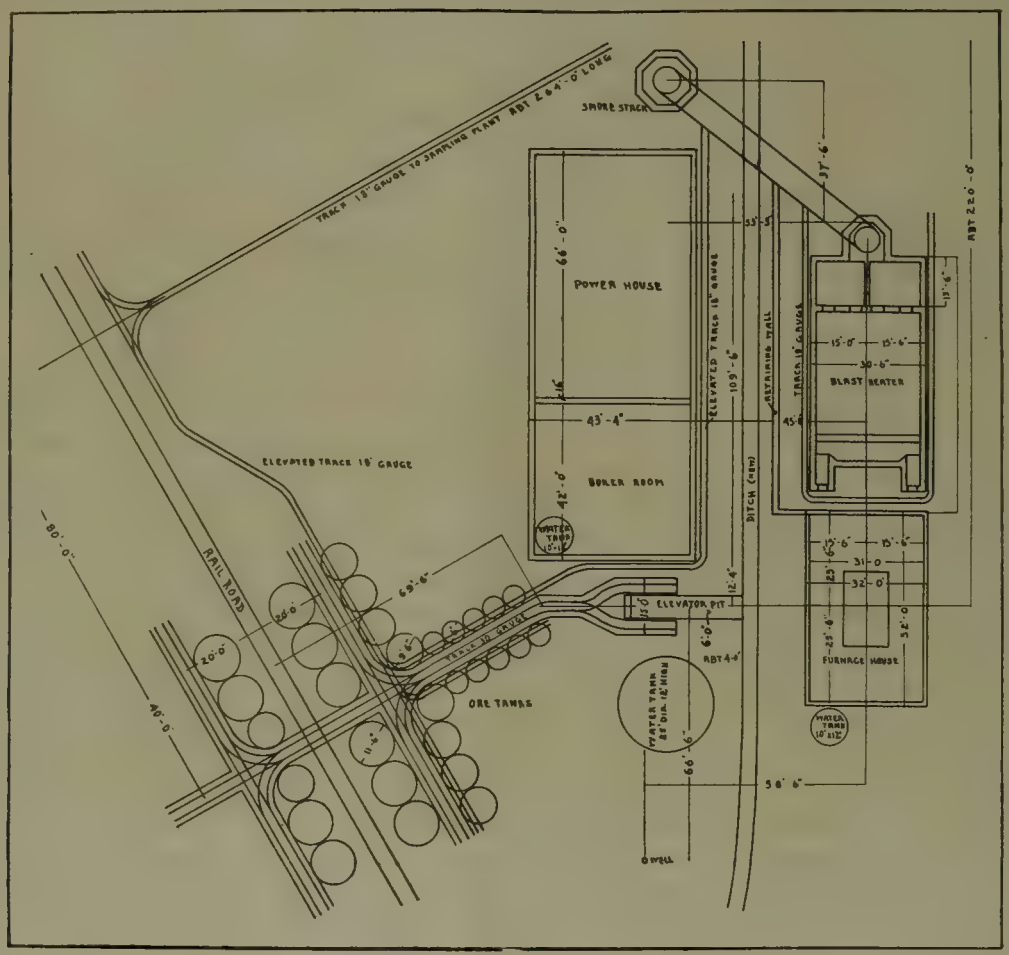


Fig. 1. Ground Plan of the Modern Smelter.

There have been many attempts at pyrite and matte smelting in Colorado. Perhaps the most ambitious was that of certain Iowa capitalists who built the Rocky Mountain plant at Florence to treat Cripple Creek ores. The furnace cost $250,000 and ran but a short time. It has stood idle about seven years and was sold last fall to satisfy a judgment for $78,130. A furnace at Leadville, as Mr. Argall has related, was taken over by the American Smelting & Refining Co. and closed for reasons other than its technical performance. Small furnaces near Ward, Buena Vista, and other points have run for various periods, and at Golden, as shown later, an excellent plant made a fairly long campaign. Only one company, however, depending on copper as a collector for gold and silver, has been successful through a long period. This was the pioneer smelting company of the State, the Boston & Colorado, which began smelting at Black Hawk in Gilpin county in 1867. In the spring of that year the company was organized by a number of capitalists of Boston and Providence, who subscribed $275,000 to build the first smelter in the West, an undertaking not unnaturally regarded then as somewhat hazardous. James W. Converse became president and J. W. Merrill treasurer of the new company, positions which they held for many years. The initiative for the enterprise came from N. P. Hill, who at that time had recently been professor of chemistry in Brown University. Later he became capitalist, United States Senator, newspaper owner, and in many ways one of the foremost and most influential men in the West. When work on the new plant began there were only three old stamp-mills running in Gilpin county. The processes in use were extremely wasteful, there was no market whatever for refractory ores, the miners were discouraged, and many of them were moving away. Mr. Hill's attention was first attracted to Gilpin county in 1864. The need of better methods strongly impressed him. He returned the next year and studied the matter on the ground. Later he visited Europe and learned what was possible at

foreign smelters. Finally he came to Gilpin county with metallurgists from New York and Wales and a carefully selected lot of 72 tons of ore was shipped to Vivian & Sons at Swansea for test. While, therefore, the enterprise started in 1867 was new and properly to be considered venturesome, it was founded on ample study and carefully matured plans. How much this meant, is reflected in the long and successful career of the company, with its many technical and financial triumphs.

Treatment began in January 1868 with one smelting and one calcining furnace. At first Herman Beeger was the metallurgist, but shortly after Richard Pearce joined Mr. Hill in the enterprise, and that partnership which proved so fruitful of results and was to last so long, began. Business rapidly increased, and three smelting and seven calcining furnaces were added. In 1873 branch works were established at Alma, in Park county. For a time the matte was shipped to Swansea for refining, being hauled across the plains by wagon and sent down the Mississippi to New Orleans. In those days it took six months to get a settlement, and it was not always satisfactory then. Brick used at the furnace came from Scotland and cost $1 each. Castings were 20c. per pound, and other costs in proportion. Necessarily rates were high, and $35 per ton was charged on some ores. The new works were profitable, and in 1870 the company began treating its own matte. For a time a refinery was maintained in Boston, but eventually the works were concentrated at Argo, a suburb of Denver, when in 1879 a new plant, including a refinery, was built. Smelting has been carried on here continuously ever since, and for many years the company paid quarterly dividends, with a comfortable extra distribution at the end of the year. The Argo works at one time included five furnaces. The number working was some time ago reduced to two, and later to one, which has since been busy cleaning up preparatory to dismantling the plant. The refinery was destroyed by fire in 1906 and was never re-built. After its destruction the matte made at Argo was handled by the American Smelting & Refining Company.

The Argo plant has been notable for its technical as well as business triumphs. It was here that Richard Pearce developed the smelting of copper ore in reverberatories, gradually working up from 5-ton to 100-ton furnaces. Here, to, the Ziervogel process was early applied and the 'Pearce process' of refining was developed. The story of the latter has been told so recently and so well by Harold Pearce that no more than a reference is needed.* Some of the earliest work, too, was done here in the utilization of waste heat. So important were the economies introduced from time to time that the early smelting rates were gradually reduced until in the last year the average rate was $3 per ton. When smelting began at Black Hawk, ores carrying 15% copper were abundant. These were gradually worked up, and as the mines became deeper the percentage of copper in the ore fell. Concentrates from Gilpin and Clear Creek counties now contain about 2% copper. Some highly silicious ore, carrying 3 to 4% copper, is shipped direct, but in the immediate territory there is an undeniable shortage in copper-bearing ore. For a time the Argo plant drew heavily on adjacent States. A little ore came from the Black Hills. More

Fig. 2. General View of the Golden, Colorado, Plant of the North American Smelter & Mines Company.

*Bull. Amer. Inst. Min. Eng., No. 26, Feb. 1909.

was obtained in Wyoming and New Mexico, and Arizona and Utah each contributed. Butte never shipped much ore to this plant, though some came from the Trenton, and the Gagnon mine was at one time controlled by the Boston & Colorado company. As emphasis, however, came to be placed on the copper rather than the gold content, it became more economical to smelt near the mines, and other smelting centres prospered at the expense of Denver. The final closing of the smelter is due to the change in conditions of ore supply rather than to any failure in technical or business direction. The immediate occasion was the necessity of making expensive general repairs and investing considerable sums if the new conditions were to be met. There are now some 300 stockholders. The youngest of the original stockholders is 72 years old. The younger generation is interested in other things, and on the whole it seemed better to close out at a profit and look to re-investment in other business.

At the same time that the Argo was planning to go out of business a new smelter was being built a short distance away at Utah Junction. This, the Modern smelter, is situated on a tract of 48 acres reached by the Denver, Northwestern & Pacific, the Chicago, Burlington & Quincy, and both the standard and the narrow-gauge lines of the Colorado & Southern railway. The plant was visited in August and went into blast in October 1909. No expense was spared to make it automatic and economical. Steel and concrete were employed throughout, 3000 bbl. of Ideal cement having been used. The general arrangement of the buildings and tracks is shown in the accompanying sketch (Fig. 1). The compactness and convenience of the works is to be noted.

Ore is delivered by private switch. The scales have a capacity of 200,000 lb., and are self-registering. They were built by the Strait Scale Co. of Kansas City, and are set high from the ground so as to permit easy inspection. Three-rail tracks are carried so that either standard or narrow-gauge cars may be handled. These have been made the master scales for the district by the Western Railway Weighing Association. The ore-bins are below the railway tracks. They are round steel bins set on concrete and are made with hopper bottoms. The total bin-capacity is 30,000 tons. The bins deliver to the level on which the charging car runs. As ore is shoveled from the cars to the bins every fifth shovelful is thrown into the sample car which runs on the same level as the ore cars. The sample car is trammed to the sampling works, where by means of crushers, rolls, mixers, and Dewey samplers, an automatic sample amounting to $^1/_{320}$ is taken and sent to the bucking room. In considering these arrangements it should be remembered that it is only expected to handle low-grade ores at this plant. Automatic sampling from the first is therefore hardly called for.

The charging car is also a weighing car. It was manufactured by the Strait Scale Co., and carries seven weigh-beams. These may be set and locked by the chemist, after which the workman needs only to draw in turn from each bin enough to balance the beams as indicated. There is no mixing platform, but the ore is dumped from this car into a hopper from which it feeds into a bucket conveyor which elevates it to the charging bin. This conveyor, built by the Webster Mfg. Co., handles 40 tons per hour with a 7½-hp. General Electric motor. The ore dumps from the head of the conveyor into a charging bin at the side of the furnace. Three-fifths of the charge falls direct from this bin into the furnace, while the remainder is handled by charging barrows dumping on the other side of the furnace. In this way the advantages of semi-automatic charging are realized, while regular distribution of the feed is obtained through the use of the barrows.

The furnace is a McDonald, 180 by 38 in. built by the Colorado Iron Works. The bustle pipe is made 42 in. diam. so as to permit of lengthening the furnace. The blast is delivered through a stove containing 144 vertical cast-iron pipes 12 in. diam. and 10 ft. long. These stand in 14 compartments which collectively form a dust-chamber between the down-take and the stack. The outgoing gases therefore give up their heat to the incoming blast at the same time that the flue-dust is deposited. A by-pass is provided so that the dust-chambers may be cleaned without stopping. It is expected that the blast coming from the stove will have a temperature of about 650°F. This will be then raised by means of 'Western' furnaces automatically burning lignite, to 950°F. The ashes from here, as well as from the steam-plant, are washed away by means of a jet of water. The forehearth is 5 by 9 ft.; the slag is granulated, and the matte is handled by conveyor to the cars. The stack is 135 ft. high, 14 ft. diam. at the base, and 7 at the top.

The secondary features of the plant have been well looked after. An independent water-supply has been secured by means of an artesian well 420 ft. deep, and a 48,000-gal. storage tank provided. The whole place is lighted by electricity, the wires carried in pipes to the different parts of the plant, and there are even pipes carrying cooled drinking water. The engine-house is built of concrete blocks. Lignite is burned in Western furnaces under Kennicut boilers furnishing steam to a 210-hp. high-speed Corliss engine, made by the H. M. Strait Mfg. Co. There are two Piqua blowing engines delivering 10,000 cu. ft. each and taking air from outside through a screened tunnel. The dynamo for lighting is a 150-kw. General Electric. So thoroughly have the automatic features of the plant been worked out that it is expected that 80 men will be able to handle 300 tons per day. Every preparation has been made for working at the lowest possible treatment charge. The company owning the smelter is a close corporation of Chicago and New Orleans men. There are some twenty stockholders only, and little has been said as to the plans and purposes. They are reputed to be abundantly able, financially, to carry through any plans they may make. The plant was paid for with cash, bills discounted, and a start made with no debts. The corporation is organized under the laws of Colorado with a capital of $2,500,000. J. G. Powell is president, W. A. Patterson, secretary-treasurer, and H. C. Reno, vice-president and general manager. The plant will treat low-grade 'Gilpin county' ores especially,

but will handle siliceous and copper ores from as wide an area as possible. An initial supply of copper ore has been obtained from Wyoming. Morrison limestone and Colorado coke are used. Ores are sampled at the plant and the benefit of the sampling charges saved given to the mines.

The third plant to be considered is the smelter at Golden, about 16 miles west of Denver at the mouth of Clear Creek canyon. This was purchased last fall by the North American Smelter & Mines Co. from the Clear Creek Mining & Reduction Co. This smelter was erected some ten years ago by F. R. Carpenter for a Detroit corporation of which Berry Brothers were the principal owners. The plant was designed

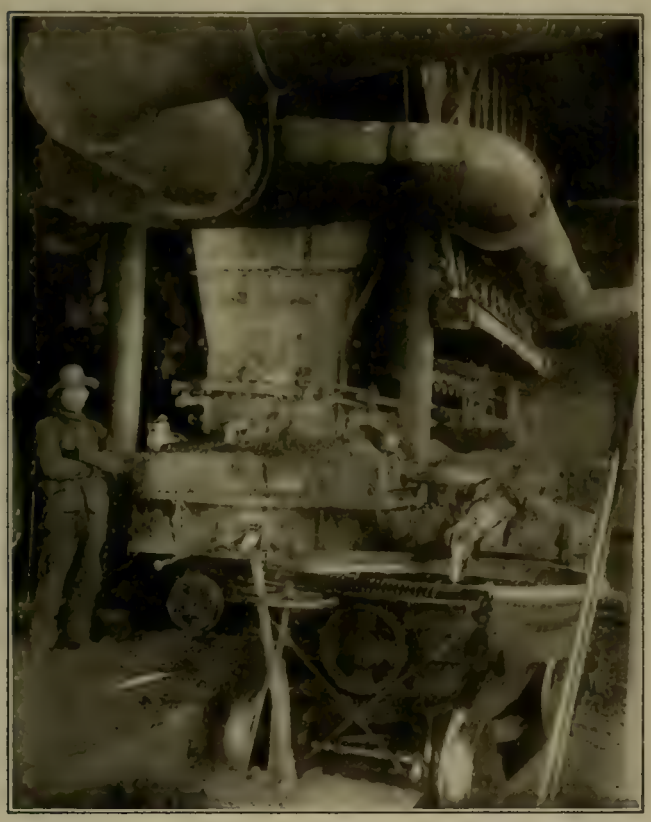


Fig. 3. Furnace and Forehearth at the Golden, Colorado, Plant

to handle 500 tons per day of Gilpin county ore according to plans developed by Mr. Carpenter in the course of work at Rapid City in the Black Hills. The smelter ran for several years and handled a considerable amount of low-grade ore. The company owning it controlled the Saratoga mine and shipped heavily from this property as well as bought freely in the open market. A minimum rate of $3 was established, and there was strong competition for ore between the Clear Creek M. & R. Co. and the A. S. & R. Eventually the Golden smelter closed down and it has stood idle ever since. The company which has just taken it over is a $2,000,000 corporation, with G. L. Irvine of Chicago president, H. A. Riedel of Denver vice-president and general manager, and A. J. Throne of Louisiana second vice-president. Certain Pittsburg people are also interested. The same people have purchased mines at Idaho Springs, including the Banner Consolidated, Centurion, Donaldson, and Champion Comstock groups. These are tributary to the Rockford tunnel which opens the veins at depths of 500 to 2000 ft. on the dip. The mines have been heavy producers in the past and it is expected that systematic development will again place them among the leading shippers. Frank H. Nye, a former State Mine Inspector, has been placed in charge of the mines and of the Kilton sampling plant at Idaho Springs, which has also been purchased. J. H. Robeson has been made consulting engineer, and will plan the mine development. The smelter is being overhauled and $25,000 is being spent on repairs and extensions. A Vivian reverberatory is to be added and connection made with the Central Colorado Power Co.'s lines. The company already owns lime quarries, the tracks to which are being put into condition. An early start is promised.

These various changes focus sharp attention upon the matter of ore supply. The Argo went out of blast because of the difficulty of obtaining a sufficient supply of copper-bearing ore. The Modern at the same time begins work depending mainly upon the open market. The North American is planning to begin, but is evidently counting largely on its own mines for ore. In the meantime the A. S. & R. furnaces are running at about half capacity, although this company has contracts with the main producers and has a virtual monopoly of the market. Whether lower rates, if put in, will bring out enough ore to keep all the furnaces busy is uncertain. When the Golden smelter was running before, nearly everything available was shipped and many old stopes were emptied. So much ore came out that the Argo at one time had more than a year's supply ahead. Yet in the end there was not enough ore at a payable rate to keep the plants running. A similar cut in rates now would find fewer old stopes to empty. On the other hand, the Newhouse and other tunnels are farther into the mountains, and the old mines are being drained to greater depths. The introduction of electric power has made possible the working of many properties which could not show a profit under old conditions, and there are undoubtedly large quantities of ore remaining to be mined, if costs can be sufficiently reduced. There is likely, however, to be shortage in copper ore, and it is not apparent from what source this deficiency is to be made good. Failure in the past does not necessarily predicate failure in the future, and at least I am glad to wish the new companies as long and as honorable careers as that of the Boston & Colorado. The Modern starts with an excellent plant and low working costs. It is stated that 4% less coke is used than at any competing plant, and clean slags running 8% higher in silica are made from charges containing only 0.5% copper. The initial difficulties seem to have been overcome, and engineers will watch with great interest these efforts to make a market for ores which heretofore have required to be concentrated.

Gold Mines of Tibet.

Written for the Mining and Scientific Press
By Alexander Del Mar.

The principal and almost the only important gold mines of the higher areas in Asia alluded to by classical writers, were situated in a northeasterly direction from Greece and Asia Minor, in what were then cold climates. But as the period when these mines were worked is not given, and as Herodotus and other writers on the subject may have quoted from accounts which were ancient even in their times, it cannot be assumed that such climatic conditions were the same when the mines were productive. This subject has an important bearing upon the location of the mines and what was found in them.

If, following the example of Lock, in his work on 'Gold', a map of Asia is marked with all the gold mines on that continent known to classical antiquity, then, going eastward, they will appear first in Turkestan, in the upper valleys of the Amu Daria (Oxus) near Bokhara; and secondly and chiefly, in the mountains of Tibet, long. 82 to 87°E. from Greenwich. Says Lock (p. 314): "Bokhara and Tibet are especially renowned for their productiveness." Both of these groups of ancient mines lie between parallels 30 and 40, but with this difference: the first group is situated at a comparatively low elevation and in a warm climate; while the second is at a high elevation, in what is now a cold climate. It is evident that the principal mines, those, for example, which are alluded to by Herodotus, Ctesias, and Megasthenes, were in Tibet.

Here again is another difficulty. Tibet at the present time does not extend northward beyond the desert of Gobi, while in the times alluded to by Herodotus it extended to the Polar sea and included all that is now known as Siberia. Although the Tibetan mines were worked possibly as early as the twentieth century B. C., it does not appear that they were the oldest gold mines in the Orient, because it is likely that the gold mines of China and perhaps also some of the mines in the Punjab, Naghpur, Orissa, Mysore, and Malabar, were older, or as old. The most ancient ones, as well as the most important which were known to classical writers, were in Tibet.

In the same chapter in which Strabo repeats the observations of Onesicritus concerning the manner of appointing the Grand Lama of Tibet, he informs us that when Alexander the Great conducted his expedition to the confines of that country, he had a mining advisor with him named Gorgus, who reported that "valuable mines, both of gold and silver, were situated not far off among the mountains" [illegible] which it is evident that the Macedonian hero had something more practical in view than visiting "the birth-place of Bacchus". Between the researches of Gorgus and those of Huien Tsiang, Marco Polo and the Jesuit missionaries, who say little about the matter, no information was permitted to reach the outer world concerning the mines of Tibet. The gold of Tibet, as we shall see further on, is "sacred to the Grand Lama" and for this, perhaps as much as for any other reason, the country has ever been interdict to the rest of the world. The British, however, have seized every occasion to break down this barrier. Captain Turner (1793-1806) reported gold-dust in nearly all the streams crossed in his journey to and from Lhasa. Moorcroft (1816) reported on the gold mines of Little Tibet near Mehal, at the head-waters of the Sutlej, where numerous excavations at various levels attested long continued and probably ancient workings. Lieut. Strachey (1846), another traveler in this region, found that the principal gold mines, Sar-Chaka, were farmed by a sar-pun (gold mines overseer), who paid to the Sacred Treasury of Lhasa $8500 per annum and had 170 miners at work. The gold was in quartz, and mining supplies were brought from Pruang, as the country was barren of agriculture. The metal was sometimes found in large nuggets or masses, the Lama of Gangri showing one weighing 2 lb. 1 oz. As a rule, the Lamas, after claiming the big pieces, pretended to have buried them again, as 'spiritually dangerous'. Such claims and pretensions could hardly have had weight with mine-farmers; and must therefore be limited in their application to individual and ignorant miners. Similar claims of 'sacred gold' appear in the ancient Code of Manou. Captain Montgomerie (1865-7) reported a gold mine at Toti-phu, four miles north of Lhasa, others at Debang and Ramoche, worked by the priests, who affected to re-plant all their large finds, but upon another pretence; that of their power to germinate auriferous offspring! Montgomerie also reported a gold mine six weeks journey northeast from Lhasa, at a place called Sar-ka, or Thok, where gold was obtained in large quantities. 'Sar' is said to be the Tibetan word for gold, and 'thok', for a mine.

Col. Walker (1867-8) appears to have employed for similar researches an Indian pundit, who visited an extensive placer mine at Thok-Jalong (altitude 16,330 ft. above the sea), where the yield was large and the nuggets often heavy, one weighing 75 tolas, or about two pounds. The diggings were farmed out by the Sar-pun, who allowed each miner a small area, for which he paid one sar-shoo, about two-fifths of an ounce, per annum; the Sar-pun himself being watched very closely by the Lhasa authorities. The cold was intense and the miners lived in pits seven or eight feet below the surface of the ground and roofed like tents. Of these habitations there were 600, which, at an average of ten miners to each, would make the whole number about 6000. On the way from Rudok to Thok-Jalong the pundit heard minute descriptions of no less than seven different goldfields, namely, Sar-kong, Dikla, Ragyok, Thasang, Maroobhoob, Gunjee, and Nianmo, besides Sar-lung and Jalong, which he actually visited, and Phaiyu-Pooyu, of which he only heard. Upon reading these reports Sir Henry Rawlinson wrote as follows in the Indian Antiquary (iv, 225): "Now then, for the first time, we have an explanation of the circumstances under which so large a quantity of gold is, as is well known to be the case, exported to the West from Khotan and finds its way into India from Tibet; and it is probable that the search for gold in this region has been going on from a remote an-

tiquity since no one can read the ex pundit's account of Tibetan miners living in tents some seven or eight feet below the surface of the ground and collecting the excavated earth in heaps previous to washing the gold out of this soil, without being reminded of the description which Herodotus gives."

Cooper (1870) found at one day's journey from Lityang, on the road to the Taso mountains, numerous streams with sands containing gold, which the hoofs of his cattle occasionally turned up, but which he was warned not to gather, because "gold, like all else of a yellow color, was sacred to the Grand Lama." The yellow color, however, is not Lamaic, but Chinese, the Lamaic color being red.

Capt. Trotter (1877), in giving an account of the pundit's second journey, which was from Ladak to Lhasa, visited the goldfields of Thok-Daurakpa, where the miners' habitations, like those described on his previous journey, called phukpa, were 32 in number and contained from 5 to 25 miners each. Some of the diggers were from Shigatze. There was no water at the mines, and it had to be brought in on donkey-back from a distance. He mentioned large tracts of auriferous lands elsewhere, which could not be worked for lack of water.

Besides the gold mines within the present boundaries of Tibet, Lock describes enormous auriferous areas in Siberia, Manchuria, Nepaul, and Bhutan, which formerly belonged to Tibet, and in some of which provinces traces have been found of ancient workings. He adds that the gold-washers of Nepaul (Tharus), the Duars of Bhutan, and the Meehs and Kacharis of Assam, are evidently of Mongolian origin: that they use mercury for amalgamation: and that such use among Mongolian miners appears to be ancient. The Siamese also claim a Mongolian origin, and believe that the use of mercury in amalgamation is ancient, an inference that they base upon the known antiquity of their cinnabar mines. The present exports from Khotan and Gar-thok evidently form but a small part of the entire production. As to the yield in ancient times, there are no data. We can only conjecture that, like all placer mining—for the mines alluded to were placers—the yield was irregular, depending largely upon the supply of water for washing the gravel, and this again upon the length of the warm season, which, in the northern and elevated regions of Tibet, as we know from Alaskan experience, must have been comparatively brief. Upon the hypothesis that the number of mines and miners worked and employed in ancient times was no less than at present, it may be roughly computed that the annual yield fell within fifty thousand pounds sterling in value, or a quarter of a million dollars.

In 1872 a collection, consisting of 464 bronze coins acquired in China by the Rev. Justus Doolittle, an American missionary at Foo Chow, passed into the hands of Horace Fletcher, of San Francisco, and by him was submitted to my examination. The coins are fully described in my 'History of Money in Ancient States', a work now out of print. Some of the oldest and most curious of these coins were also lithographed and published in a pamphlet on 'The History of Money in China', by Brodie & Co., of San Francisco. The most ancient coin of this collection was of the Emperor Sung, 2257 B. C. It was of bell shape and weighed 425 grains. The inscription, in ancient Chinese, was Taung king hoo, that is, as read by experts in China. As read by H. T. Kuen, the Chinese Vice Consul at San Francisco, an American academician, it was Tong king fo, both of which he translated as, 'for gold good', or 'good for gold'.

Despite the limitations which the Greek authorities affix to the antiquity of money, I am confident that this is a genuine coin, and therefore that not only was bronze money employed in China at the remote period of Sung, but also that it had been preceded in point of time by the use of gold for money, either in the form of coins or bullion. Assuming this to have been the case, it follows that gold mines must have previously been worked in China, or in some country upon which China could depend for such supplies of the precious metal as were sufficiently copious to warrant the use of the metal for the important purpose of a circulating medium. Besides China itself, of whose ancient mines but scant knowledge has reached the Western world, there were the ancient mines of the Golden Chersonesus (Siam), which have been identified with the Tarshish and Ophir of the Bible, and the tundras of Tibet, or Siberia, the latter of whose produce must have found its way into China by way of Cathay (Manchuria).

As going to show the alteration of climate that has taken place in the vicinity of the last named mines, it may be stated that they present evidences of having been worked not only for gold, but also for ivory; for these tundras are in places full of the carcasses of elephants and rhinoceroses preserved in the ice; both of them still yielding ivory of marketable value. Within the last two centuries some 300 carcasses have been exhumed by the Tibetan and Siberian miners; while recently nearly a hundred more were found practically in a single cluster. In 1898 no less than 80,000 lb. of fossil ivory were offered for sale at the Yukutsk fair; the principal source of supply during the whole period mentioned being the Island of Liakoff, north of the Manchurian tundras.

The forces which can be considered as active in producing faults, according to H. F. Reid, who recently discussed the matter before the Geological Society of America, are: horizonal tensions and compressions; vertical forces (upward or downward); and horizonal drags on the under surface of the crust. In a uniform crust, horizontal forces alone produce normal or thrust-faults having hades of 45°; that the available vertical forces alone would produce normal faults with a smaller hade, and that the addition of a tension to a vertical force increases the hade, whereas the addition of a pressure diminishes it. Drags will generate pressure and tensions; they may cause faults with horizonal displacements. The elevation of large regions is due to vertical and not to tangential forces.

Gases obtained by extraction from granites by the aid of a vacuum have shown by analysis the following composition, as reported by W. H. Tilden in the *Proceedings* of the Royal Society of London: CO_2, 23%; CO, 6.45; CH_4, 3.02; N_2, 5.13; H_2, 61.68.

Geology at Globe, Arizona.

Written for the MINING AND SCIENTIFIC PRESS
By F. L. RANSOME.

*In 1903 was published the first report[1] by the United States Geological Survey on one of the southwestern copper districts, based on field work done in 1901 and 1902. At that time practically nothing was known of the geologic relations of the copper ores of Bisbee, Clifton and Morenci, Ely, Bingham, and Yerington. Low-grade disseminated deposits, such as have recently come into prominence, were commonly looked upon as unworkable under then existing conditions. In view of these facts and of the great revival of mining activity both at Globe and Ray the time seemed opportune for a re-examination of the Globe district in the light of new knowledge, and I have recently spent two weeks in this work and in a reconnoissance of the country lying between Globe and Ray.

The reader of the following notes should, if possible, have before him the geologic map of the Globe district,[2] as it is impracticable in this place to reproduce it or to present more than the most meagre outline of the general geology. It must suffice to say that at Globe there is a pre-Cambrian crystalline complex consisting of the Pinal schist and a number of granitic intrusives, among which was originally included the Schultze granite. This complex is overlaid by the Apache group, mainly quartzite and doubtfully referred to the Cambrian, upon which rests the Globe limestone of Devonian and Carboniferous age. These Paleozoic rocks are much faulted and were extensively invaded, probably in Mesozoic time, by diabase. In early (?) Tertiary time a large part of the region was covered by a thick flow of dacite which was faulted and eroded prior to the deposition of the Gila conglomerate, the youngest important formation in the Globe district.

Much interest has of late centered about the Schultze granite, owing to its relation to the Miami-Inspiration belt of copper deposits. This rock is exposed in the west central part of the Globe quadrangle as a very irregular area about nine miles long in a northeast-southwest direction and about six miles in greatest width. Northwest of the main mass, separated from it by a strip of schist that in one place is not 300 yards wide, is a smaller area of granite which in the Globe report was correlated with the Schultze granite on petrographical grounds. This may conveniently be designated the Porphyry Mountain mass. A re-examination of the Porphyry Mountain mass shows that the correlation with the Schultze granite was an error, into which I was led by the proximity of the two masses and by the general similarity of the rocks as shown by thin sections. The Schultze granite proper cuts the Pinal schist, but is nowhere within the Globe quadrangle, in contact with the Paleozoic formations. Consequently its age is not definitely determinable from local evidence. In Professional Paper No. 12 it was assigned to the pre-Cambrian, partly because most of the granitic rocks of Arizona were at that time generally believed to be older than the Cambrian and partly because the Porphyry Mountain mass, then supposed to be the same as the Schultze granite, is clearly overlaid by Paleozoic quartzite north of the Continental mine. Neither of these reasons now has any validity. So far as the Globe quadrangle is concerned, all that can safely be said is that the Schultze granite is younger than the Pinal schist and at least one of the pre-Cambrian granites, but is older than the dacite, which clearly overlays it in the vicinity of the Pinal range, in the western part of the quadrangle. It is true that south of the new town of Miami the Schultze granite has intruded and metamorphosed a small body of basic rock called metadiabase in the Globe report, and that in all probability, as will be seen, this metamorphosed rock was originally a mass of the common diabase of the district; but this identity could not have been safely inferred in 1902 without other evidence.

In the last few years work outside of the Globe district has thrown new light on the age of the Schultze granite. The close dependence of a large number of the most important copper deposits of the Southwest upon intrusions of post-Paleozoic granite or monzonite rocks has come to be generally recognized, and C. F. Tolman, Jr.,[3] deriving his conclusion mainly from the unpublished work of J. E. Spurr at Ray and of W. H. Weed at Miami, has suggested that the Schultze granite is "post-Paleozoic (Tertiary?)." My own examination at Ray shows that the more or less altered granite porphyry associated with the copper deposits cuts the normal diabase of the region and passes to the west into a granite petrographically identical with the Schultze granite. Moreover, at Troy, six miles southeast of Ray, an even-grained granitic rock, probably a quartz monzonite, cuts both quartzite and diabase and is apparently the chief factor responsible for the copper deposits at that place. In view of these facts, unknown when the Globe report was written, there can be no reasonable doubt that the Schultze granite is not pre-Cambrian, but is post-Paleozoic. Whether it is Mesozoic or Tertiary is perhaps not yet determinable. But as it is older than the dacite, and has been deeply eroded, I am inclined to believe that, like the granitic intrusions at Bisbee and Clifton, it is Mesozoic.

In Professional Paper No. 12 the primary copper ore at Globe was thought to be genetically connected with the intrusion of the diabase. The widespread association of copper ores with granitic intrusions throughout the Southwest had not at that time been recognized and the orebodies of then known importance near Globe were all closely associated with the diabase. It was natural and reasonable under the circumstances to regard this association as genetically significant. At the present time, however, the evidence from other districts and the occurrence of the Miami ores indicate that the intrusion of the

*Published with the permission of the Director of the U. S. Geological Survey.

[1]Ransome, F. L. 'Geology of the Globe Copper District'. Professional Paper No. 12, 1903.

[2]Professional Paper No. 12 on the Globe folio, No. 111.

[3]MINING AND SCIENTIFIC PRESS, Nov. 13, 1909, pp. 646-658.

Schultze granite was the chief factor in the deposition of the copper ores. Inasmuch as the ores were probably not derived from the masses of granite and granite porphyry now visible but from deeper sources it does not appear necessary to endeavor as Mr Tolman[4] has done to show that the Schultze granite extends eastward directly under the Gila conglomerate of Globe valley, to the Old Dominion mine north of Globe. There are moreover, grave objections to his hypothesis, two of them being fatal. In the first place, the main mass of Schultze granite does not pass under the conglomerate, but is so limited along its eastern border by Pinal schist as to render any such bodily extension to the east improbable. In the second place, the peculiar granitic material near the Old Dominion mine, supposed by Mr Tolman to be Schultze granite, is not that rock, but is petrographically identical with the pre-Cambrian Madera diorite of the Pinal range. Finally, the workings of the Old Dominion mine have extended far to the west under this granitic material and show that it attains no great depth, but is underlaid by dacite, which in turn rests upon much faulted diabase, quartzite, and limestone. This granitic material in the vicinity of the Old Dominion mine is so interesting a geologic feature and has hitherto proved so puzzling that it deserves some additional comment.

In the original Globe report attention was called to the occurrence northeast of Globe of a deposit composed almost entirely of fragments of Madera diorite. The principal exposures of this material extend from Copper gulch, half a mile east of town to the old Buffalo smelter on Pinal creek, a mile northwest of Copper gulch. The surface exposures are generally of such a character that an observer might readily conclude solid Madera diorite to be in place beneath them. Some of the ravine sections, however, as well as mine workings, show that the diorite occupies a position at the base of the Gila conglomerate and rests on dacite. In some places it actually grades into the characteristic fluviatile conglomerate and the deposit was described in Professional Paper No. 12 as a local basal phase of that formation. The homogeneity of the material, however, and the lack of evidence indicating water transport of much of it, were recognized as facts imperfectly accounted for in the explanation offered. During the past eight years the granitic deposit has been much better exposed in road and railway cuttings and in underground workings. It appears in some of these new openings as a thoroughly shattered mass in which the largest single fragments observed are from 5 to 6 ft. diam. Wherever penetrated underground the material shows the same thorough shattering. Cross-cuts through it, such as the lower drain tunnel of the Old Dominion mine have to be closely lagged. In one place, in Copper gulch, the Gila conglomerate may be seen lapping up over a slope of this shattered Madera diorite, the contact between the two being definite. In other places the broken quartz diorite has supplied so many angular or slightly rounded fragments to the overlying Gila conglomerate that there is a gradation between the two formations, and to this fact together with the position of the quartz diorite above the dacite, was due the former assignment of it to the Gila formation. The better opportunities for study now available have suggested another hypothesis, namely, that the shattered Madera diorite is a thin wedge that has been thrust over the dacite from the southwest by faulting. Investigation has fully confirmed this view. Wherever a shaft has gone through the quartz diorite it is found to be separated from the dacite by a zone of trituration and slickensiding that is plainly due to fault movement. One of the best exposures of this fault-plane is to be seen in a small prospect tunnel about 2000 ft. northeast of the Old Dominion smelter. This tunnel runs N.15°E. for about 150 ft. through the shattered Madera diorite and then passes for 20 ft. through a fault-breccia in which rounded polished fragments of the quartz diorite are embedded in a sheared gouge composed of triturated quartz diorite and dacite. This is separated from the solid underlying dacite by a smooth slip-plane dipping 37° to the southwest. The course of events was as follows: After the Paleozoic sediments and diabase had been much faulted and eroded, they were covered by the flow of dacite. This in turn was probably eroded and then a thrust was developed southwest of Globe, probably in the area now deeply buried under Gila conglomerate, and a mass of the pre-Cambrian Madera diorite was shoved over the dacite to the north-northeast. The shattered mass thus bodily thrust over the dacite was readily attacked by erosion and supplied much detritus to the Gila conglomerate. Finally, the Gila conglomerate, the remnant of the underlying wedge of shattered diorite, and of course all of the underlying rocks were affected by the normal faulting already discussed in connection with the description of the Old Dominion mine in Professional Paper No. 12.

Within the shattered Madera diorite at the Old Dominion mine is an east-west strip of similarly broken yellowish granite porphyry, probably 300 ft. or more in width, but without well defined limits.[5] This appears to represent a dike in the Madera diorite intruded before the thrust faulting took place. It closely resembles some of the porphyritic varieties of the Schultze granite mass and was probably intruded at the same time as was that body. The recognition of this thrust faulting introduces a new element into our conception of the structure of the Globe district and one that may prove to be of much practical importance as the mines become deeper. There is evidence of movement of the same kind, for example, in the Live Oak mine near Miami, where the Schultze granite for a considerable area has been found to be underlaid by Pinal schist, the contact being an undulatory nearly horizontal zone of faulting.

Finally, it is probable that the intrusive mass mapped in the Globe report as the Lost Gulch monzonite and placed in the pre-Cambrian is really younger. Its relations to the Paleozoic rocks are nowhere shown, but as it is cut by diabase it is older than the Schultze granite. It is now provisionally assigned to the early Mesozoic.

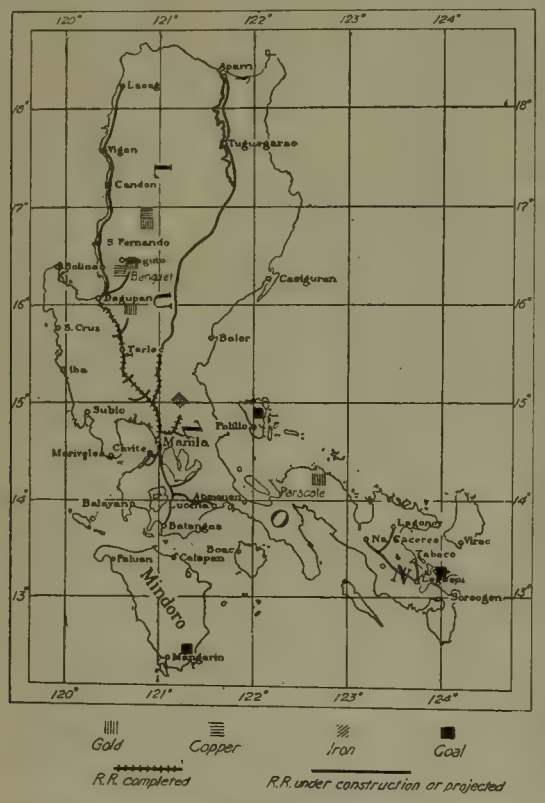
[4] MINING AND SCIENTIFIC PRESS, Nov. 13, 1909, p. 646, Fig. 1.

[5] See Professional Paper No. 12.

Gold Dredging at Paracale.

Written for the MINING AND SCIENTIFIC PRESS
By An Occasional Correspondent.

The Paracale district, on the southeast coast of the Island of Luzon, in Camarines Province, Philippine Islands, is becoming important as a dredging field. This region has long been known for its gold and natives have panned gold in the streams for centuries. After the discovery and conquest of the islands the Spaniards early undertook mining. But it was not until the early nineties of last century that much was attempted in the way of modern methods in mining. An English company, which had secured large con-



Map of Northern Philippine Islands Showing Location of Paracale District.

cessions, began the installation of crushing machinery, and in 1896 some Spaniards and *mestizos* of Manila constructed a small bucket dredge and put it to work on the Paracale river. This dredge was a mere pigmy. It did not have more than four or five horse-power and could not dig to a depth of more than ten feet—about one-third the distance to bedrock in most parts of the river. Its capacity could not have been over fifteen or twenty cubic yards per day, and it did not even handle its own dirt, which was transported by small boats to an arrastre on the bank of the river for treatment. Not much opportunity was given the dredge to demonstrate its value as a gold winner. The Philippine insurrection against Spain, which broke out shortly after the installation, stopped all mining operations in the district. For years the dredge stood on an island in the river where a high tide had beached it and finally fell to pieces.

Little further was done in mining in the Paracale district until about the year 1905, three years after an American mining law had been put in effect. Late in that year Frank B. Ingersoll and A. J. MacDonald, of Manila, completed negotiations with New Zealand dredging people by which the latter agreed to send a man to test a tract of about 500 acres acquired by the former on the Paracale river directly in front of the town of the same name. As an inducement to put the deal through the claim owners, who had previously been unable to arouse any interest in the United States, posted a cash deposit in a Manila bank which was to be forfeited to the New Zealanders in payment of expense of their representative in case he made an unfavorable report on the property. On the other hand, they agreed to install a dredge in case the value of the ground was as represented. The man sent out to do the testing was George R. Fearby, an Australian miner, who was afterward murdered in Cochin, China, by natives while prospecting for tin. Mr. Fearby brought with him to Paracale a hand-boring apparatus and started testing in January 1906, occupying several months in the work.

As a result of Fearby's report his principals shipped over from New Zealand some second-hand machinery, and the work of setting up a dredge was begun in February 1907. It was completed in August, but when William Kane, the dredge-master, arrived from New Zealand to take charge, he discovered that the apparatus was not adapted to the kind of ground found on the Paracale and a long shut-down followed in order to give the dredge a general overhauling and to remodel the gold-saving devices. Finally, in November 1907, dredging operations were resumed, but in less than sixty hours after the machinery was started the boiler failed, the accident being due to a defective plate. It took some five or six months to procure another boiler and put the dredge in shape to resume operations. Work began again in April 1908, and about the middle of May had blocked out a face and was taking out gold. The record of this dredge, considering the amount of dirt handled, has been phenomenal. Between May 25, 1908, and January 1, 1909, it produced 2814 oz. of gold from the working of 50,244 cu. yd. of dirt. The amount of ground handled did not average 300 cu. yd. per day of 24 hours, and much of the time the dredge was shut down for repairs. The gold was worth $18 per ounce, giving the total product a value of $50,653. The dredge was not operated between January 1, 1909, and February 6, 1909. Between this latter date and July 1, 1909, it handled 44,356 cu. yd. of dirt, with an extraction of 2171 oz. of gold. The whole period from May 25, 1908, to July 1, 1909, shows 94,600 cu. yd. handled with a return of 4985 oz. valued at $89,731 United States currency. This is an average of a trifle less than 95c. per yard. The dredge has a 70-hp. boiler, 60-hp. engine, a digging ladder 62 ft. in length, a revolving screen, and 37 digging buckets, each of 4½ cu. ft. capacity. The pontoon is built of Oregon pine and is 114 ft. long, 30 wide, 5 ft. 6 in. deep at the bow, and 9 ft. deep at

the stern. The greater depth at the stern is required to support four sluices, 80 ft. long, which have an overhang of 30 ft. beyond the stern of the boat. The general system of gold-saving includes a big spread of expanded metal and cocoa matting.

While this dredge has a bucket capacity of 2000 cu. yd. per day, it has averaged about 15% of that figure in actual digging. What a powerful modern dredge with suitable appliances could do in the way of paying dividends in such rich ground is easily figured. The percentage of black sand found in the dirt is large, and it carries the fine gold with it to such an extent that the sand must be saved in order to win the gold. On an average probably a ton of black sand per day is saved. Another peculiar feature is that each day the dredge buckets bring up from the bottom of the river an average of five to six tons of soft free-milling 'sugar quartz' which is rich in visible gold. Several thousand tons of quartz and black sand have been saved and will be treated by a Blake crusher, Huntington mill, and Wilfley concentrator which will shortly be installed.

The operations referred to have been carried on by a New Zealand corporation, the Paracale Gold Dredging Co., Ltd., working on shares with the claim owners. This company is capitalized for £10,000, with shares at £1, and these shares are now, January 1910, quoted at £5 10s. The success of this first dredge has given a big impetus to dredging operations in the Paracale district. A second boat has been installed farther up on the same river by another New Zealand company, the Stanley-Paracale Gold Dredging Co. This machine has been operating for only a few weeks, but, according to reports, has taken out some 50 or 60 oz. of gold per week. It differs from the first dredge in that it has no revolving screen or tables, its buckets discharging directly into a large sluice box. This company is also capitalized at £10,000, with shares at £1, and its shares are now, January 1910, selling at £2 10s. A third dredge has been installed on the Paracale river and is expected to produce shortly. This is a Risdon dredge with 3¼-ft. buckets, which was formerly set up on the Island of Masbate. It was bought by its present owner, the Philippines Gold Dredging Co., and removed to Paracale. This company is a Philippine corporation capitalized at ₱200,000. It has acquired about 250 acres of land in the plain bordering on the Paracale river next to the ground of the Paracale Gold Dredging Co., Limited.

The successful results already obtained in dredging have caused great activity among the prospectors, and probably 25,000, to 30,000 acres of alluvial ground have either been staked as placer claims or leased from the individual owners. It is not unlikely that one-third of this area will prove valuable for dredging. A great deal of testing is now going on and the coming year should witness the installation of further dredges. The Paracale river is really an arm of the sea with a rise and fall of some five or six feet of tide. The flat through which it runs is perhaps a mile in width near the mouth. It continues about the same width for a mile or more up and then spreads out into smaller flats with ranges of hills cutting in between. The total area available for gold dredging in this flat is about 1,500 acres. The average depth to bedrock on the lower river is from 30 to 40 ft. Higher up where the Stanley dredge is at work the depth is considerably less. A great deal of sand and other fine material is found and probably not over 35% of the dirt handled can be stacked. Of the three dredges only the Risdon has a stacker. The bedrock is a soft decomposed gneiss. There are occasional patches of clay to be worked through.

The Malagnit river, which flows into the Pacific Ocean not far from the Paracale river, has been prospected to a considerable extent with hand-drills, and promises to furnish some large tracts of dredging ground. It has been located for a distance of about ten miles up from the mouth and, together with adjacent tracts of private ownership, there are probably 3000 acres of dredgeable ground, although as yet a considerable part of it has not been tested for gold. There is a much larger percentage of gravel and heavy material there than on the Paracale. Several other streams in the same district, all tidal rivers running into the Pacific Ocean, promise to furnish good dredging ground. The custom in the district is to have only five white men on a dredge: the dredge-master, three winch-men for as many shifts, and one extra man, who should be an engineer and machinist. All the other labor is native. The dredge-masters receive $200 to $250 per month and board, and the other white men $125 to $150 and board. The natives receive 37½ to 50c. per day, according to their ability.

Gas is frequently found in coal mines, but is usually considered only as a dangerous material to be driven out as promptly as possible. In one of the collieries of the Frankenholz Mining Co. in the Sarrebrück basin of Germany 'fire damp' has been saved and used as fuel. It was discovered in a diamond-drill hole while prospecting underground. Finding after a few days that the flow did not diminish, a pipe was fitted into the hole and the gas conducted to the surface for use under boilers. When the supply showed signs of diminishing a parallel hole was drilled about 35 ft. distant and an additional supply under good pressure was found. 'Blowers' of inflammable gas are not uncommon, being occasionally found even in metal mines, as at Silver Islet in Lake Superior. It is probable that they might be used more often, thus changing them from sources of danger into a valuable asset.

Vanadium is used mainly as an alloy of steel, to which it adds remarkable toughness. Its effect in steel is said to be due to its removal of oxygen and nitrogen, to its union in a solid solution with the iron, and to its formation of carbides that increase the strength of the steel. It is said that steel treated with vanadium has great resistance to shock and to fatigue caused by constant bending, that it makes much better saws and springs, and that high-carbon vanadium steels also make much better tools, such as cutters and riveting dies. About 0.1% of vanadium is used for deoxidizing and denitrogenizing steel, and about 0.25% of vanadium is left in the steel itself. It is ordinarily used with chromium or manganese, or both, to which nickel may also be added.

STAR OF THE CONGO MINE.

Written for the MINING AND SCIENTIFIC PRESS
By An Occasional Correspondent.

Work necessary in preparing the site for reduction plant, and getting the mine into shape for the production of 1000 tons per diem, is now under way. Operations have been much restricted due to the never-failing cause—native food supply. The contractors have heaps of grain, but the difficulty is in getting carriers to bring it in. This, however, will finally disappear with the advent of the railway next July or August. The experimental furnace work in connection with the reduction process is in full

Map of Central African Copper District.

swing, and the results obtained coupled with the excellent shotting of the copper and the 2% of unreduced metal all point to the process proving success, thus eliminating blast-furnace operations. Copper will be made cheap when the best working conditions are attained. Eighteen months to two years from date should see the plant in full swing and cutting just a little ice in the world's production. Ruwe is closed again, pending labor and further prospecting. The main adit at Kambore is making good progress; it has now advanced 1000 ft. and within another 450 ft. it should strike under the old N shaft, when it will be in a position to handle over 3,000,000 tons of 14% ore.

An oxygen generator for emergency use has been invented by Clarence Hall, of the United States Geological Survey testing plant at Pittsburg. It consists of a small water can with lower compartment filled with sodium peroxide. When the emergency arises, the stop-cock between the two is opened slightly, the water comes into contact with the peroxide and oxygen is released. It passes through the water, becoming cooled, and through a mask to the mouth or nose of the person using the apparatus. The charge of chemicals is sufficient to last a half hour.

PHOSPHATE DEPOSITS IN IDAHO, UTAH, AND WYOMING.

Phosphate deposits in Idaho, Utah, and Wyoming were examined and mapped last summer by parties of the United States Geological Survey. On December 9, 1908, the Secretary of the Interior withdrew from all kinds of entry, pending an examination of their phosphate resources, lands in these three States covering 4,541,300 acres. All the lands withdrawn were not then supposed to be phosphate bearing, but they included all areas in which, according to the meagre evidence then available, valuable phosphate deposits might exist. Since that time field work and further study has led to the restoration of some of these lands to entry and the withdrawal of others, so that the total area now withheld from entry is 2,551,399 acres.

Two parties were detailed by the Survey to examine these fields. One working from Montpelier, Idaho, included Hoyt S. Gale, R. W. Richards, and C. L. Berger. W. H. Waggaman, of the Bureau of Soils, collected representative samples of phosphate rock and made field chemical determinations of their content of phosphoric acid. George H. Girty, a paleontologist of the Survey, was with the party during June and July. The other party, which was under the direction of Eliot Blackwelder, of the University of Wisconsin, examined phosphate lands in the extreme southern part of the area withdrawn, and studied stratigraphic problems in the northern part of the Wasatch mountains. Topographic work was done in two adjacent areas. One of these is in the extreme northeast corner of Utah and the other in the southeast corner of Idaho, and the two together form a region that includes much of the more accessible parts of the phosphate fields.

During the season the main party examined about 1200 sq. mi., mapped 400 sq. mi. in considerable detail, both geologically and topographically, and traced the outcrops of phosphate rocks in this area. Analyses of 330 representative specimens of phosphate show accurately the grade or quality of the material found.

The areal surveys made have defined the position and the geologic relations of the larger developed deposits, so that more reliable estimates of available tonnage can be obtained. The results of the careful study of the stratigraphic relations of the phosphate-bearing formations and the associated strata have simplified the work of identifying and tracing the deposits. Important outcrops of phosphatic beds have been found and mapped in areas lying beyond those now locally recognized as phosphate bearing. These deposits occur in readily accessible parts of the field and are not yet covered by mining claims. Evidence has been obtained of the existence in this field of deposits of high-grade phosphate rock in strata of Jurassic age that are much younger geologically than the deposits hitherto recognized, and although these deposits have not yet been shown to be of commercial value they may prove eventually to be of considerable importance. Final results of these surveys will be published later in one of the reports of the Geological Survey.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the interchange of ideas and opinions pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that mutual criticism is more valuable than mutual compliment. Insertion of any contribution is determined by its practical interest to the readers of this journal.

Metal Losses in Copper Slags

The Editor

SIR:—In your issue of November 13 last J. Parke Channing suggests a method of calculating the amount of matte in a slag, which seems to me to be correct. The method is to determine the amount of gold in the slag, and with the supposition that all of the gold in the slag is in the form of matte, to calculate the amount of matte in the slag, using the ratio of gold to copper as found from a matte sample. Mr. Channing also writes that, "the remaining copper in the slag, amounting to about two-thirds of the whole, is probably in the form of oxide." In regard to this Lewis T. Wright in a more recent issue says, "As stated in the paper," meaning one read by Mr. Wright before the American Institute of Mining Engineers, "the facts observed leave room for belief that some of the copper of the slag may have been existent as silicate." In Peters' 'Principles of Copper Smelting', page 113, we find the following: "When an ore is smelted, there is a considerable loss of values in the slag, resulting mainly from particles of matte or metal which have failed to separate properly from the slag, and, in a lesser degree, from the formation of oxides of the valuable metals—especially lead and copper—that have entered into combination with silica, and have thus become, chemically, a part of the slag." This view of the subject seems to be the one most favored at present by the metallurgist.

It is a recognized fact, that, if zinc is present in a slag, much of it is in the form of a sulphide. Personally I have known a slag rather high in zinc to contain 1.7% of sulphur. Allowing 0.2% of this for any matte, etc., in the slag, it leaves 1.5% of sulphur to combine with the zinc, or sufficient to form 4.5% of zinc sulphide. This zinc sulphide is ('Principles of Copper Smelting', page 393), in solution in the slag and evidently in solution in very much the same manner that any cuprous oxide or silicate is, if present. It seems reasonable, inasmuch as zinc has much the same power of replacement for copper that iron has, to suppose the following reactions to take place:

$$Cu_2O + ZnS = Cu_2S + ZnO$$
$$Cu_2SiO_3 + ZnS = Cu_2S + ZnSiO_3$$

Copper is in much the same condition in a slag, both as to quantity and physical characteristics, regardless of the presence of zinc. Therefore the assumption that the copper in a slag, aside from that in the form of matte, is in the form of cuprous sulphide, seems reasonable, and, furthermore, that it is dissolved in the slag in much the same manner as zinc sulphide.

In endeavoring to prove this, I have tried to find a slag, which contained no elements other than copper likely to be combined with sulphur. The only one at hand is that made at the reverberatory furnace of the Union Copper Mining Co. at Copperopolis, California, in the summer of 1907. An analysis of the roasted ore follows, also the copper and sulphur content of the slag. To flux the ore about 10% of quartz was added and the slag formed was a rather stiff one due to the large amount of alumina and magnesia in the ore, which probably caused more matte to be suspended in the slag than is usually the case.

ANALYSIS OF ORE

	Per cent
SiO	21.80
Al_2O_3	13.00
MgO	6.30
CaO	1.00
Cu_2O	3.37
CuFeS	10.57
FeS	5.87
FeO	20.20
$FeSO_4$	5.10
FeO	8.90
Combined H_2O	2.82
	98.93

	Cu, per cent.	S, per cent.
Matte	45.00	23.00
Slag	0.63	0.23

Assuming that all of the sulphur in the slag is either in the form of cuprous sulphide or matte, a determination of them separately is made as follows: In copper sulphide, from the atomic weights, the ratio of copper to sulphur is practically 4 to 1. In the matte, by means of the analysis, the ratio is 2 to 1.

Let

C = the copper in the form of Cu_2S
C′ = the copper in the form of matte
S = the sulphur in the form of Cu_2S
S′ = the sulphur in the form of matte

Then

$$C + C' = 0.63$$
$$S + S' = 0.23$$

and

$$C = 4S$$
$$C' = 2S'$$

Substituting

$$4S + 2S' = 0.63$$
$$4S + 4S' = 0.92$$
$$2S' = 0.29$$
$$S' = 0.145$$

C = 0.34% copper in the form of Cu_2S
C′ = 0.29% copper in the form of matte

Some experiments were conducted, during the summer of 1907, at the above mentioned plant by the superintendent, H. W. Ross, as follows: The reverberatory furnace was operated as usual, with the exception that the charge before skimming consisted entirely of a concentrate of pure sulphide, containing about 8% copper. Assuming that this charge melted into a matte, containing about 10% copper and leached through the slag replacing the suspended matte containing 45% copper, with a 10% matte, but not affecting the cuprous sulphide dissolved in the slag, we can multiply 0.29 by 10/45 and obtain 0.06% copper in the form of matte under the new conditions. If we add this to the 0.34% as cuprous sulphide, we obtain 0.40% as the total copper in the slag. As actually found in practice this

slag contained 0.45% copper. The slag and matte at Copperopolis contained no gold or silver, otherwise, it would be interesting to calculate the amount of free matte in this slag by the method suggested by Mr. Channing.

The conclusions therefore from these data would seem to be that the copper in the slag is in two forms: first, as cuprous sulphide dissolved in the slag in a manner similar to zinc sulphide; second, as matte particles suspended in the slag, which amount, in a good slag and one well settled, ought to be small. The data given are not by any means sufficient to prove these conclusions, and I shall be glad to see some more discussion upon the subject, either for or against the above statements.

N. M. Zopf.

Kennett, California, January 22.

Conservation and Some Difficulties.

The Editor:

Sir—In reference to your editorial on the article of Horace V. Winchell in your issue of December 18, I beg to inform you that from a long residence within Forest Reserves, I am in a position to know that his pen-picture of the Dakota widow guarding her six trees is not in the least over-drawn. I have known of several cases where widows have been denied the 'free-use permit' for fuel, merely because they happened to take in washing or keep a few boarders in order to make a living. I have known of prospectors who had violated no law being bulldozed to such an extent that they abandoned their claims, to be re-located by some friend of the ranger. In one case a wire fence was run across a miner's claim, and thereby the rangers shut off his camp from the public highway. I have known of several cases where a permit for some 'special privileges' was wanted and where the application has been returned repeatedly, and for no apparent reason other than to wear out the patience of the applicant or to delay the issuance of such permit until some power-company or other favorite should have an opportunity to file a later application, have it acted upon, and thus secure that which the former applicant had asked for. Without a Forest Service and an every ready 'permit system' to hold up the people (the permit has been made to answer the same purpose as a gun in the hands of a highwayman), the power companies, at least the Huntington companies, would never have secured the hold upon the streams of the West that they now have. It looks sometimes as if the Forest Service was a sort of 'bureau of information' run to keep the power-companies posted as to the wants and desires of the settlers. Government by permit, as exemplified by the administration of the Forest Service is un-American and wrong in principle. In practice it is worse. The Forest Service seems to be getting into everything except practical forestry; and seems to show an especial dislike to the mining business. It would require a miner to have a paying mine before he be allowed to locate the ground, and it seems to have no regard at all for his rights. In one case where a miner working at a distance from supply points had planted a few vegetables within the limits of his claim and had put a little brush fence around it, the ranger made him destroy the fence and denied him the right to keep out the stock. In another case where the miner had planted a few potatoes within the limits of his claim, and was accomodating enough to sell a sack of them to the ranger who claimed to be out and unable to get potatoes without making a long trip for them, the miner was required to pay acreage rent on his claim, on the ground that he was using it for other than mining purposes. This was extortion, pure and simple. In another case where a miner had the prior legal claim, according to advices from the land office, for some land upon which the Forest Service had designs, the miner was cited 'to show cause,' on the ground that a 'special examiner' had reported "no gold visible in any of the leads within his claim." It was a placer claim and had the word 'placer' written on the face of the notice. He was threatened with arrest if caught prospecting and was instructed to prove the mineral character of this particular piece of ground by doing work on other lands, and finally they tried to get him to sign a relinquishment, the contents of which were wholly false. He declined, but retained the copy and furnished a duplicate to the Land Office. The Forest Service sought to obtain possession of the original, and finally, with a promise to return him an exact copy, typewritten, he let the ranger have it, but not until I had secured a copy which I still hold. This paper purported to come direct from the office of the Chief Forester in Washington. The miner is still waiting for the copy that was promised him. As to the special examiners, Mr. Winchell has told but a small fraction of the tale. Special examiners are sent out by the Forest Service on almost any pretext when a permit is wanted, and the examiner will usually explain to the applicant that he has nothing to do with the matter in hand, himself; that he has only to examine into the merits of the case and recommend. A little later he will tell the applicant that he can recommend or not. In the further course of the conversation he will manage to repeat this statement a few times with a little more emphasis on the word 'can' each time. By the time he gets through he will have the applicant thoroughly convinced that everything depends upon his recommendation, and that a recommendation favorable to the applicant would be of great benefit to said applicant. Was there ever a scheme better calculated to lead to grafting than this permit system of the Forest Service? It is any wonder that the Secretary of the Interior, Mr. Ballinger, has found reason to refuse to accept recommendations from this source? In several of the pamphlets sent out by the Forest Service and quoted in the halls of Congress, this statement appears: "Prospecting and mining are absolutely unchecked." In my opinion this statement is absolutely untrue. No harder blow can be struck at the mining business than to discourage the prospector and the small miner, and I dare say that in nearly every case where a mining district has been put within a reserve the production by 'small miners' has shown a decided decrease. Not only is the prospector being driven from the field, but a study of the school-census will also show a decrease in popula-

tion within the reserved areas. Not that the Forest Service has promoted the race-suicide, but the fact remains that the policies and practices of the Forest Service are driving outside the reserved areas everybody who is not tied down by property or business. Why does the Forest Service assess the miner $50 per year rent for a 5-acre mill site on land that was formerly sold at $1.25 to $2.50 per acre? Why is the miner required to give bonds and go to more expense and through more red tape to get a permit to lay a few rods of pipe or a common V-trough to conduct water for a short season, than is required of a power-company to get a right-of-way to be held for several years, and why is the latter right extended again and again without action? The only apparent reason for this is to keep the miner from locating any water-right that might interfere with the plans of the power-companies. Since the meeting of the Irrigation Congress at Seattle, the Chief Forester has had a great deal to say about the power-combine. It will be noticed, however, by the observing ones, that his kick has been directed only against those who have got in ahead of the Huntington companies. In the *Fresno Republican* of May 16, 1908, two letters were published over the signature of Gifford Pinchot. In the first, addressed to Dean Kirchhoff, Mr. Pinchot stated that he had no information whatever that the Huntington companies are trying to monopolize anything, or words to that effect. In the second letter it is stated that "the Forest Service has never shown any favoritism toward the power-companies." Now, as these letters were published soon after I had called the attention of the Forest Service to several specific cases of the rankest kind of favoritism benefiting the Huntington companies of which Dean Kirchhoff is president, I can but view the publication of these letters at that particular time as being for political purposes and with intent to deceive. I have also seen other examples of this favoritism since the publication of these letters. Probably no other branch of the Government has ever sent out as much misleading literature, not even David T. Day's black sand articles, as has come from the Forest Service, and much of it bearing the approval of the Chief Forester. Much has been said by the conservation writers about 'timber thieves' and 'grass thieves', and reading some of these articles in Eastern papers one not familiar with the facts would be led to believe that nearly everybody in the West was a rascal. I have lived in both the East and the West and have found no place where the rights of others are more respected or where personal property is safer than in the mining camps and the mountain districts of the West. Most of these 'timber thieves' and 'grass thieves', when it comes to square dealing, will compare favorably with the management of the Forest Service. There are few miners who would not scorn to stoop to the petty acts of extortion and blackmail practised by the Forest Service. It is just as honorable for a 'grass thief' to lawfully pasture his cattle upon the public domain, until some law is enacted forbidding it, as it is for the Forest Service to collect money from cattlemen for the use of land that they have no business at all to rent; for instance, lands included within a mining claim, or to take money from cattlemen for the use of certain portions of land, and then allow several thousand head of sheep to run over the land. This reminds one of the man who gives a check on the bank, and immediately withdraws his money from the bank before the check is presented. To take money for some 'special privilege' and then to deny in part or in whole that which has been specifically paid for, under a little clause printed at the bottom of permit forms, which reads that: "permittee agrees to obey all rules and regulations now or hereafter made by the Forest Service," by claiming that a new rule has been made since the permit was granted, is dishonest. I have read much of the great wisdom with which the reserves are administered. Surely the wisdom displayed in compiling some of these permits is great enough to excite the envy of a bunco-steerer. In 1905 the Secretary of Agriculture wrote a letter recommending the passage of a bill granting an extension of time to the Edison Electric Co., in which to construct some power-plants on Kern river (the rights were held by others prior to the Edison Electric Co. taking hold). In this letter one of the reasons assigned by the Secretary for recommending the passage of the bill was that these plants were being constructed throughout a country that was subject to mineral location. This ought to have been a good reason for his withholding his recommendation to have the country longer tied up. But he goes on to say that the power-companies have frequently been called upon to make an unreasonable money-settlement to the mineral locators and that some of these cases were nothing less than blackmail. For every case where the Edison Electric Co. has paid an unreasonable sum of money to a miner on Kern river that the Secretary can specify, I will show two cases where the miners have paid money or given up valuable considerations to the Forest Service under circumstances that will come nearer filling the requirement constituting blackmail than cases specified by the Secretary. The Edison Electric Co. has sold out its holdings to the Southern California Edison Co., and I presume that S. C. Smith of the House or F. P. Flint of the Senate will introduce bills to grant another five or ten-year extension of time. If the Secretary of Agriculture wishes to further use his office to promote this system of monopolization, it is to be hoped that he will do so next time without libeling the miner.

E. L. Allison.

Bakersfield, Cal., December 21.

[Mr. Allison's vigorous castigation of the Forest Service expresses a point of view which must be considered in any settlement of the questions raised. It is right and proper that injustice or favoritism incident to this or any other branch of the Public Service should be promptly made public. Whenever turning on the light raises objections it is time to start the dynamo, and from an intimate acquaintance with officers of the Forest Service we feel sure that an earnest effort is being made to insure prompt and equal justice in its dealings with the public. The complaints made by Mr. Allison deal in part with

ill-advised and arbitrary acts, of rangers mainly, which result in petty grievances and much local friction. This is inevitable in a new service and with new men. Just such public discussion is, we think, one of the best means of correcting it. Of the other questions, relating to conflicting claims for water-rights, we have no knowledge, but we can well believe that miners having claims on a right of way may have held them at prices which amounted to blackmail. We believe miners to be as free, but not necessarily any freer than others, from ordinary human failings, and we have several times had cause to remember that each question has at least two sides. In this case Mr. Allison is, frankly, presenting one side.—EDITOR.]

Channing on Mining Investments.

The Editor:

Sir—In a recent address before the Finance Forum in New York, J. Parke Channing says, "Unless you are actually in the mining business or make a thorough investigation, it is not for you to invest your money in prospects. This must be left to those people distinctly in the mining business, or to development companies who can afford nine failures out of ten."

It has been my observation that the majority of the profitable producing mines of this continent received their original prospecting and development at the hands of men of limited means, usually of a small local syndicate or stock company, the personnel of which is largely composed of the local camp merchants and friends of the owner or promoter of the prospect, and that this local financial combination either ultimately proves the value of the prospect and sells out at a profit to a larger aggregation of capital, or else 'goes broke'. It is notorious that the strong exploration companies and development companies which Mr. Channing says can afford nine failures out of ten, will not even send their engineers to examine undeveloped prospects. These large companies and combinations of wealthy operators want developed mines, as many a Western claim owner has found to his sorrow after spending all his limited 'wad' in New York trying to interest these 'big fellows' in his prospect.

I would like to ask Mr. Channing if the investor in large enterprises like Nipissing, Greene-Cananea, Utah Copper, Ray Consolidated, Nevada Consolidated, Miami, Inspiration, and Dominion Copper, who makes his investment in some one of these stocks after reading the reports and endorsements of the enterprises made by leading mining engineers, is going to get a 'better run for his money', eliminating the feature of quick turns in the stock market, than if he should invest his money in a prospective mine endorsed by engineers of the same good standing and experience.

Granted that investments in prospects, even under efficient and honest guidance, be hazardous, is it any more hazardous than buying stocks in some of the above-mentioned corporations where the control is always changing from one group of financiers to another? A great operating mine in control of one group of men may prove a better investment than when in control of a different combination of speculators who merely intend to prostitute the good name of the property for manipulative purposes, and who care nothing about the accuracy of reports and the integrity of operation. Who is going to tell the average investor as to who controls the property in which he contemplates an investment? The control may change overnight.

Of course a fair discussion of this question demands an absolute elimination of the stock-market features. By this I mean a man who buys Utah Copper, as an example, today and takes a profit tomorrow on a one-point rise, is not an investor. If I buy stock on an advancing market I am liable to make at least a quicker and possibly a larger profit on my money than if I put up money for the development of a prospect: but I would not then be mining. If I could always accurately forecast the market I certainly would never have to do any digging to make a competence. Meanwhile I prefer to take my chances with a promising prospect, knowing that most prospects if promising and intelligently developed seldom require large expenditure of capital to prove their merits or demerits as future profitable mines. I think it safe to predict that the time is rapidly approaching, if it has not already arrived, when the average mine investor will prefer to trust to the vagaries of Dame Nature in backing a small prospect than to take chances in going against the high-finance game as it is worked today in mines and industrials alike, by stock-market manipulation.

Will Mr. Channing please send the addresses of some of the 'development companies who can afford nine failures out of ten,' and are therefore supposedly willing to tackle prospects. I regard Mr. Channing's address as admirable in every respect excepting in the paragraph I have attempted to discuss.

PERCY WILLIAMS.

Vancouver, B. C., January 26.

Duties on Mining Machinery in Siberia.

The Editor:

Sir—I beg to acknowledge receipt of your letter of November 16. Mining machinery and supplies, parts of machines, and the like, enter the port of Vladivostok free of duty. In regard to shipments, it is important to note that each package must bear some mark and the gross and net weight, which marks must appear on the bill of lading. It is of great convenience to have the bill of lading issued 'To order' instead of to a certain individual or firm, as in this case it can be turned over to anyone to attend to the customs formalities; otherwise it is necessary for the consignee to give a power of attorney to the customs broker in each case, in order that he may secure delivery through the Custom House. In case the bill of lading is made out 'To order', it is necessary for the shipper to endorse it.

H. FRED NEWHARD.

Vladivostok, Siberia, December 29.

[The above communication is from the deputy American Vice-Consul at Vladivostok, and is in answer to our enquiries made in behalf of correspondents.—EDITOR.]

Special Correspondence.

LONDON.

Stratton's Independence Mill and Work. — Ouro Preto in Minas Geraes, Brazil, Makes Good Report.

Stratton's Independence has issued its first report since the reconstruction September 8, 1908. The mine is at present leased. During the year ended June 30, 1909, the amount of ore raised was 38,082 tons, of which 21,162 tons was sorted out and shipped to the smelters. The gross value per ton was $26.04, and freight and treatment came to $7.42, leaving a net revenue of $18.61. Of this net revenue 35.9% went to the company and the remainder to the lessees. The income of the company from this source was £32,360. The wet mill for treating the dump ore restarted on April 1, and during the three months to June 30 made a profit of £1037. The net profit was £13,221. Out of this £6250 is paid as dividend, which is at the rate of 5% on the capital, and the directors at the same time declared a similar dividend on account of the current year's operations. Development of the mine was recommenced in November 1908 with the object of extracting medium-grade ore from the caved workings. This ore was to be coarse crushed and the fine, containing the telluride, screened out and roasted. The trial operations were not successful because the capacity of the roasting furnace was much greater than the possible supply of ore. Philip Argall, the consulting engineer, is now engaged in elaborating an alternative plan for treating the ore without roasting. On starting the wet mill in April 1908, treating the low-grade dump ores, it was found that the average content was 26% less than was estimated when sampling the dumps. This made all the difference between profit and loss in treatment, so operations were suspended. Investigations were then made with a view to finding the richest parts of the dumps, and subsequently the plant was re-started April 1. During the three months to June 30 the ore treated amounted to 12,265 tons averaging $4 per ton, and yielded 158½ tons of concentrate containing 4.235 oz. per ton and 221 tons of concentrate containing 1.186 oz. per ton. The mill is now treating from 6500 to 7000 tons per month at a cost of $1.52 per ton, and another Chilean mill will shortly bring up the production to 10,000 tons per month.

Some extremely cheap cyanide work is found at the Ouro Preto gold mine in Minas Geraes, Brazil, and A. J. Bensusan, the superintendent, and R. H. Kendall, the metallurgist, are to be congratulated. The ore itself is of comparatively low grade, and the yield is about £1 7s. 6d. per ton. The process of extraction consists of catching free gold on blankets, concentrating on frue vanners, and cyaniding the concentrate. Within the past two years the sandy tailing from the vanners has been cyanided; the average content is only 3s. 6d. per ton. About 2s. 6d. is extracted at a cost of 6d. per ton. A plant has also been erected to treat the slime tailing and it started operations in June 1909. During that month 1300 tons was treated, and the extraction was 7s. 2d. at a cost of 1s. 11d. per ton. During the year ended June 30 last 73,166 tons of ore yielded 25,050 oz. of bullion realizing £100,609. The total cost was £88,627, and the profit (including £1206 interest, rents, etc.) was £13,188. Owing to extra expenditure on plant required to cope with an unexpected increase in the water entering the mine, and also on the new slime plant, it has been necessary to curtail the amount of dividend distributed. The preference shares receive £3663, which is the usual 10% on £36,334, and the ordinary shares, of which there are 100,000 of £1 each, receive £2500, or 2½%. In spite of the trouble caused by the increased inflow of water, development has been well maintained; in fact, the ore reserve is higher than the year before. The figures at June 30 were 202,030 tons, and there were many additional blocks that could be called probable ore. Stoping is done at several levels, especially at 315 metres, 470 metres, and 680 metres. Prospecting and development has been carried down to 1028 metres.

WASHINGTON, D. C

Bureau of Mines — Alaskan Problems — Spitzbergen Coal Land — Conservation Commission — Borax Lands

The bill creating a Bureau of Mines in the Interior Department passed the House with but three or four negative votes. It was evident the members had made up their minds some time before, for the eloquent efforts of James A. Tawney, of Winona, Minnesota, in opposition proved of but little avail. The burden of Mr. Tawney's plea was that that there were already too many bureaus, that another would cost money, and that the work was now being carried on effectively by the United States Geological Survey. Those favoring the Bureau declared that the task of the Bureau of Mines was one of such magnitude that it could not be carried on successfully by the Geological Survey without some of the other work being neglected. They also pointed to the high death rate in American coal mines and in the metal mines and made comparisons with European countries that were not at all to the credit of the United States. Still further, those favoring the measure declared that its endorsement by the United Mine Workers of America, representing labor; by the operators' organizations, representing the employers in a number of States, by national scientific bodies, States geologists, and others representing the scientific side of the problem was sufficient assurance for them that such a Bureau should be established. Mr. Tawney suggested that the Bureau if established might grow into a department, and one member retorted that this fear was proof that there was a wide and useful field for the Bureau. The bill was amended slightly in several places, but in the main it is the bill as reported by George Huff, of Greensburg, Pennsylvania, chairman of the House Committee on Mines and Mining. It provides for a complete investigation of the causes of mine accidents and other technologic investigations relating to mining, and for the transfer of the Technologic Branch of the Geological Survey and all the investigations now going on under that branch, the testing of coal, lignites, and other mineral fuel substances and the structural materials. The Senate Committee on Mines and Mining will consider the bill at an early date.

Alaska is looming large in Washington affairs these days. More than a dozen bills relating to the Territory have either been introduced or will be soon, all touching upon the mineral wealth and government of that district. Members of Congress were beginning to believe that the special problems of that wonderfully rich country were nearing solution, when John E. Ballaine, of Seattle, appeared upon the scene with a novel proposition. Mr. Ballaine, who is the owner of large interests in the Territory, has made a formal offer to the Senate Committee on Territories to lease 5000 acres in the Katalla and Matanuska districts at a royalty of 50c. per ton. Such a tonnage royalty, it is claimed, would net the Government $50,000,000 on the 5000 acres. Mr. Ballaine asks that Congress pass a law to authorize the head of one of the departments to lease to a coal company to be organized by him, at the same time prohibiting the leasing of other coal lands in the Territory for a less royalty. Mr. Ballaine offers to furnish bond for $1,000,000 for performance of his part of the agreement. The Government is also to agree, says the Seattle man, that part of its coal supply shall be obtained from this company or from a naval station which the Government may establish in the Matanuska district, the coal to be shipped over a railroad from Seward to the coast, to be built and controlled by the same interests as the coal company. This proposal contemplates a radical departure from past practices in the Government's disposal of Alaska coal lands. It comes avowedly to do battle with another proposition, embodied in a bill which has been prepared but not yet introduced, designed to permit the sale or lease of such lands at a rate of $10 per acre. Mr. Ballaine's proposal has attracted much attention, but it is too early to say whether it will be adopted.

At the suggestion of Henry Cabot Lodge, Senator from Massachusetts, the Senate has just amended the Guano Act of 1856, making it apply to coal and other minerals, which brings in a rather delicate international question. The

Guano Act provides that whenever any citizen of the United States discovers a deposit of guano on any island, rock, or key not within the lawful jurisdiction of any other government and not occupied by citizens of any other government, and takes peaceable possession thereof and occupies the same, such island, rock, or key, may at the discretion of the President be considered as appertaining to the United States.

This law has been found effective and adequate in its application to guano deposits, which usually are found upon rocky islands of no intrinsic value. Now the attempt is to be made to apply it to coal lands. Obviously the original act could hardly be construed to imply any considerable seisure of territory. The amendment to the law is sought in behalf of John M. Longyear, of Brookline, Frederick Ayer, of Lowell, Massachusetts, and other capitalists who are desirous of developing certain coal deposits in the Spitzbergen islands, which are claimed by no country. In his annual message President Taft dealt at some length on the anomalous position of the Spitzenbergen islands, and stated that the United States Government, in view of proofs filed with it in 1906, has accepted under reservation the invitation of Norway to participate in an international conference relating to the islands. These proofs showed the American possession, occupation, and working of certain coal-bearing lands in Spitzbergen, and the reservation prescribed that the question of altering the status of the islands and countries belonging to no particular State and as equally open to the citizens and subjects of all States could not be raised. The Lodge amendment, if finally adopted would tend to confirm the rights of Messrs. Longyear and Ayer and their associates in the coal lands already occupied.

Francis G. Newlands, Senator from Nevada, has introduced a bill in the Senate calling for the appointment of a national commission for the conservation of natural resources. The commission would consist of fifteen members with the following duties: to organize for the investigation of all questions relating to the conservation, use, and control of the water resources of the United States for navigation, irrigation, municipal supply, power, and swamp-land reclamation, to the prevention of floods and the maintenance of stream control, to the prevention of waste in the mining and extraction of coal, oil, gas, and other minerals, to the protection of human life in the mines, and to the prevention of erosion and soil wash, to the conservation of the forests, to the preservation of the public domain for homeseekers, to the protection of the timber, coal, iron, and oil lands of the United States against absorption by monopoly, and for the investigation of all other questions relating to the conservation of the natural resources of the United States for the preservation of its beauty, healthfulness, and habitability. This commission if formed would co-operate with commissions or boards appointed by the States for similar purposes, with a view to recommending suitable action by Congress and the States.

George S. Nixon, of Nevada, has just introduced in the Senate an important bill defining the manner in which deposits of borax and borate material may be acquired. The bill provides that all public lands within the United States, containing valuable deposits of borax, borate of lime, borate of soda, or borate material, shall be subject to location, entry, and patent under the placer-mining laws. Patents heretofore issued for lands containing such deposits, whether as patents for lodes or patents for placer, are to be confirmed. Placer patents heretofore and hereafter issued for lands containing such deposits shall vest in and convey to the patentee the title to all lands included within the exterior boundaries of the land described in such placer patent; provided that where lands containing such deposits have heretofore been located under the laws providing for the entry of mineral lode claims said locations may be perfected and patents issued under the laws applicable to lode claims; and provided further, that in case of any conflict between locators under the placer laws and the mineral lode law, on locations heretofore made of lands containing such deposits, the conflict shall be determined as though location of said land under either of the above laws was valid at the time said locations were made.

KALGOORLIE, WESTERN AUSTRALIA.

Output for November.—Consolidations.—Filter-Press Discussion.—Roasting Losses.

The gold output from the State in November was valued at $2,825,000. Of this amount Kalgoorlie contributed $1,530,000. The yield from the State for 1909 will be about $1,300,000 behind 1908.

Amalgamation of mining companies has been very fashionable on the Rand for some time, and seems liable to become so in Kalgoorlie. Just about complete are the amalgamation of the Hannans Star and Boulder Deep Levels; and the Chaffers and Boulder Main Reef on the south end of the Golden Mile. During the past fortnight plans for joint working of a number of mines on the north end of the belt have been arranged. The mines comprising the Oroya-Brownhill Co. are practically worked out, but the company has a good deal of cash, stores, and a 50-head mill. The Golden Link Eclipse mine nearby is a good mine with 71,000 or more tons of sulphide ore worth $8.50 per ton, with no mill in which to treat it. The capital of the Golden Link was increased to 1,250,000 shares at $1.25 each. The Oroya-Brownhill sells all its leases, mill, and stores for 500,000 shares. A number of adjoining leases called the Kalgoorlie Amalgamated with 142 acres takes 150,000 shares. There will be 100,000 shares in reserve. As regards cash, the Oroya-Brownhill contributes $75,000, the Link $75,000, and the Amalgamated, $33,000 as working capital. The new company is known as the Oroya-Links, Ltd., from January 12, 1910. The big residue dump on the Brownhill lease—now about 300,000 tons—and vacuum plant are not included in the deal. The new company will have an area of 313 acres in the following mines: Golden Link, Kalgoorlie Amalgamated, Brownhill, Oroya North and South blocks, Trafalgar, and Kalgoorlie Mint, and an interest in the Central and West Boulder. It has been practically decided to put in nine No. 8 Krupp ball-mills in place of the sixteen Griffin mills destroyed by fire at the Perseverance. The following figures show the difference in working these types of dry crushers:

	Krupp No. 5.	Griffin 30 in.
Size of feed from crackers...	3 to 5 in.	1 to 1½ in.
Cost of cracking per ton.....	8 cents	16 cents
Speed of mill	26 r.p.m.	198 r.p.m.
Horse-power absorbed	16 to 18	20
Capacity per day	40 to 45 tons.	37 tons
Product through 150 mesh...	40 to 50%	70%
Cost of milling per ton.....	50 cents	72 cents

The product from each type of mill is roasted and then ground in pans, the pans having to grind 20% more through 150 mesh from the ball-mills; but when all is considered, there will be a distinct saving of about 20c. per ton by installing the Krupp mill, which, in a mill of the size of the Perseverance—20,000 tons monthly—means a saving of $4000. The Krupp mill liners last from six to nine months, while the Griffin mill spares wear out in about two weeks. On the Perseverance there was continual work with the latter mills, and they caused much worry. At the 1550-ft. level in the Kalgurli, work has proceeded 154 ft. in ore 16 ft. wide averaging $18 per ton. This is satisfactory, as there were doubts as to the ore values at this level.

The November returns from the chief mines were:

Name.	Tonnage.	Value.	Profit.	Dividend.
Associated	11,327	$93,000	$19,500	$120,000
Associated North. Blocks.	3,630	21,000	3,000	.....
Chaffers	4,004	32,000	5,000	.....
Golden Horseshoe	25,742	245,000	98,000	.....
Great Boulder Proprietary	17,847	250,000	135,000	.....
Hainault	5,814	39,000	7,000	.....
Ivanhoe	19,488	200,000	100,000	.....
Kalgurli	10,760	142,000	77,000	.....
Lake View Consols.....	11,037	78,000	13,000	85,000
Oroya-Brownhill	11,710	*192,000	127,000	.....
Oroya-Black Range	4,457	56,000	20,000	.....
Sons of Gwalia.....	13,500	118,000	48,000	.....
South Kalgurli	9,089	62,000	13,000	50,000

*Account of the amalgamation (Oroya-Links) bullion reserve and special clean-up declared.

The Kalgoorlie branch of the Australian Institute of Mining Engineers met at the Chamber of Mines last week for the discussion of H Adams paper on The Disposal of Residue and the reading of F G Brinden's paper on 'Roasting Practice on the Kalgurli Mine' There was a representative gathering and no lack of discussion The arguments on disposing of residue from filter presses and vacuum plants mainly dealt with the pipe lines and their troubles It is believed that it is better to keep a pipe running full than half full, as there is a greater tendency to clog when running half full At the South Kalgurli they are now experimenting with sluicing out the presses by pumping, but this depends on getting water at the special rate of 5s per 1000 gal It is not proposed to alter the presses like the Merrill press. It is rather early to discuss this new phase of the discharge of the press; but, if it can be done cheaply, the press will hold its own with any vacuum plant The former type is more expensive in erection than the latter, and really there is not so much difference in the cost of treatment Both processes have their little weaknesses in washing the slime cakes. Interesting work along this line may be anticipated. Mr. Brinsden discussed roasting of sulpho telluride ore with about 3% sulphur in Edwards furnaces at a rate of 350 tons per day. Details were given of the analysis of the ore before and after roasting, of furnace construction, feeding the furnace, flues, flue dust, and stack, of percentage of sulphur at different points in the furnace, grading tests, and other interesting information. In a certain part of the Edwards roaster SO_3 is formed, while in the Merton furnace a good deal of H_2SO_4 is formed on the arches beneath the third hearth. It was stated that the quantity of dust going out of the stack, 100 by 5 ft., is hard to determine, in fact, this is an undetermined quantity on this field. If any of the readers of the MINING AND SCIENTIFIC PRESS know of any method of determining the percentage of dust lost from smelters or roasting plants, an account would be read with interest. Some argument arose as to the origin of the iodine method of testing the roasted ore, which has been especially useful on this field. Dr. Earp, of the Perseverance some years ago, gets the credit for its introduction.

In the November number of the Chamber of Mines *Journal* is a short article and two tables on the 'Estimation of the Capacity of Vacuum Filter Plants', by T. B. Stevens, of the Oroya-Brownhill Co., where 750 tons are treated daily. The estimates are made by (1) the specific gravity of the agitator pulp, and (2) taking sections of the cakes from the filter-vat charges.

TORONTO, CANADA.

Porcupine Lake.— Snow-Shoe Claims. — Gowganda Shipments. —Ore-Stealing Laws. — International Nickel Company.

A. A. Cole, mining engineer, in an official report to the Ontario Government of an inspection made of the best known prospects in Porcupine lake, including the Wilson, Miller, Gillies, Hollinger, Davidson, and Bannerman, gives it as his opinion that all signs so far are favorable for a good gold camp. On all the properties visited he saw free gold in place, the veins being for the most part composed of rusty quartz with a wall-rock of schist. In southern Tisdale township on the Wilson, Miller, Gillies, and Hollinger, the veins run northeast and southwest and stand up in ridges above the adjacent schist. In other localities they are not so prominent. Several of the veins will average 25 ft. in width, one on the Wilson averaging 75 ft. for some distance. The problem of the occurrence of gold at depth has not as yet been solved. In this connection great interest attaches to the diamond-drilling now in progress on the Miller claim, an option on which is held by M. J. O'Brien, the Cobalt millionaire. Mr. O'Brien has had a force of men at work on the property for some time, but is not yet sufficiently satisfied with the results as found at a depth of 50 ft., to close the option and pay the $300,000 purchase money, but has asked for a month's extension. Active operations are being begun on behalf of the McArthur Gold Mining Co., a Scotch concern, which has acquired the Brannerman, Way, and Griffith claims at the northwest end of Porcupine lake. Their representative, Peter McLaren, has engaged a force of 12 men and will sink two shafts on a quartz vein running from 4 to 8 ft. in width, where test pits have shown gold well distributed through the quartz. Frank Cochrane, Minister of Mines, is endeavoring to put the public on its guard against the sellers of snow shoe claims. He points out that in the case of claims staked when the whole country is under snow there can be no certainty of the bona fide discovery of minerals, and that a few discoveries do not mean that the whole country is studded with gold. A large number of engineers and mining men who have returned after an inspection of the field, while favorably impressed with the actual discoveries, are disposed to temper their enthusiasm, with a note of caution. A. M. Hay, president of the Trethewey mine of Cobalt, says that while the showing of free gold in the large quartz dikes indicate great possibilities, it must not be forgotten that the occurrence of these dikes has been known for some time, and that claims had been staked there four or five years since, including some of these dikes, the working of which had not proved the existence of gold in paying quantities. By far the larger number of claims, he said, had been taken up by prospectors who were merely trying to locate near the claims that were admittedly valuable in order to sell for the best price they could get. William J. Loring, of the British firm of Bewick, Moreing & Co., which is engaged in mining in various countries, after investigating the Porcupine camp declared that the prices asked for undeveloped claims were so exorbitant that his firm would make no investments on such terms, and that no influx of British capital need be expected until either the value of the locations had been proved by developments, or more reasonable views prevailed.

A second shipment has been made from the Gowganda district, the Reeve-Dobie mine having sent about 30 tons of high-grade ore to the Coniagas smelter at Thorold, Ontario. At the Waldman mine on the Gillies Limit the shaft is down 75 ft. and preparations are being made to stope east and west. The vein which dipped out of the shaft at 70 ft. had to be reached by a cross-cut, from which a raise was started, the vein at the head of the raise showing about 8 in. of smaltite carrying native silver. Driving has been done for about 70 ft. to the west, where another raise will be made. Further sinking of the shaft has been discontinued until cheap power is available, and in the meantime diamond-drilling will be done from the bottom of the shaft to discover the dip of the vein at 150 ft. Several tons of high-grade ore have been sacked. On the A 99 property, Gillies Limit, also bought by J. H. Waldman, a smaltite vein carrying silver has been traced for 60 ft. on the surface.

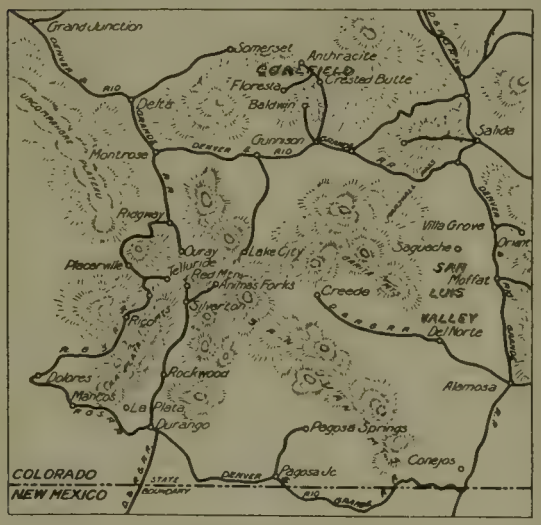
Existing legislation has been found altogether insufficient for the detection and punishment of high-grading, as it is almost impossible to prove that ore found upon a suspected person was dishonestly obtained. An important change is being made in the law throwing upon the suspected party the onus of proving how he came by the ore. A bill introduced into the House of Commons at Ottawa by George Gordon, M. P., for Nipissing, makes it the possession of gold or silver ore a criminal offence, unless the accused can satisfactorily account for it. It has received a third reading and will in all likelihood become law, the recent revelations in the Cobalt high-grading cases having shown the extent and frequency of the evil.

The Mines & Minerals Committee of the Canadian House of Commons, have undertaken to investigate the nickel industry and more especially the operations of the International Nickel Co. of New York, which controls most of the Sudbury deposits. Important evidence was given on January 19 by Arthur Wilson, an expert who has been studying the situation, who stated that the trust had retarded development by limiting the output in order to keep up the price. The export of nickel-matte from Canada to the New Jersey smelters amounted to 38,000,000 lb. annually, and he contended that the loss to Canada by making shipments in the form of matte in place of the finished product was about $1,000,000 per year. He suggested an export duty on matte and Government action to encourage the manufacture in Canada of nickel steel.

TELLURIDE, COLORADO.

Railway Repaired by Miners. — Liberty Bell, Tomboy, and Smuggler-Union Building.—Bear Creek.

Conditions at Telluride are again normal. The portion of the Rio Grande & Southern railroad which was destroyed by the bursting of the Trout Lake dam on September 5 has been replaced and communications both to the north and to the south has been restored. By the washing out of the tracks and trestles to the south, Telluride was cut off from both her coal supply and her outlet for concentrate to the Durango smelter. At a meeting of the mine superintendents of the district it was decided to offer capable miners and experienced foremen to the railroad company to assist in repairing this very important piece of track. W. H. Martin, for the railroad, accepted this offered assistance, and as a result of the energy of the combined interests traffic was resumed on the south on October 25. The mining companies were promptly reimbursed for their expenditures. Communication to the north was not restored until December 17. Meanwhile food supplies were shipped both by way of Durango and Placerville. From Placerville they were packed and hauled over Dallas Divide to Telluride.



Map of Southwestern Colorado.

The shortage of coal and other supplies prior to the repairing of the road caused several companies to suspend operations temporarily. At present, however, few, if any, effects of the disaster remain.

The Liberty Bell company is building a 3½-story boarding house, 40 by 165 ft. in size. It is situated at the mouth of the Stillwell tunnel and is completely removed from the danger of snowslides. It will be equipped with all modern conveniences. The company employs about 220 men in mine and mill, drops 80 stamps, crushing a daily tonnage of about 375 tons of ore. This will probably be increased shortly. In the mine a large block of ground has been developed within the last few years. To this the major part of the mine operations will soon be directed. The Tomboy Gold Mining Co., Ltd., employs in the neighborhood of 200 men, drops 60 stamps with a capacity of about 300 tons per day. Snowslides in this district have been somewhat severe. The buildings at the Japan tunnel were recently crushed and partly carried away by the Little Elephant slide. The buildings contained machinery, and the loss probably will be considerable. The slide filled the Tomboy wagon-road with 4 to 5 ft. of snow. The Smuggler-Union boarding and bunk-houses which were destroyed by fire a short time ago are being replaced by a large house, constructed along modern lines. The average output at the Smuggler-Union mills at Pandora is about 300 tons of ore per 24 hours. The Bear Creek region has been the scene of considerable activity in mining and in improvements. Notable among the latter is the completion of a tram from the Alta mine to Ophir loop. This tram will do away with the pack-train, which formerly was used in conveying concentrate to the loop. The numerous lessees have with few exceptions had a successful season, and considerable promising development work is now being carried on by them.

MEXICO.

Santa Gertrudis Mill. — John Taylor & Sons in Mexico. — Coal Combine.—Zacatecas M. & M. Co. Organized.

The final payment by the Camp Bird company was made to the Santa Gertrúdis company by a check for ₱9,144,825 on the Bank of Montreal. We understand that the design for the new mill is already under way. The mortars, of which there will be 16 single-discharge type, are built with extra heavy base, resting direct on concrete mortar blocks. The holding down bolts will be arranged as angle-bolts and will pass each other in an X under the base. To permit of this arrangement, the bolt-holes will be staggered. The mortars will be equipped with liners and every detail has been carefully thought out. All the various contracts that were pending by the Santa Gertrúdis company have been taken over and ratified by the new owners.

F. W. Turner, presiding at the meeting of the Anglo-Continental Gold Syndicate recently held in London, stated that they had decided to write off £50,000 to profit and loss as a result of the failure of their Santa Maria Mexican mines business. He further stated that the losses were principally due to the long drawn out litigation, which had been the curse of the enterprise, and for the present they were out of Mexican business, although they continue to hold leases on some silver-lead properties to the north of Zacatecas. It is reported that John Taylor & Sons will again become interested in Mexico. Their assistance is being sought to revive the Torres-Cherokee enterprise. They are also said to be taking an interest in some properties now held by the Mexican Mines Prospects Development Co., and to have also taken an option on a property belonging to Maurice Clarke in Oaxaca. It is interesting to remember that the founder of this house made the first favorable report on the Real del Monte mines, as the result of which that property passed into English hands in the early part of last century. One of the few successful English mining companies in Mexico is operating the now well known Barranca mines in Sonora. This mine has paid a total of 20% dividends for the year. The chairman, W. Hudson Hand, at the annual meeting, referred to the fine opportunities for investment in Sonora, as the results of the building of the Southern Pacific extension. The company had taken up a number of properties before the railroad was completed, and had made contracts by which it acquired a joint working interest in 17 mining properties in Sonora; these were not under option, but were actually owned. The chairman further stated that the extent and value of the properties thus secured will provide ample occupation for the company in Sonora for some years, and we have no doubt they will in time add enormously to our dividend-earning capacity. The San Rafael company at Pachuca has paid vast sums in dividends and has had bonanzas of phenomenal richness, but recently it has ceased to measure its production in ounces, and stated that the last week's production of bullion was 1⅜ tons. An additional increase in the size of the mill is being discussed so that this splendid result may not only be maintained but surpassed.

It seems probable that a combination will be made among the coal miners of northern Mexico. A group which controls a number of properties has bought the control of others, including the Carbonera Porfirio Diaz. This company owns about 1000 hectares of land, and it has been estimated that this contains from two to three million tons of clean coal. The same group has also obtained control of the Lampacitos and Agujita Coal companies, the San Blas & Carbonífera del Norte, and the Rio Escondido company. Practically the only independent coal companies left are the Mexican Coal & Coke Co., the Compañia Carbonifera de Sabinas, and La Sanceda. There are rumors to the effect that these will also enter the combine. The coal business

in Mexico is now on the boom. This is largely due to the efforts of the Government to assist native industries. In this case it has been done by discriminative freight rates on the National Railroad lines.

A company has been incorporated with a capital of $1,000,000 under the title of Zacatecas Mining & Metallurgical Co. to take over and work the San Cristobal and Zacatecas gold mines in the Zacatecas district. The president of the new company is Frederick Corning, who is also president of the Guanajuato Consolidated Mining & Milling Co. M. E. MacDonald was the moving spirit in the organization of the new company. He was for many years manager for the Guanajuato Consolidated company and he was the man who arranged the transfer of the Real del Monte Co. to the United States Smelting, Refining & Mining Co. of Boston. The mines controlled by the new company include the San Cristobal group, which consists of the San Cristobal, Zacatecas, Aldama, Elena, and Buenaventura mines.

SALT LAKE, UTAH.

Silver King Litigation.—Utah Copper.—Imlay Gold.

Among the mining engineers who have been brought into the suit pending between the Silver King Coalition Mining Co. and the Silver King Consolidated Mining Co. are H. Abbot Titcomb, of London, and Albert F. Holden, managing director of the United States Smelting, Refining & Mining Co. The Consolidated company claims that the Coalition has wrongfully extracted several million dollars' worth of ore from Consolidated ground, while the Coalition says that the ground in dispute is owned jointly and that the cost of extraction has been greater than the value of the metal taken out. The Coalition company has been sought by a number of purchasers, among whom are some of the large smelting people of the West, but the owners have refused all offers to date, though as much as $12,000,000 is said to have been offered at one time by the Guggenheims upon the recommendation of John Hays Hammond, who made a careful inspection of the ground several years ago. Since the completion of the merger between the Utah Copper and Boston Con., R. C. Gemmell has been made assistant general manager of the two companies. As soon as the Nevada Con. mine, smelter, mill, and Nevada Northern railroad are taken over by the Utah Copper, D. C. Jackling will have charge of all these properties. It is possible that later Ray Consolidated, Gila, and Chino, which are being operated under the personal direction of Mr. Jackling, will be taken into this merger. The Guggenheims have a large personal interest in these properties, and it is their desire to have all their Western properties owned by one corporation. It is understood that some of the smelting plants may also be incorporated in the copper concern, as under the present arrangements there are so many sub-committees as to interfere with the direction of the mines, mills, and smelters. Mr. Jackling is eminently fitted for this position as he has a wide experience in every branch of the business. Several years ago he was offered the management of Nevada Con. Morris P. Kirk, who has been superintendent of the Last Chance mine at Bingham, leaves for the Imlay gold mining properties this week. He has been in charge of the Nevada-Utah Mines corporation in Utah and Nevada for several years and is to take charge of the gold-producing properties in Humboldt county, Nevada. This company was forced to discontinue operations a couple of months ago, owing to the inability of the railroad to deliver coal. The company has a mill on the ground which is capable of reducing 300 tons of ore per day. The mill has only been operated at half capacity and a high recovery has been regularly made. The control is held by Salt Lake people and the plan of campaign includes extensive development. Some interesting data have been brought out regarding Boston Con. mill operations. It appears that while the company has been reducing upward of 3000 tons of ore daily no profits have been made. In explanation of this condition it is shown that while the mill has been making a satisfactory recovery, the volume of ore treated was not sufficient to place the property on a paying basis.

NEW YORK.

Mineral Development Co.—Braden Copper.—Arizona Copper.—Con. Arizona.—International.—Utah-Nevada Consolidated.

The annual meeting of the Mineral Development Co. was held this week at the company's office in New York. An interesting feature of the meeting was the announcement by the resident manager that the big shaft has reached a depth of 1643 ft. At this point the company begins to earn a subsidy from the Mexican Government of ₱150 for each metre gained in depth. The company is sinking to reach the dip of the Valenciana vein at Guanajuato, Mexico, and the subsidy accorded to the company is the only one of this nature ever granted by the Mexican Government. Theodore Dwight, formerly assistant secretary of the American Institute of Mining Engineers, was elected president, and Robert V. Norris, first vice-president. Pope Yeatman, chief consulting engineer for the Braden Copper Co., has gone to Chile, to make an exhaustive examination of the mines and reduction works. Barton Sewall, president of the company, says in a statement just issued, that the development during the past few weeks has been especially favorable. Ore of 4.11% copper tenor, has been developed by an adit 730 ft. below any previously opened ore. The company is bringing its mill capacity up to 2000 tons daily. He estimates that the copper will be produced at an average cost of 7c. per pound.

Members of a syndicate from Scotland, representing the owners of the Arizona Copper Co., among the number being John Gill, chairman of the company's board of directors, recently visited this country, and after some tentative negotiations with the Amalgamated Copper Co. regarding the sale of the Arizona to the Amalgamated interests, have returned home. It was reported that Phelps, Dodge & Co., Inc., had purchased the Arizona Copper Co., but this proved incorrect. The smelting plant of the Consolidated Arizona Smelting Co., at Humboldt, is to be doubled in size. The developments at the Blue Bell mine owned by the company and the contracts which have been made for handling the product of outside properties, are said to be sufficient to justify this step. It is stated on what appears to be good authority that the stock of the International Smelting & Refining Co. will be placed on a permanent 8% dividend basis at the meeting to be held next week. It is said, further, that the earnings are approximately 15% on the $10,000,000 outstanding stock.

The neutral stockholders of the Nevada Consolidated Copper Co. are about to declare a state of siege, owing to their continuous bombardment by the Utah Copper Co.'s representatives, soliciting the exchange of Nevada Con. shares for those of Utah Copper, alternating with equally emphatic advices from James Phillips, Jr., president of the Nevada Con., in opposition to such move. Mr. Phillips, in a letter issued today, says in part: "The stockholders of Nevada Con., having once exchanged their Nevada stock for Utah stock, must look to the Utah company for dividends. Under the conditions set forth in my previous letter the Utah company can not earn its proportion of dividends, compared with Nevada, on its increased capitalization, now $25,000,000." Mr. Phillips goes further and in a spirit of reminiscence not altogether kindly, recalls the Nipissing episode, with the reminder that that deal, with its attendant consequences, was like the present proposition, based upon the recommendations of Pope Yeatman and J. H. Hammond. Altogether the controversy has taken a decidedly acrimonious turn, which, in view of the present depressing conditions prevailing in the market, is much to be deplored. It is anticipated that North Butte's dividend will be cut to, perhaps, 50c. per share for the quarter. North Butte seems to have fallen into general disfavor. The shares have been selling around $35, against $90 a year ago. Dispatches received here state that the Tuolumne company which adjoins the North Butte, will, in all probability, make a claim against the latter for some $8,000,000 for ore that the North Butte is claimed to have taken from Tuolumne ground. It is also stated, though not generally credited, that the enlarged Anaconda Copper Co. is not to absorb North Butte.

General Mining News.

ARIZONA.

COCHISE COUNTY.

(Special Correspondence).—The shaft of the Arizona United Mining Co., at Johnson, is now down 825 ft., and has opened a good body of sulphide ore. The plant at present is treating 125 tons per day of carbonate ore from the upper levels producing about a carload of 45% copper matte per week. Both sulphide and carbonate ore assay well in silver and gold. The plant was erected by the Traylor Engineering Co., and is in charge of B. M. Snyder.——In Texas canyon, near Dragoon, a Joplin jig is being used to concentrate wolframite. The ore is reduced in a hand crusher and concentrates to a clean product.

Johnson, February 4.

The Copper Queen Consolidated Mining Co. is to drive a 500-ft. adit 400 ft. below the apex of Sacramento hill to prospect the ground near the surface. The orebody recently

Arizona United Mining Co.'s Smelter.

opened on the 400-ft. level of the Holbrook property has now been proved to be 90 ft. wide, the cross-cut having been extended to connect with the C and D drifts on the 450-ft. level.

GILA COUNTY.

(Special Correspondence).—Development on the 300-ft. level of the Live Oak mine is opening sulphide ore, the average copper content of the drifts sampled during the past week being 2.58%. Churn-drill work will begin as soon as the necessary equipment has arrived.——The Inspiration Copper Co. is installing a 60-hp. hoist at its Joe Bush shaft, where an 80-hp. boiler was recently set up. The bulk of the underground development work is being done on the 400-ft. level of the shaft, where the work of blocking out the orebody is in progress. The churn-drills are putting down holes No. 30 and 31, northwest and southwest from the Joe Bush shaft.——The third churn-drill is working on the Miami property about 200 ft. north of the Cordova Copper Co.'s northern boundary.——The Old Dominion smelter output for January was 2,130,000 lb. of copper. The accident at the A shaft, December 31, 1909, caused a slight decrease in the ore production for several days. Two furnaces are treating 600 tons of 6.5% ore per day at present.——A 2300-kw. electric generator is to be installed in the power-plant for the electric pumps below the twelfth level.

Globe, February 4.

MARICOPA COUNTY.

(Special Correspondence).—The Vulture Mines Co., operating the Vulture mine south of Wickenburg, is running the old 20-stamp mill, and erecting a new mill which is being equipped with twenty 1600-lb. stamps, amalgamating plates, and a cyanide plant, for the construction of which the D. D. Demarest Co., of San Francisco, has the contract. A. R. McKay, the superintendent, states that the new mill will be in operation by April 1. The mine is opened to a depth of 600 ft. on an incline, and the ore consists of gold-bearing quartz assaying $14 per ton, 80% of which can be recovered by amalgamation.——The Arizona Prospecting & Developing Co. is commencing operations on two groups of claims near the Vulture mine. Copper ore has been found on its Antler and gold ore on its Speculator group. Prospecting equipment has been installed and shaft-sinking is in progress. H. S. Le Compte and A. F. Simpson, stockholders in the company, are directing the work.

Wickenburg, February 5.

MOHAVE COUNTY.

Figures just compiled for the production of the Golconda mine in 1909 by John Boyle, the manager, show the proportions which zinc mining has assumed in Mohave county. From this mine alone there was shipped last year 7100 tons of ore netting $136,000. The ore averaged 46% zinc, making a total of 6,532,000 lb., as against 631,000 the preceding year. The Golconda is now shipping 900 tons of ore per month, and the management estimates a similar rate of production from the adjoining Tub mine where shipping is to be started in a few days.——Work is just starting in the Prosperity adit, which will cut the Golconda vein 165 ft. below the present level.——The C. O. D. mine, which has been idle for a number of years, is the latest of the old producers to resume operations. P. F. McLaughlin, of Goldfield, has associated himself with John Boyle, Jr., who has held an option on the property for some time, and is already on the ground for the preliminary work of cleaning up. A large quantity of lead-silver ore has been mined from the upper levels.

PIMA COUNTY.

(Special Correspondence).—The Pioneer Smelting Co., organized by L. S. Wheeler, W. C. Moore, and George A. Corwin, of New York, and J. A. Highland, of Boston, is preparing to erect a copper smelting plant of 300 tons capacity on a site near the Gould mine, 18 miles west from Tucson. The equipment has been ordered from the Colorado Iron Works, of Denver, and Mr. Wheeler thinks that the furnace will be ready to blow-in by July. When operations are started the Gould mine is expected to supply most of the ore which is said to consist of sulphide running over 3% copper. Other properties in that district are expected to supply some ore later. A. L. Waters is to have charge of the construction and operation of the plant.

Tucson, February 5.

YAVAPAI COUNTY.

Two cross-cuts are being driven on the 700-ft. level of the Haynes Copper Co.'s property at Jerome. These total 950 ft. and have opened several veins with a fair amount of gold and silver, and a small percentage of copper. T. E. Campbell is manager.——The Mint Gold Mining Co., operating in Copper basin, has started a new double-compartment shaft and will install an electric hoist and erect a 30-ton mill this spring. Considerable ore has been blocked out on the 100-ft. level from the old shaft. The company will obtain its power from the plant of the Arizona Power Co. on Fossil creek. George W. Montgomery is manager.——The Golden Ridge Mining & Milling Co., operating southwest of Prescott, has completed new living quarters for the men and are to install a 4-drill compressor. Eli S. Perkins is manager.——An Indiana syndicate has secured 100 acres of placer ground in the Big Bug district from T. F. Averill and will commence operations this spring by installing a pumping plant on Big Bug creek to force water to the ground, where the gravel will be drawn to the sluices by large scrapers.

CALIFORNIA.

CALAVERAS COUNTY.

The ditch at the I. X. L. mine that furnishes water for power to operate the pumps is being repaired and it is understood that work will be resumed at the property.——The lower adit at the Montana mine is being extended to open the ore worked in the upper levels.——Operations have been resumed at the Del Monte mine, near Mokelumne Hill. The mill is run when enough ore has been taken out to operate for several days.——The mill at the Easy Bird has been started and work resumed in the mine.——The workings at the Queen mine are being retimbered and the mill will be started in a few days. C. C. Allen is superintendent.——New machinery is to be installed at the old McPherson mine near Mountain Ranch and operations re-

sumed as soon as the roads are in good condition for hauling.

MARIPOSA COUNTY.

The Long Mary mine has been unwatered to the 300 ft level and the mill is being run one shift.——The company is to sink the shaft at the Mount Gaines property another 100 ft. and has laid off 40 men till that work is completed and another level opened.——The force at the Ruth Pierce has been increased and the mine will be operated on a larger scale.——The Mariposa mill is crushing ore for W E Paine and J N. Turner.

NEVADA COUNTY.

New equipment has been ordered for the Mountaineer property in the Nevada City district and the raise from the 700 to the 400 ft. levels will be started as soon as this reaches the mine. The first section of the shaft from the 400 ft. level to the surface has been timbered and the foundations for the new hoist and pumping plant are finished.——The bedrock adit at the Blue Lead mine, at Relief, is now under the middle of the channel and a raise is to be driven to open the gravel. J. O. Jones is operating the property.——At the Champion a number of lessees are at work and the pipe line is being repaired to commence pumping at the 1800 ft. level. There are 20 stamps dropping in the mill.——The pumps at the Canada Hill have been running for the past two weeks and D. M. Stevenson, who is operating the property under bond, expects to have the mine unwatered in about five weeks.

PLACER COUNTY.

Operations are to be resumed at the Gold Blossom mine in the Ophir district shortly as the property has been bonded to an Eastern syndicate.——The wires of the Pacific Gas & Electric Co. have been strung to the Orpheum mine and the mill and pumps are being operated by electric power.——New machinery is being installed at the Spring Garden property.——Operations have been resumed at the Yankee Jim property under the management of Thomas Browne. A raise is to be driven to open the channel.

SAN BERNARDINO COUNTY.

(Special Correspondence).—Telluride ore has been found at a depth of 148 ft. in the Green mine, in the Slate Range district. The orebody is reported to be over a foot wide and assays as high as $1000 per ton. Nicholas C. Green is manager.——The Helen property, near Tecopa, reports the uncovering of a 12-ft. body of silver-lead-gold ore worth $36 per ton.——The California Hills Co. continues active development. Good assays are reported from several points.

San Bernardino, February 7.

SHASTA COUNTY.

W. W. Robinson, who is opening the old Climax mine near Igo, has let a contract to sink the shaft 300 ft. and will install a 50-ton cyanide plant if the ore at the lower level is equal in value to that taken from the upper workings.——A second shipment of 50 tons of silver ore was recently made from the Rogers mine on Andrews creek to the Kennett smelter.——The Evening Star mine, in the Old Diggings district, has been purchased by George Bayha, representing German capitalists, and a cash payment of $15,000 has been made. The mine has been operated for the past 15 years, regular shipments being made to the smelters. It was equipped last year with a powerful electric hoist.——Rufus Hall has secured a lease on the property of the Glenn County Mining Co. on Dog creek, and is arranging to send the ore to the Balaklala smelter.——The blast-furnace at the Bully Hill plant at Winthrop has been shut down to install a new water-jacket.

SIERRA COUNTY.

W. J. Smith, of Vorden, has obtained a bond on the Empire mine in Gold valley.——The Wisconsin gravel mine near Forest City has been bonded and operations resumed under the management of Joseph Kelly. There are 300 acres in the property and a rich channel has been worked up to both ends of the ground.——The second raise that was put up at the White Bear mine reached gravel at the height of a little over 40 ft. The rock near the gravel was very soft and swelled badly and the raise had to be abandoned without much prospecting. The gravel that was taken out was washed and contained fine gold, but it is suggested this raise was also put up in the rite. The main adit will now be extended for some distance before another raise is put up.

TUOLUMNE COUNTY.

(Special Correspondence).—The Draper mine is at present working with a smaller crew than usual, but it is said more men will be put on before long. The outlook for the property is reported to be encouraging.——Preparations are being made for the complete resumption of operations at the Dutch mine. The mill is being thoroughly overhauled and repaired and will be started within a few days. Development work is being energetically carried on with a crew of 15 men.——For several weeks past nothing but development work has been done at the Mohican mine, but when wood can be hauled over the road leading to the property complete operations will be resumed. Good orebodies have been opened, making certain a steady run of the mill for a long time.— A 4-ft. vein of high grade ore has been uncovered on the McGuire & Browning claim, which is situated between the Mohican and Ellen Winton mines.——A rich discovery was made a few days ago on the 1300 ft. level of the App mine, where an orebody believed to be the old App vein which was lost on the 1100-ft. level, was uncovered. The ore assays from $5 to $25 per ton.

Tuolumne, February 7.

A 4-ft. vein has been opened by the adit at the San Juan property at Big Oak Flat.——The mill at the Black Oak has been started on ore from the upper levels and the water is being drained from the lower portion of the mine.——The shaft at the Mack mine is down 700 ft. and drifts are being driven on the 600 and 700-ft. levels. The 20-stamp mill is running steadily. Mathew Jacobs is superintendent.——The mill at the Keltz mine is being overhauled and will be started this spring. Some rich ore has been opened recently.——Operations have been temporarily suspended at the Republican property.——The Southern Mines Exploration Co. is to start its plant in March.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—A shipment of 43 tons of lead-zinc ore from the Gambetta mine to the Linn mill that was made last week concentrated to 31 tons of 54% zinc and 2 tons of 62% lead. B. J. O'Connell, the operator, is sending out a 50-ton shipment of zinc ore that will mill better than 50% in that metal.——A 10-in. streak of silver ore has just been opened in a winze from the southwest drift on the Anamosa vein which assays as high as 1800 oz. silver per ton. O. W. Mann is manager.——An 8-in. streak of galena has been uncovered in the west drift on the Baltic vein operated through the Raymond adit. The ore assays 2 oz. gold and 35 oz. silver per ton, with 7% copper and 40% lead. J. Raymond is manager.

Georgetown, February 5.

(Special Correspondence).—A rich body of ore has been uncovered in the Treasure Vault mine and shipments have been started. A test lot of 2382 lb. sent to the sampler at Georgetown was settled for on the basis of 10.6 oz. gold and 2.4 oz. silver per ton. Another test of 280 lb. assayed 16 oz. gold and 1.05 oz. silver per ton. Six sets of lessees are at work and all are breaking pay-ore. John Ward is the owner.——The Jackson mill has again been put in operation after a close-down of several weeks occasioned by the freezing of the pipe line.——Denver people have secured a bond and lease on the Refugee mine on Bellevue mountain. Work was put under way last week.——Work has been resumed on the Arizona mine by George Ford and associates.

Idaho Springs, February 5.

GILPIN COUNTY.

(Special Correspondence).—Semmens & Co., operating the Parole mine in the Nevada district, are sending out heavy shipments of milling ore to the Black Hawk custom mills.——Visintini & Co., leasing on the 150-ft. level of the Puzzle mine in the Nevada district, are following an 8-in. streak of smelting ore. A shipment of nine tons that was

made last week assayed $223 gold per ton.——The shaft on the Rockford mine, in Russell district, is now down 230 ft. Drifts are to be started east and west and the shaft will be sunk to the 400-ft. level. H. F. Lowe is the owner.——An average of three carloads per week of smelting ore is being sent out by Ress & Co., leasing on the Iron mine. The ore is sent to the Modern smelter at Utah Junction and average returns of 6 oz. gold per ton are being realized.——A gold retort weighing 97 oz. was sold last week by the Fifty Gold Mining Co. to the Rocky Mountain National Bank. This was taken off the plates at the mill in two weeks.

Central City, February 4.

LAKE COUNTY.

A company of Leadville men have secured a lease on the Silver Nugget, Alice, Enterprise, and adjoining claims, southwest of the Garbutt. It is the intention to sink a 3-compartment shaft 750 to 800 ft. and from the bottom prospecting will be carried on to open the ore-shoot of the Garbutt. It is understood that the work will be started early in March.——At the Stone, Dome, and La Plata, lessees are shipping steadily an average of 20 tons per day from each of the claims, and at the same time development work is being pushed steadily ahead. The ore that is being hoisted is a sulphide with considerable carbonate which assays high in lead. Most of the work on the claims is being done at the 300-ft. level. All of the ore is hauled to the Yak switch.——From the lower level of the A. Y. & Minnie a winze is now down 70 ft., and has been sunk in ore the whole distance. It is probable that the shaft will be sunk another 200 ft. to develop the orebody now being opened by the winze.

SUMMIT COUNTY.

The shaft at the International property, near Robinson, has opened the Robinson vein and two carloads of ore per day are being shipped. The work of overhauling the mill is nearly completed and in a short time the plant will be in operation and the company shipping concentrate.——There were 125 cars of ore shipped from the Wintergreen mine during 1909 and preparations are being made to increase the output this year. William Lindsay is operating the property.——Peter W. Breene is opening the Reconstruction group on Copper mountain.

TELLER COUNTY.

The Western Investment Co., of Victor, holding a lease on 65 acres situated at the west end of Isabella Mines Co.'s Bull hill property, reports a rich find made in the workings of the Empire State shaft, on the Orphan Belle group of the company's holdings. The discovery was made in a raise between the 600 and 500-ft. levels.——Shipments have been resumed from the Conundrum mine on Gold Hill, owned by the Ethel Louise Gold Mining Co., and operated under lease by S. A. Worcester, of Victor.——Ore assaying $62,000 per ton has been opened at a depth of 1376 ft. in the Rubie mine on Bull hill operated by the Rubie Mining & Leasing Co.——Official announcement has been made by John T. Milliken, president of the Golden Cycle Mining & Milling Co., that an option has been granted to an English syndicate on the stock of the company, the option running until February 28. The corporation has already made examination of the property which includes the Golden Cycle mine at Victor, one of the heaviest producers of the Cripple Creek district, the mill in Colorado Springs, and the extensive coal lands east and north of Colorado Springs.

M. B. Rapp, who recently secured a lease on the south end of the Dante mine on Bull hill, formerly operated by the British American Mining Co., has opened a new orebody at the 500-ft. level of the No. 2 shaft. The pay-streak is between 2½ and 3 ft. wide, and the ore will ship at about $30 per ton.——The annual report of F. J. Campbell, general manager for the Vindicator Consolidated Gold Mining Co., recently mailed the stockholders shows a net production for 1909 of 31,664 tons of the value of $895,847.60. Of this amount freight and treatment charges totalled $228,810.32 and the total mine expenses $321,632.26. Lessees were paid $213,351.46 and the gross profit from mining was $132,053.65. The development work during the year measured 8000 ft. and the total length of the bodies developed was 1954 ft. Dividends were paid during the year amounting to $112,500 and the cash remaining in the treasury on January 1, was $92,358.03. The company paid its first quarterly dividend for 1910 on January 25, amounting to $45,000.——The Portland Gold Mining Co. paid a dividend of 2c. per share totaling $60,000, and bringing the January dividends of the Cripple Creek district up to $105,000.——The Pharmacist Consolidated Gold Mining Co. paid a $7500 dividend on February 1.——The plants treating Cripple Creek ore give the following figures for ore treated in January:

Plants.	Tons.	Average Value.	Gross Value.
Golden Cycle Mill	25,500	$20.20	$515,100.00
U. S. R. & R. Co.	12,500	22.00	275,000.00
Portland Mill	9,000	20.00	180,000.00
Smelters, Denver & Pueblo.	4,500	65.00	292,500.00
Isabella Mines Mill	3,100	3.40	10,440.00
Trilby Mines Mill	1,350	6.00	8,100.00
Blue Flag Mill	1,240	6.00	7,440.00
Wild Horse Mill	1,500	4.00	6,000.00
Gaylord Mill	1,274	4.60	5,860.40
	59,964	$21.68	$1,300,440.40

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—Several unusually important sales have been consummated in this district during the past few weeks. The largest made for some years was the sale of the John Jackson tract of 400 acres, lying near the Chitwood camp, for a consideration of $250,000. A portion of this land has been mined for some time producing in all about $2,000,000 from 65 acres.——Another important sale was that of the Young tract of 320 acres southeast of Joplin to Frank Creller. Several other smaller tracts northwest of the city were included in the purchase. The larger tract has been prospected and a number of shallow shafts are in ore. The land is being laid off in lots some of which will be sub-leased.——Shelton, Bayless & Co. are sinking a second shaft on the Guinn land north of Webb City, and are planning the erection of a mill. The work on the lease was started by the Grace company who abandoned the lease when the shaft was not far above the ore-level and the work was completed by the present company. The orebody is found at 180 ft.——S. Y. Ramage is planning the erection of another mill on his lease of the Morgan forty on the Center Creek land. Two shafts are already in ore and are supplying the mill. The lease is well blocked out with drill-holes showing ore at 150 ft. The new plant will be of 300-tons capacity.——The Henderson-McDonald company has bought the South Portland mill for $7000, and is removing it to the old Troupe land where the present company is interested. This land has been extensively exploited and was considered worked out, but the present company has found good ore in the old working and has tapped the old drifts at 175 ft.——Malone Brothers, operating on the old Boston Get There land at Prosperity, have just completed the removing of the old American Beauty mill from a lease at Duenweg to the new tract. It has a capacity of 300 tons per day. This old tract was mined at the upper levels several years ago quite extensively, but the sheet-ore levels have never been opened. Work has been started in the old shaft which opened 7% ore.——Among the good discoveries of the past fortnight may be mentioned one in the Carthage camp, on the Ben Mevey land, made by Chitwood & Mooneyham. The best ore, as shown by the drilling, occurs at 180 ft., and consists of zinc and lead. As soon as the shaft reaches the ore-level and drifts are run, a concentrating plant will be erected.——The Peacock Valley Mining Co. has made an excellent find of lead ore in the Carterville camp. The drill-clippings are rich, showing the deposit from 175 to 190 ft. There is no trace of zinc blende.—Starr & Meece are opening a rich mine west of Joplin in the sheet-ground area, the ore being found at 170 ft. In all 11 drill-holes have been put down, 10 of which show ore. Two runs of varying thickness are shown, the upper at 146 ft. which is separated from

the lower at 172 by a thin rib of barren rock. The ore is being piled up awaiting the erection of a concentrating plant.

Joplin, January 29.

MONTANA.

LINCOLN COUNTY.

The Silver Cable mine, in the Cabinet mountains, has been bonded to J. H. Town for two years. There are five claims in the group which have been opened by over 2000 ft. of development work disclosing several bodies of ore. A 50 ton concentrator, offices, and living quarters have been erected on the property and a road built to Libby, a distance of 23 miles. Development will be continued till the weather moderates and then additional machinery will be installed and work started on a large scale.

NEVADA.

ESMERALDA COUNTY.

Two blocks which have heretofore been reserved by the Atlanta are included in a lease just granted to the Queen Consolidated Mines Co., with headquarters at Milwaukee. The lease stipulates that the shaft be sunk at once to 750 ft. The same company has ordered hoisting equipment for its Queen shaft, three miles east. The Garrison lease on the Atlanta is cross-cutting at the 750-ft. level, the Maloney is driving for the Clermont vein at 700 ft., the La Manse is installing new machinery to sink deeper, and J. A. Houlahan is operating the Matilda, Century, Imperial, and Brooklyn leases, all on the Atlanta. Ford and MacKay are taking good ore from the original St. Ives workings, the last shipment running $63 per ton, and in a few days will begin stoping on the 350-ft. level. Four men are now employed in breaking ore. On the Booth, a cross-cut is being driven at the 150-ft. level from the Banner shaft to cut the Red Top vein near the boundary line and is close to the vein. The Grand Central group of claims, adjoining the Great Western at Hornsilver, south of Goldfield, has been sold to D. Mackenzie. They were located in 1872, and from two shallow shafts a quantity of high-grade ore was shipped overland. A force of miners is now cleaning out the old workings and retimbering.

LINCOLN COUNTY.

The raise for the shaft at the Pioche Metals property in the Pioche district has been completed and a gasoline hoist is being installed. The raise was driven 236 ft. to the surface and sinking will now be continued. David Lemmon is superintendent.

LYON COUNTY.

The Mason Valley Mines Co., operating in the Yerington district, is to be partly reorganized. The present capital of the company is 1,000,000 shares, par $1. This is to be changed to 200,000 shares, par $5, and a bond issue of $1,000,000 is to be made and offered to the stockholders at par; one-half of the proceeds to be used in the erection of a smelter to handle the company's ores and to do custom work as well; the balance of the money to be placed in the treasury. The engineers estimate the ores already developed at about 600,000 tons, averaging 3% copper.

NYE COUNTY.

(Special Correspondence).—The winze 300 ft. south of the shaft on the 400-ft. level of the Midway has broken into a body of ore assaying from $12 to $20 per ton. The vein has been opened for 20 ft. with no indication of the opposite wall and a cross-cut is being run from the 600-ft. level to intersect the new vein at that point.——The vein on the 1100-ft. level of the Belmont has widened to 10 ft., the ore assaying about $40 per ton. The drift has been driven for a distance of 165 ft. and preparations are under way to resume the sinking of the shaft. About 650 tons per week is being sent to the smelters.——The Ruth lease, on Manhattan Dexter, has sacked 100 tons of $40 ore.——The Pioneer lease reports the opening of a body of ore on the 150-ft. level that assays from $100 to $150 per ton. The vein is said to be several feet wide.——The Chloride Cliff Mining Co., at Rhyolite, has opened a body of ore assaying about $30 per ton, and is reported to be considering the installation of a small mill.——The Mushett lease, on Manhattan Earl, has installed a 20-hp. hoist and will sink a new shaft to intersect a vein uncovered on the Forman fraction claim. It is 11 ft. wide and assays about $40 per ton.——The Swanson lease on the Earl mine has opened $40 ore on the 200-ft. level. The shaft is being sunk to the 250-ft. point.

Tonopah, February 4.

STOREY COUNTY.

Work has been resumed in the winze the Charles Butters Co. is sinking at the 280-ft. level of the Potosi and will be continued to a depth of 150 ft. Preliminary work has been started on the Monte Cristo property recently purchased by that company and a head frame and surface buildings will soon be erected.——The Comstock Mohawk Co. has made the final payment of $5500 on the Conlan group of claims on the Brunswick lode. The company has had an option on these claims for the past year, and is preparing to open them on a large scale. At a meeting of the Comstock Pumping Association $10,000 was appropriated from the treasury to go toward the cost of an additional pump for the 2100-ft. level of the Ward shaft to be used in assisting in the drainage of the Gold hill mines. The Yellow Jacket, Crown Point, and Belcher companies of that group have consented to pay a pro rata of the expense of pumping. A committee will confer with the managers of the other Gold hill mines and endeavor to secure their cooperation in the drainage of the south end of the lode. This action means the drainage of the Gold hill properties some 400 ft. below the present water-level.

WHITE PINE COUNTY.

The northeast cross-cut on the 55-ft. level of the Ely Centennial has opened a body of ore that assays over 5% copper, with a small amount of gold and silver.——Three shovels are clearing the overburden on Copper flat, and two loading ore for the smelter. There has been considerable snow which has hindered operations both at the mine and concentrator.——At the Giroux the shaft is being retimbered to the 1000-ft. level and sinking continued from that point.

NEW MEXICO.

SIERRA COUNTY.

(Special Correspondence).—No. 1 shaft at the U. S. Treasury is nearing the 200 and will be continued to the 300-ft. point. A station will be cut at the 200-ft. level and drifts extended to cut the shoot opened at the 108-ft. point. From the 300-ft. station a drift will be extended to connect with the White Eagle shaft. Recent developments above the 100-ft. level have opened a large body of ore that assays from $10 to $12 per ton. It is expected to erect reduction works before the end of the year. Willis G. Moore is consulting engineer.——New machinery, including a crusher, boilers, and engine, is being installed at the Keystone. Good ore has been opened, the principal orebody being several feet wide and assaying as high as $100 per ton. Byron L. Morrison, of Colorado Springs, is operating the property under a lease.——At the Eureka two adits are being driven. The upper one is in 50 ft. on a lime and porphyry contact. Several sacks of $75 ore will soon be shipped.——Shipping ore is being sacked at the Gold Reserve. Development is progressing steadily.——At the Polar Star the 90-ft. shaft has opened a promising body of ore. Assays are reported to run about $100 per ton. A steam-hoist, compressor, and other machinery will be installed shortly.

Chloride, February 5.

SOUTH DAKOTA.

LAWRENCE COUNTY.

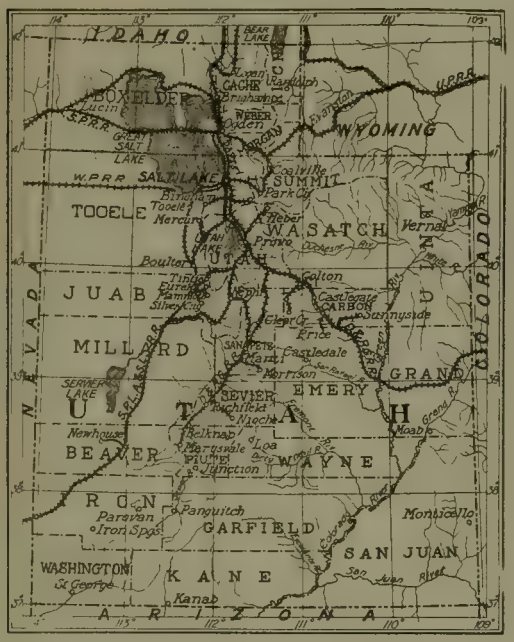
The Star mill of the Homestake company at Lead has been started adding 200 stamps to those already dropping. The Highland hoist and Old Abe are running now, supplying ore to the mills. Non-union men are being imported from other camps to operate the properties.

UTAH.

SALT LAKE COUNTY.

The cross-cut on the lowest level of the Butler-Liberal portion of the North Utah Mining Co.'s property has opened two feet of galena ore. The company is now mining ore in four parts of the mine, the stope on the 235-ft. level having recently broken into ore containing a high percentage of

gold and silver. W. D. Bohm is manager.——The south drift in the Utah-Apex has been in rich ore for the last 150 ft., and from its strike it is thought that it will unite with the famous Dana fissure. The ore reserves have increased so much lately that the company is planning on erecting a plant that will have a capacity of 500 tons per day.



Map of Utah.

CANADA.

BRITISH COLUMBIA.

(Special Correspondence).—The cross-cutting operations on the 1300-ft. level of the Josie mine, in the Rossland district, are making good headway.——The orebody being worked on the 1200-ft. level of the Idaho claim of the Consolidated group is opening up in a promising manner and work on the Iron Mask, Centre Star, and War Eagle mines of the same company is being carried on with good results. The usual tonnage being sent to the Trail smelter each week.——The Mayflower mine in the south belt has been leased to N. Hansen and a force of five men put to work. A chute is being built from No. 3 adit to the track. A good body of ore has been opened.——At the Van Roi, near Nelson, a crew of over 100 men is now employed and the milling operations average 150 tons per day.——The Silverton Mines, Ltd., is working the Hewitt & Lorna Doone property. Three drifts are being driven on the several veins that traverse the property and will open much new ground. The Molly Hughes shipped 59 tons of ore last week containing a quantity of native silver.——The Lucky Jim mine has closed down on account of inclement weather, which has been interfering with shipments.——The Rambler-Cariboo property is keeping up a steady output and some good shipping ore has lately been opened in the lower levels.——A party of French capitalists, who are interested in the Canadian Metal Co., operating the Blue Bell mine at Riondel, visited the property of the company during the past week. Since the reorganization of the company last year its financial affairs have improved and the work at the Blue Bell has given good results. About 900 tons of zinc ore per week is now milled, and it is hoped that the result of the visit will be the doubling of the present output. An improved form of reduction is planned at Riondel, and if present plans carry, the additional works will be put in at an early moment. There is a large deposit of zinc ore awaiting treatment on the company's property.——In connection with the proposed high-voltage power line for the Sheep Creek-Ymir district, it is now stated that the men owning the water-right in the gorge of the Pend d'Oreille, near its confluence with the Columbia, will shortly commence development.——In the face of a 380-ft. adit at the old North Star mine a large body of ore containing about 60 oz. silver per ton and 40% lead has been pierced. Driving and sinking are now in progress to ascertain the value and extent of the deposit.——Work is being rapidly put under way at the Sullivan mine and shipments will soon be started to the Consolidated smelter.——In the adit, on the Cosavello property at Moyie, a gold-bearing quartz vein has been cut 130 ft. from the portal, assaying as high as $60 gold per ton.

Rossland, February 5.

ONTARIO.

The output from the Cobalt district for January, 1910, was greater by 400 tons than for the same month in 1909. The Colonial is again on the shipping list after a year of idleness.——The annual report of the Hargraves Mining Co. states that all litigation has been settled, a 6-in. vein opened on the 372-ft. level, and 12 cars of ore shipped per day.——The shaft at the Temiskaming is down 420 ft. and has cut through the main vein although the ore at the bottom is of good milling grade. A station is now being cut at the 400-ft. level and a cross-cut will be driven to the ore. Two winzes are down over 50 ft. each on the No. 3 vein at the 300-ft. level. There is enough ore on the dump to supply the 100-ton mill for a year and enough above the 300-ft. level to keep the plant busy two years.——A carload of high-grade ore was shipped from the drift on the Little Nipissing property to the O'Brien smelter at Deloro.——A second shipment of 30 tons of high-grade ore from the Reeves-Dobie mine at Gowganda has been forwarded to the reduction plants. A. J. Dignum is managing director. The Boid-Gordon and Mann mines in the same district are preparing to ship.

MEXICO.

MEXICO.

(Special Correspondence).—The Seguranza Mining Co. has constructed a new road to Naranjo, on the Mexican Central railway, passing to the west of Taxco, by way of Teneria, Cruz de la Virgin and Tecalpulco, thus reducing the distance between the mines and the railway to eight hours' travel. Electric air-drills have been received by the Seguranza company and are giving entirely satisfactory results. A contract has been let for driving the main drift north on the Zaragoza level to make connection with the El Bobo level. High-grade ore has recently been found in the old workings of the Escorpion mine, which lies between the Coronas and El Bobo. Large bodies of milling ore have also been found in the Ampliacion de Olvidado, recently purchased, and lying to the north and west of its other properties.——In the San Fernando mine, famous in the past for its large production, a body of high-grade ore was recently discovered. The limits have not yet been determined. The company has contracted with the Toluca Electric Light & Power Co. for 50 hp. for the purpose of running drills, hoists, and fans for ventilation. This is one of the oldest and most productive mines of the district and is under the direction of Angel de Caso.——The town of Zacualpan is now lighted by electricity, a branch line having been constructed from the power station at the Coronas mines.——E. G. Stackpool, formerly of Taxco, is here for the purpose of making an examination of the Cuchara mine and mill. The Cuchara mill, with the exception of a few minor changes, is understood to be giving entirely satisfactory results, and the plant will soon be working to its full capacity of 50 tons per day. The mine has an ample supply of ore in reserve and is carrying on development on a large scale.——The Concepción Mining Co., recently organized, is producing good ore and is negotiating for electric power.——The Santa Cristina Mining Co. has started an adit on the south end of its property, with a view to reaching the junction of the main vein with the veins of the Maraquita property which lies to the north of it. This property is being operated by H. C. Reeche and associates, of Dubuque.

Zacualpan, February 4.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

J. E. Tall has gone to Coalinga.

E. H. Nutter has gone to London.

G. S. Rice is at Primero, Colorado.

Albert Roberts is in San Francisco.

J. Parke Channing is at Globe, Arizona.

F. L. Ransome has been at Globe, Arizona.

E. B. Kirby was in San Francisco this week.

Horace G. Nichols has left London for the Rand.

Henry Hanson was in San Francisco Wednesday.

S. F. Shaw is returning to New York from Costa Rica.

Otto Sussmann was at Globe and Ray, Arizona, last week.

Percy S. Ryder, formerly of Colorado, is at Tucson, Arizona.

H. W. Hardinge is now at Cobalt, Ontario, on professional work.

H. W. Turner has gone to Midway, Kern county, California.

William Kemp, of Tucson, visited Yuma county, Arizona, recently.

Philip Wiseman, of Los Angeles, was in Tucson, Arizona, recently.

J. V. N. Dorr, of Denver, is expected soon at Wickenburg, Arizona.

E. W. Brooks, of Los Angeles, was at Winkelman, Arizona, recently.

Henry Krumb, of Salt Lake, was at Troy and Ray, Arizona, last week.

Hugh Rose has been appointed general manager for the Santa Gertrúdis.

R. P. Coleman, of Salt Lake City, was in Yuma county, Arizona, last week.

E. M. Stewart is mine superintendent for the Ray Con. Copper Co., of Arizona.

T. H. Jenks is examining properties in Gunnison county, Colorado, for Boston clients.

F. H. Nettleton, engineer for the Flynn Exploration Co., was at Ray, Arizona, last week.

Reiji Kanda has returned to Japan from Korea and will leave for London early in March.

W. E. Defty, of Phoenix, Arizona, expects to go into Sonora, Mexico, on professional work this month.

Frederick H. Morley has left Denver for Hermosillo, Mexico, where he will be busy for several months.

Hallet R. Robbins, of Seattle, is at Denver after having spent several weeks at Boston on professional business.

R. B. McGinnis, with the Chicago Exploration Co., was in San Francisco last week on his way to La Dura, Sonora, Mexico.

Fred Burns, recently with the South American Mines Development Co. of Ecuador, is now superintendent for the Guanajuato Con. M. & M. Co., at Guanajuato, Mexico.

Market conditions in New York the past week have been exceedingly unsatisfactory. The atmosphere is one of intense strain, and it is evident that at least for the present all the larger plans, which the leaders have made for market campaigns, must be laid aside. Copper metal has been slightly firmer in the face of generally unsatisfactory conditions. Electrolytic copper is quoted a trifle below 13¾c. for April delivery, but the larger agencies will sell no copper at this figure and such sales as have been made are only odd lots that do not affect the situation. The position of the stronger factors in the metal market is based on the belief that the Producer's Association's figures for January will show a decrease of at least 30,000,000 lb. in the accumulated surplus.

Market Reports.

LOCAL METAL PRICES

San Francisco, February 10.

Antimony	12–12½c	Quicksilver (flask)	$61–$61½
Electrolytic Copper	13¼–13½c	Spelter	5½–5¾c
Pig Lead	4.90–5.00c	Tin	36–37½c

METAL PRICES

By wire from New York

Average daily prices in cents per pound

Date.	Electrolytic Copper.	Lead	Spelter	Silver per oz
Feb. 3	13.37	4.67	5.77	51½
" 4	13.37	4.67	5.72	51¼
" 5	13.37	4.67	5.67	51½
" 6	Sunday.	No market.		
" 7	13.31	4.67	5.65	51½
" 8	13.31	4.67	5.62	51⅛
" 9	13.31	4.67	5.62	51¼

ANGLO-AMERICAN SHARES.

Cabled from London.

	Feb 2 £ s d.	Feb. 10. £ s d.	
Camp Bird	1 7 6	1 8 0	
El Oro	1 8 0	1 8 3	
Esperanza	2 19 6	2 18 9	
Dolores	1 8 9	1 8 9	
Oroville Dredging	0 9 0	0 8 6	ex div.
Mexico Mines	8 5 0	8 10 0	
Tomboy	0 17 6	0 17 8	

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing Prices. February 10.		Closing Prices. February 10.
Adventure	8½	Mohawk	65
Allouez	4⅛	North Butte	35
Atlantic	9	Old Dominion	63½
Calumet & Arizona	71	Osceola	104
Calumet & Hecla	635	Parrot	20⅜
Centennial	22½	Santa Fe	2
Copper Range	77½	Shannon	14⅝
Daly West	8	Superior & Pittsburg	13⅛
Franklin	20¼	Tamarack	71
Granby	90	Trinity	8¾
Greene-Cananea, ctf	9⅛	Utah Con	37½
Isle Royale	22	Victoria	4¼
La Salle	15	Winona	9⅞
Mass Copper	7	Wolverine	138

(By courtesy of J. C. Wilson, Mills Building.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices. February 10.		Closing prices. February 10.
Amalgamated Copper	73⅛	Miami Copper	25⅜
A. S. & R. Co.	92	Mines Co. of America	½
Boston Copper	18¼	Montgomery Shoshone	1
B. C. Copper Co.	7¼	Nevada Con.	22
Butte Coalition	24⅜	Nevada Utah	1¼
Cumberland-Ely	7½	Nipissing	9⅞
Davis-Daly	3¼	Ohio Copper	4
Dolores	7¼	Ray Central	3⅛
El Rayo	2⅛	Ray Con.	22⅜
Ely Central	1⅝	South Utah	2⅞
First National	5	Superior & Pittsburg	14
Giroux	9¼	Tenn. Copper	31
Guanajuato Con	1⅝	Trinity	9
Inspiration	8⅛	Tuolumne Copper	3⅝
Kerr Lake	8⅞	United Copper	7
La Rose	4⅛	Utah Copper	48⅝
Mason Valley	2	Yukon Gold	4¼

SOUTHERN NEVADA STOCKS.

San Francisco, February 10.

Atlanta	$ 17	Mayflower	$ 3
Belmont	1.52	Midway	24
Booth	13	Montana Tonopah	83
Columbia Mtn	7	Nevada Hills	50
Combination Fraction	28	Pittsburg Silver Peak	70
Daisy	7	Rawhide Coalition	15
Fairview Eagle	12	Rawhide Queen	10
Florence	2.20	Round Mountain	53
Goldfield Con	7.52	Sandstorm	3
Gold Kewenas	7	Silver Pick	10
Great Bend	3	St. Ives	15
Jim Butler	10	Tonopah Extension	70
Jumbo Extension	33	Tonopah of Nevada	6.50
MacNamara	27	West End	23

(By courtesy of the San Francisco Stock & Exchange Board.)

Prospecting Core-Drill.

The Terry Core Drill Co., 30 Church street, New York City, has recently placed on the market a hand-power core-drill which is designed for prospecting, foundation testing, and for making wash borings. To determine, without washing, the character of soils or mineralized sand, special tools are provided with which 'dry samples' can be obtained. This method of testing, particularly in placer deposits, is important, as the exact formation can at once be determined, whereas, by the washing process, the heavy or mineralized particles will not always wash to the surface. The maker claims that the design of this drill is unique, as it has been equipped with a fly wheel, which insures a uniform speed of the drill tools with the least exertion. This is an improvement which has not previously been taken advantage of in hand-power drills. The drill has unusually long bearings for the spindle, a feature of all the drills designed by this company. These long bearings impart a

steady motion to the drill-rods, and prevents their lashing in the bore-hole, thereby avoiding unnecessary breakage of the cores, increasing the speed of drilling and the percentage of core which is recovered. The capacity of the drill is 300 ft., to which depth it will bore a 2¼-in. hole, cutting a 1¼-in. core. Either diamond or shot-tools can be used. For mountainous countries, inaccessible to larger apparatus, and where fuel is difficult to obtain, it is particularly adapted. The shipping weight is 415 lb., and the fly-wheel, the heaviest single piece, weighs 73 lb. When knocked down it may be readily transported from place to place, and can be quickly assembled for operation. The drill-driving shaft is provided with change gears, so that fast or slow speed may be obtained, according to the character of the material to be drilled. The head swivels to any angle, and can be moved back on its frame to clear the bore-hole when raising or lowering the drill-rods or when casing is being driven. A sensitive feeding device is used, which consists of a double drum with ropes extending to the water-swivel and to which pressure is applied by a lever with a ratchet and pawl. Mounted on the rear of the drill-frame is a hand-hoist used for raising or lowering the drill-rods and for driving casing through soil to bedrock. The frame, supporting both the drill-head and hoist, is of seamless cold-drawn tubing, light in weight, yet of sufficient strength to withstand the heaviest load which may be placed upon it for its rated capacity. Cut gears and phosphor-bronze bearings are employed throughout, and all working parts are carefully and accurately machined so that friction is reduced to the minimum. A hand force-pump is used, which supplies water to the bore-hole. For drilling operations more extensive than a hand machine is capable of undertaking, and when portability is essential to the work, a power attachment can be applied to this drill by substituting a pulley for the fly-wheel and a counter-shaft with a friction clutch to control the power. When so arranged it can be driven with steam, gasoline, or horse-power. The friction clutch is advantageous when a gasoline engine is used, as it eliminates the annoyance of stopping and starting the engine when the drill may be momentarily stopped. When equipped to operate with power it is capable of boring a 2¼-in. hole to the depth of 400 feet.

Commercial Paragraphs.

Forbach & Newitt have established the Tucson Assaying & Engineering Co., at Tucson, Arizona.

The Sullivan Machinery Co. announces the removal of its New York City office from 42 Broadway to 30 Church street.

The Atlantic Equipment Co. has opened a branch office at 2101 Beaver avenue, Pittsburg, Pa. H. Kleinhaus is in charge.

Harold Baxter, who has opened a mining engineer's office at Phoenix, will make a specialty of directing mine development in Arizona.

The Hammond Iron Works, Warren, Pa., is distributing some convenient vest-pocket memorandum books in both an English and a Spanish edition.

The Galigher Machinery Co., Salt Lake City, Utah, is distributing an atlas of the world. It contains interesting illustrations of the company's plant, in addition to a complete set of maps.

The Bucyrus Co., South Milwaukee, Wis., advises that within the last few weeks it has received orders for two 13½-ft. dredges for California, one 8½-ft. dredge for South America, one 8½-ft. dredge for India, and one 3½-ft. dredge for Alaska.

George W. Myers, San Francisco, has recently put the 'Ideal' stamp stem guide on the market. It is a renewable metal guide requiring no loosening of bolts for removing one or all of the stems. A distinctive feature of this device is a double reverse taper on the guide bushings causing secure locking of the latter when dropped into the sockets of the frame. Mr. Myers, the patentee and manufacturer, advises that the Ideal guide is meeting with general approval in old as well as new mills and that its sale is constantly increasing.

Catalogues Received.

The Mulconroy Co., 723 Arch street, Philadelphia. Catalogue No. 20, '7-League sewed leather soled rubber boots'. Sent to any address. Illustrated, 3½ by 6 inches, 12 pages.

The United Iron Works, Oakland, Cal., Folder 35. 'The Tadmor Quartz Mill', an illustrated description of this new and interesting device for the fine grinding of ore. 6 by 9½ inches. 18 pages.

American Spiral Pipe Works, Chicago, Ill. Pamphlet No. 30. Showing spiral riveted pipe, forged steel pipe flanges, hydraulic and exhaust steam supplies. Illustrated, 8 by 10 inches, 24 pages.

The International Steam Pump Co. Bulletin W-175. 'Worthington Turbine Pumps'. Illustrated, 6 by 9 inches, 32 pages. Bulletin W-176. 'Type 'D' Centrifugal Pumps'. Illustrated, 6 by 9 inches, 12 pages.

Sullivan Machinery Co., Chicago. Bulletin No. 56 B. Automatic slide valve hoisting engines for mines. Illustrated, 6 by 9 inches. 8 pages. Bulletin No. 60 C. Hammer drills and stone-dressing tools for quarries and cutting-sheds. Illustrated, 6 by 9 inches. 16 pages. Bulletin No. 60 F. Hammer drills for construction, quarrying, and mining work. Illustrated, 6 by 9 inches. 12 pages.

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EDITORIAL.

INNOKO produced $300,000 in 1909, according to estimates of the Geological Survey. The Innoko and Kuskokwim placer districts were visited last season by Mr. A. G. Maddren and a report on them has just been published. Incidental information about the Haiditarod region is also given that will be of especial value to prospectors going into this part of Alaska next summer.

FIRE has not yet made its annual visit to the Geological Survey at Washington and Congress has one more chance to protect public property by furnishing a fire-proof building. Last year a move in this direction was defeated by the unexplained opposition of Mr. J. R. Mann. This year not even an estimate seems to have been submitted. Possibly the officers of the Survey are discouraged at repeated failure, but the importance of safeguarding the Survey records would seem to warrant an attempt at least to get the matter before Congress.

AMALGAM thieves were cleverly trapped at Goldfield this week, and among those arrested was the town constable, who also happens to be a candidate for sheriff and prominent in labor union affairs. That is bad but no worse than the case of a banker lending money to an assayer on stolen ore. The combination, however, of thievery, politics, and labor union leadership, has been all too common in the West, and is the essential explanation of the low estimation in which the Western Federation of Miners is held by the public. We sincerely hope that progress is toward better things.

THAT Mexican banks are investing money in foreign countries indicates an accumulation of a surplus, and is a sign of prosperity, as pointed out by Mr. Enrique Creel, recently Mexican Ambassador to the United States, but it may also be taken as evidence of slackened industrial activity. That business should be aggressively active, however, is not necessary for the national welfare at all times, and we may accept Mr. Creel's interpretation of the action of the Banco Nacional, the Banco de Londres y Mexico, and the Banco Central in placing thirty million pesos abroad.

CASSANDRA was unpopular, and the prophet of evil will ever be unwelcome; hence prophetic utterances are conventionally optimistic. The silver miner was promised a higher price for his metal in 1909, and he actually realized the lowest average price on record. Messrs. Pixley & Abell in their annual silver letter, published elsewhere in this issue, find warrant for hopeful promises for 1910, despite

the fact that the demand for gold in the Orient is distinctly growing. The argument from the general revival of trade is a valid one, and, because world-wide, will probably operate, even if the trusts try to punish the Government and people by 'crashes', 'avalanches,' and other spectacular stock-gambling phenomena on Wall Street.

THE MIDWAY OILFIELD has recently been visited by a party of San Francisco capitalists that has returned enthusiastic. The gusher of the Kern Trading & Oil Company near Maricopa was inspected with especial interest. This has been producing about 3000 barrels of 20 degree oil per day since February 6. A short distance away the Ethel D. is flowing a steady stream. The Santa Fe, St. Lawrence, and other wells continue to yield heavily, and in many directions new work is under way. In 1909 this field produced a trifle less than 2,400,000 barrels, and additional deep sands were discovered.

A LITTLE GOLD is a dangerous thing. Out of it grow gilded dreams and disturbing visions of fairy castles. The feeble sprinkling of gold in the crystalline rocks of the Adirondack mountains in New York State has been the unfortunate cause of wasting many thousands of dollars that might have been better spent. For decades gold-mining has been attempted in the Adirondacks, and the faker with his wonderful 'new process' has flourished, largely at the expense of the merchants and petty capitalists of the Mohawk and Hudson valleys. Among these schemes the Sutphen process became distinguished as an artificial star of large magnitude. The rush of prospectors into the region in 1898, directly stimulated by the Klondike excitement, was so great that over 4000 claims were filed with the Secretary of State, and filings still continue in large numbers. Out of compassion for the senseless dissipation of good money in so fruitless a quest the State Geologist, Mr. John M. Clarke, has published a bulletin fully explaining the sources of this gold, and showing how thoroughly the region has been investigated, thus putting an end to further hopes of finding important deposits.

PRICES OF COPPER mining stocks have been much studied of late. In our Discussion department is presented this week an analysis of the value of five active stocks. These figures were prepared by one well qualified by experience and success to judge in such matters and are based on data emanating in the main from the companies concerned. As an expression of opinion it is worthy of careful consideration. The higher ruling prices for these stocks could only be based logically upon expectations of finding additional ore reserves or of higher prevailing prices for copper. The probability of reserves being increased both by direct exploration and by cheaper reduction rendering lower grades available may be granted, but as 'Investor' points out, the investment-life of the properties is already long, and there must be a limit beyond which the interest on the money spent in development, offsets the profit. It is impossible, as well as undesirable, to market all the ore at once, and in case of copper as of coal, iron, and steel, market conditions as well as costs of production enter into the problems of profit and loss. Higher prices for copper are expected by many, but prediction is always hazardous. Our own opinion is unfavorable to any immediate or considerable rise. It is doubtful whether these matters seriously enter into public estimation of copper stocks. It is believed that the stocks themselves will rise, and therefore people buy, with the result that stocks do rise. The problem is one in psychology rather than technology, and the astute leaders of Wall Street devote more attention to judging men than mines. Manipulation carries the leading stocks high and the others mount on the flood of public excitement. So long as this remains true, buying and selling of copper mining stocks will be a game rather than a business.

Corporation Tax Returns.

Corporations generally look forward with confidence to a decision by the Supreme Court of the United States holding the corporation tax law unconstitutional. Two test cases are now being tried, and if an attempt be made to collect such taxes before the question is settled, they should be paid, but under formal protest. It is the part of wisdom to comply with the law, partly because it is good citizenship so to do, and partly because it would leave a corporation in a less embarrassing position in case the statute were upheld. The attempt to raise money by a direct Federal tax, which after all is the cheapest kind of tax that a people can pay, is based upon the power conferred by the Constitution "to levy and collect taxes, duties, and excises." The authority of Congress is undoubted in this particular, limited by the requirements of apportionment according to population, of uniformity throughout the United States, and of avoiding what would be equivalent to duties imposed on articles the subject of inter-state commerce. If the law be held to violate the constitutional limitations, it would apparently be found vulnerable in regard to apportionment according to population. A layman's pronouncement upon this point is of no consequence: a lawyer's would be important in proportion to his gift of prophesy concerning the probabilities of the final twist which the Supreme Court may give to the Constitution. This is said in no spirit of disparagement; the Supreme Court is valuable because it is supreme, not because it is a fountain of infallible wisdom.

Leaving aside the speculative features of the matter, and conceding the practical wisdom of complying with the law, the miner confronts an interesting problem in making his statement to the revenue collector of his district. The law, of which copies may be obtained from the local revenue officers, requires such a statement to be submitted by March 1; it specifies the items, and the method of computing the net income. The tax is one per cent upon the net income in excess of $5000. The statement must be sworn to by the president, vice-president, or other principal officer, and its treasurer or assistant treasurer, and must set forth the total amount of paid-up capital stock of the corporation; its bonded or other indebtedness; gross income from all sources; all ordinary and necessary expenses; total losses and

amount written off for depreciation, amount of interest paid, amount of taxes paid, and net income, this being the remainder after deducting the out go specified in the last four clauses. Once again the question of depreciation comes to the fore. It is warrantable to assume that any reasonable deduction, based upon customary experience, will be allowed as applying to deterioration of plant. This would vary from ten to twenty-five per cent, under ordinary circumstances. Depreciation, however, does not apply to orebodies; the tax is upon income, not upon assets. The law, however, affirms, "The deduction for depreciation should be the estimated amount of the loss accrued during the year to which the return relates, in the value of the property in respect of which such deduction is claimed that arises from exhaustion, wear and tear, or obsolescence out of the uses to which the property is put, and which loss has not been made good by payments for ordinary maintenance and repairs." This seems to apply to plant, or permanent equipment, needing renewal by reason of 'exhaustion'. There are those, on the other hand, who see in this language the opportunity to write off depreciation for exhaustion of ore reserves. A test case would be interesting, if the statute as a whole should receive the approval of the Supreme Court; meanwhile high legal opinion seems to lie against such a construction.

Reverberatory Smelting at Cananea.

Developments in the smelting of copper have proceeded at a rapid rate in the United States within the last fifteen years. Up to that time the tendency had been distinctly away from the use of reverberatory furnaces, and efforts were chiefly made toward the perfecting of blast-furnace smelting. Among these efforts the most notable were the attempts to dispense with fuel by the utilization of the heat-value of the sulphur in the charge, and the departure from the low blast-pressures of earlier days in order to increase the smelting capacity. Pyritic smelting in a form modified from that of its original advocates has become established as standard practice where conditions are suitable, but the need for rapid running aggravated the losses in flue-dust. Briquetting and sintering, though still attracting the attention of experimenters, and in some cases giving favorable results, have for the most part not proved capable of wide application. The improvement of the reverberatory has been in answer to the demand for economical treatment of flue-dust and calcined concentrate, which the blast-furnace cannot handle advantageously.

One of the most interesting contributions to recent reverberatory practice is found in a paper describing the operations at Cananea, Mexico, by Mr. L. D. Ricketts, originally published in the Bulletin of the Institution of Mining and Metallurgy. At Cananea, Mr. Ricketts has treated a difficult class of material, consisting of flue-dust and calcine in the proportion of approximately 2 to 1 at a cost of only $1.77 per ton of dry charge, using oil as fuel. This result has been rendered possible by the liberality of the Mexican Government in admitting fuel-oil free of duty. The furnace was constructed along the lines of the well known reverberatories in the smelter of the Anaconda Copper Company in Montana, with a hearth measuring 19 by 100 feet. The original design contemplated the use of coal, which was found unsatisfactory, mainly on account of the character of the fuel. The low-ash Gallup coal proved too light, while a coking coal from Dawson, New Mexico, left a bed of coke on the grate which burned too slowly. An attempt to employ pulverized coal proved uneconomical owing to difficulties in regulating the amount of air needed, while the ash filled the flues and rendered recovery of waste-heat from the furnace-gases impossible. Trouble was also experienced at times from the deposition of fine carbon in the form of soot upon the charge, constituting a non-conductor which seriously retarded the smelting. Fuel-oil, however, has yielded a solution of the difficulties previously experienced. Heat recovery is effected by the use of Stirling boilers of 300 horsepower each, two being regularly in service, and a third being held in reserve. The actual water evaporated per pound of oil burned in the reverberatory is 6.74 pounds, while the efficiency in a similar boiler fired direct with oil was 13.96 pounds of water for each pound of oil. Taking into account the temperature of the feed-water the relative efficiencies were 7.45 and 16.08 pounds of water respectively.

Taking the record month, it is seen that the charge contained on an average 7.13 per cent copper and 7.51 of sulphur, yielding a matte containing 40 per cent copper, with a recovery of 95.97 per cent. The slag carried only 0.41 per cent copper, a result which bespeaks excellent technical management. The composition of the slag shows silica up to 41.20 per cent, the iron (FeO) being 34.60, and the alumina 11, with 7.30 per cent of lime. In practice 8149 tons of charge were smelted with 7003 barrels of oil, of which only 3901 were chargeable to actual smelting. The remainder was represented by recovery in the form of steam. Mr. Ricketts points out that considerable advantage in the rate of smelting should be credited to the work of the McDougall roasting furnaces where the particles of concentrate are heated to incipient fusion, so that in addition to the oxidation of iron and sulphur a chemical union between the acid and base in the slag-making components takes place to such an extent as to materially facilitate the completion of the reactions on the hearth of the reverberatory. An interesting feature in the operation of the furnace at Cananea consists in the continuous fettling of the sides of the hearth by feeding dampened fine silicious ore through apertures along the walls. By this means the slag-line is protected, while from 10 to 15 tons of highly refractory material are daily smelted, at a great saving in cost and time, proportionately increasing the capacity of the furnace. The admirable work of Mr. Ricketts and his capable assistants will go far toward increasing the use of the reverberatory where the quantity of flue-dust and fine ore is sufficient to warrant such an installation. It is not surprising that some metallurgists are asking why it might not be better, where friable copper ore is to be smelted, to crush all to a suitable size and treat it exclusively in the reverberatory.

BY THE WAY.

That the value of money in commodities has varied greatly from time to time is well known. We are indebted to Mr. Stuart Croasdale for the following interesting discussion of the subject by Dr. Joseph Priestly, published in 1788. The original spelling and phraseology is carefully retained.

The Greek coins underwent very little change compared with that of the Roman money, or of the money of modern European states, and therefore is less worthy of our notice. All the allowance we are to make for the changes of value in the *Drachma* (a coin equal to the Roman *Denarius*, and worth about eight-pence of our present money) and to which the changes of value in the rest of their money corresponded is, that from Solon to the time of Alexander we must reckon sixty-seven grains for the weight of it, from thence to the subjection of Greece by the Romans sixty-five, and under the Romans sixty-two and a half, a change which is very inconsiderable. The constant and stated rate of the value of gold to silver among the Jews, Greeks, and Romans, in the whole period of ancient times, was ten to one, with very little variation, and the rate of silver to Cyprian brass one hundred to one; and the general supposition is, that there was one fiftieth part of alloy in the gold coins of the ancients. At present gold is to silver as about fifteen to one, and silver to copper as seventy-three to one. The *As*, from being a pound weight avoirdupois, fell to two ounces in the first Punic war, in the second Punic war to one ounce, and presently after it was fixed by the Papyrian law to half an ounce. These alterations were occasioned by the necessities of the commonwealth; but as Arbuthnot observes, the plenty of gold and silver would have done the same thing, and have brought down such an enormous brass coin; or rather silver coins of an equal value, and less weight would have been introduced. It may easily be imagined how scarce silver was at Rome when, in all the early times of the Roman history, eight hundred and forty pounds of brass were equivalent to one of silver. Some say the proportion between these two metals before the first Punic war was nine hundred and sixty to one. The different proportion which has just now observed to have taken place in Greece, during the same period, shows how little communication there was between Greece and Rome in those times. Indeed the commonwealth gradually reduced this proportion, probably in consequence of a freer intercourse with other nations, which would necessarily be attended with the introduction of silver where it was so scarce. The adulteration of the Roman coin in some periods of their history exceeds anything we read of with respect to other countries. The money of Caracalla had more than one half alloy, that of Alexander Severus two thirds, and under Gallienus it was nothing more than gilt copper.

Corn was commonly reckoned in Greece at a drachma the medimnus; which, reduced to our computation, is four shillings and six-pence per quarter. In Demosthenes' time it was much higher; being five drachmas the medimnus, which is about one pound two shillings and seven-pence per quarter. In times of plenty in Greece the price of a sheep was eight-pence, of a hog two shillings, an ox three pounds three shillings; and a soldier served for a drachma a day, which was about eight-pence. Upon the whole, we may perhaps allow that the proportion of money to commodities in the most flourishing time of Greece, or the time in which the classical historians wrote, was about one third less than it is at present with us; which was about the same that it was in Europe before the discovery of America. As the common people of Rome lived very much upon bread corn, the price of that article will be a better guide to us than any other single circumstance in judging of the proportion between money and the necessaries of life among them. The ancient price of corn in Rome, and to which it was reduced at the burning of Rome by Nero, was three nummi the modius, that is three-pence three-farthings the peck. According to Pliny, the coarsest bread was made from corn worth forty ases, equal to two shillings and six-pence three-farthings a peck; of wheaten bread forty eight ases, equal to three shillings and three farthings; and the finest of all eighty ases, or five shillings and one-penny farthing; so that about the time of Pliny, corn was considerably dearer in Rome than it is commonly at London. The article which stands next to bread corn among the necessaries of life is cloathing. Common wearing cloaths, made of wool, such as were always worn at Rome, we should not think very dear. For Cato the elder never wore a suit worth above one hundred drachmas, equal to three pounds four shillings and seven-pence; and we must consider that the Roman cloaths were not made close, but large, and loose, and therefore would last longer than our close garments. This article is likewise to be understood of plain undyed cloth, which was white; for the expence of dying, particularly purple, which the Romans and the ancients in general, most of all affected, was prodigious. Pelagium, one species of that dye, was worth fifty nummi, equal to eight shillings and eleven-pence, per pound. The buccinum, another species of it, was double that value: the violet purple was three pounds ten shillings and eleven-pence per pound, and the Tyrian double dye could scarcely be bought for thirty-five pounds nine shilling and one-penny farthing per pound. There must also have been a great differenc in the fineness of their wool, and consequently in the price of it. For a Roman pound of Padua wool, the finest of all (though indeed when it was rather dear) sold for one hundred nummi, at which rate the English pound troy comes to seventeen shillings and eight-pence three farthings.

From the prices of all these articles taken together, we should conclude that the proportion which money bore to commodities in the most flourishing times of the commonwealth, and under the first emperors, was rather higher than it bears at the present with us. But this could only be the case at Rome, and in the neighborhood of it. All the necessaries of life were considerably cheaper in Greece. Polybius, who lived in the time of the third Punic war, says that provisions were so cheap in Italy in his time, that, in some places, the stated club in the inns was a semis a head, which is but a little more than a farthing.

Compressing Air by Water.

Written for the Mining and Scientific Press
By George C. McFarland

In some of our mining districts the mountain streams furnish abundant water power during most of the year, and in many cases the streams can be flumed and piped to a compressor site contiguous to the mining operations. In such cases a standard air compressor driven by a belt or rope drive from an impulse or turbine wheel furnishes a cheap and satisfactory supply of air for the machines and sometimes for the hoist and pump. While these furnish a satisfactory source of air-power for stable and proved mining properties, their installation is hardly justified in opening prospects and in work of like character which is not certain to extend over a long period of time. There are hundreds of streams in the West that would furnish ideal cheap power, but it happens that few of the larger producing mines are located contiguous to any of them. There are many promising prospects so situated, many of which would doubtless be developed if a small water-compressing plant could be cheaply and easily installed. Not only mine work but heavy rock and tunnel work on railroads in the West could be facilitated in many cases by using hydraulic air-compressors. I know of one instance in Colorado where a series of railroad tunnels was driven by steam-power, coal being hauled 30 miles up into the mountains to fire the compressor boilers, while a foaming mountain torrent that would have furnished hundreds of horse-power ran neglected in the canyon a stone's throw away.

A system of direct air-compression that has elicited a good deal of favorable comment from mining men is the Taylor system adapted to the development of falls and rapids of moderate height. I should say that this system would have a small field of usefulness in the Western country. While it is efficient and requires a minimum of attention in operation the great cost of installation, except in the largest units, would preclude its general use. The most recent installation is a 5000-hp. plant now about completed at the ragged chutes of the Montreal river nine miles south of Cobalt, Ontario. Work has been in progress on this installation for three years and for the past year a force of 200 or 300 men has been employed. The Montreal river has here, in about a 1000 ft., a drop of 28. The power people built a concrete jetty into the middle of the river and to protect the opposite bank from cutting, built a concrete wall in a trench a few feet back, and parallel with the bank. During the high water this summer the river current, thrown sideways by the jetty, gouged into the opposite bank as far as the concrete wall and partly undermined it, which illustrates one way of how not to attempt to raise the level of a swift river.

Just below the jetty at the head of the rapids are the two shafts steel lined, 16 ft. in diameter, and 300 deep. A 20 by 26 ft. tunnel 1000 ft. long connects these shafts with the uprise shaft at the foot of the rapids. The air is compressed to 140 lb. pressure and is conducted to Cobalt by a 20-in. pipe. The pipe was made in 40-ft. lengths with welded flanges, and sliding expansion joints set in concrete piers every half mile. Aside from the transmission pipe lines, I would estimate the cost of the plant at the chutes as not far from $1,000,000. This makes the cost per horse-power for installation about $200, which does not compare favorably with the cost of an ordinary air-plant. I know of two small plants that were installed for less than $90 per horse-power, including flume and pipe-line, as well as wheel and compressor.

A Montreal power company, that is developing the falls of the Matabitchuan river 22 miles southeast of Cobalt, has a scheme which ought to furnish air as cheap at least as the hydraulic air company. With a 2000-ft. line of 5-ft. steel pipe, and a small dam, 300 ft. of head is secured for the turbines giving 12,000 hp., this is converted into electricity

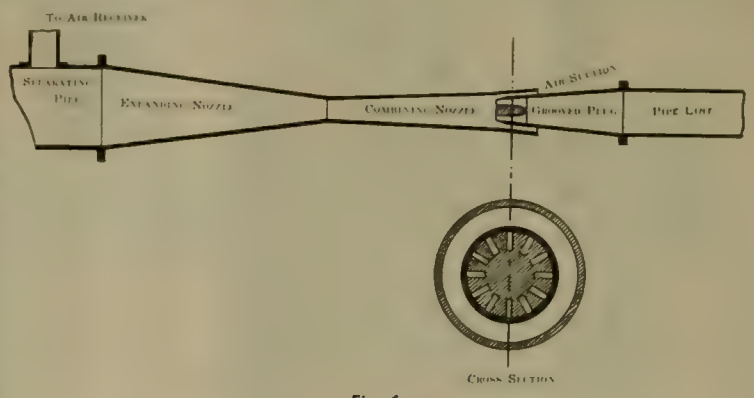


Fig. 1.

at 40,000 volts. It is intended to transmit to substations at Cobalt and use part of the current to drive four-stage air-compressors, selling the air to the mines.

For mines or prospects that are close to high-line ditches or swift streams where a fall of several hundred feet can be secured with a mile or two of ditch and flume, the following simple contrivance can be used for direct air-compression. As shown in Fig. 1, a short nozzle is bolted to the pipe-line; this nozzle is plugged with a grooved cast block so as to divide the jet into ten or twelve streams as shown in the cross-section. These streams are directed into a throat pipe similar in shape to the casing of the Venturi meter. Air is sucked in and commingles with the water in the long gently tapering combining nozzle and passing the throat the stream expands into a length or two of large pipe where the air bubbles separate and pass into the nozzle pipe of the air-receiver. Only a portion of the energy of the water can be used in this way. For example, if the pipe-head were 400 ft. and the air pressure used 80 lb., 200 ft. of the head would be expended in compressing the air. After being freed from the entrained air, the water would be under a pressure of 80 lb.; equivalent to nearly 200-ft. head. This could

be used to run a water-wheel or allowed to run to waste. In the latter case the system would be wasteful, but in many cases a cheap, easily installed, plant is preferable to a more expensive one of high theoretical efficiency. To get good results it is important that the lines of nozzle and throat conform closely to those shown in the sketch, the combining nozzle, being in length about thirty times the diameter of the small jets. This is long enough to thoroughly mix the air and water. These multi-jets exert a strong suction; 20-lb. pressure will pull a 20-

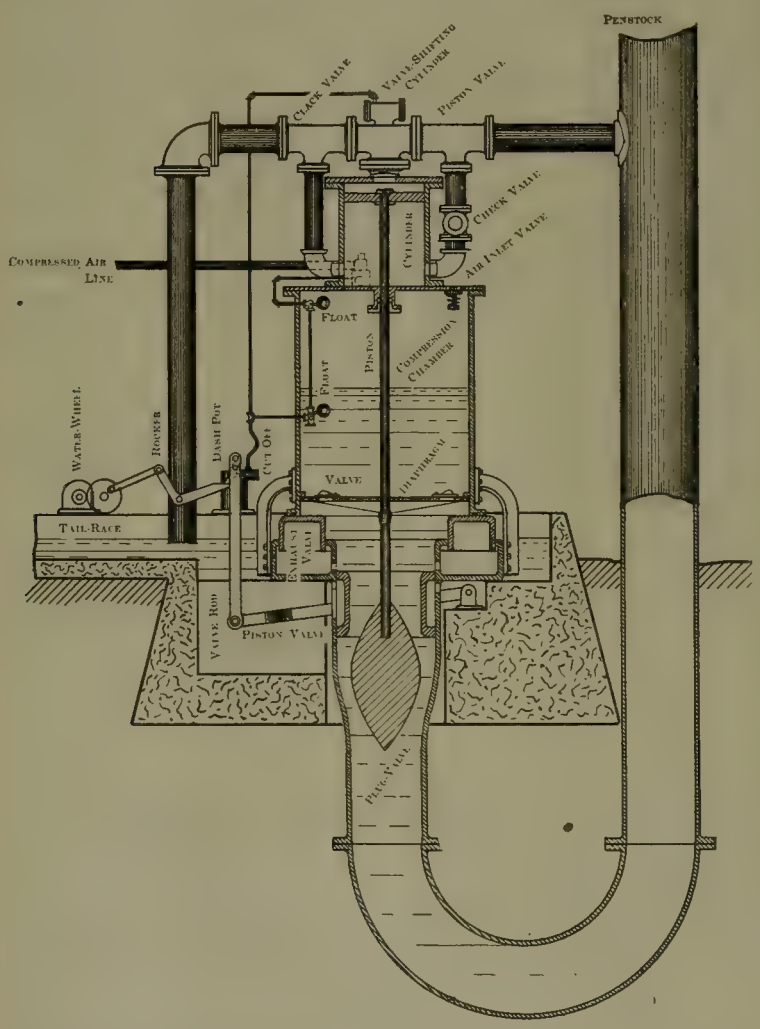


Fig. 2.

in. vacuum. If the pressure head of the water is 400 ft. and the air pressure 80 lb., 1 ft. of water will compress 1.5 ft. of free air, and the ratio between the area of the issuing jets and the area of the throat should be 1 to 2.1. This scheme may be used to good advantage around placers in case it is desirable to use a couple of small drills for block holding the big boulders. If there is a good pipe-head, an inch and a quarter bleeder turned into a small jet-compressor would furnish ample air.

In districts where only moderate heads of water are available, and no great expense can be incurred, I suggest a form of direct compressor similar to that shown in Fig. 2, which is practically a highly developed hydraulic ram. To understand the application of the ram or water hammer principle to air-compression, we will suppose a 40-ft. head of water has been flumed to the compressor site and conveyed from the pressure box to the compression chamber by 200 ft. of 2-ft. steel pipe laid on a fairly uniform gradient. We will also assume that the compression chamber holds 60 cu. ft. of free air. The first stage will be to turn the water pressure on the air-chamber, which will fill a little over half full and compress the air to 17.5 lb. Now to compress this air to 80 lb. and force it out of the chamber into the air-receiver will require the expenditure of 285,000 foot-pounds of energy. Our 200-ft. column of water in the pipe weighs 39,000 lb. If this column of water were allowed to fall freely (by suddenly opening the full cross-section of the lower end of the pipe) for a vertical distance of 7.2 ft., or 36 ft. on the slope of the pipe, it would, neglecting pipe friction, acquire a velocity of 21.9 ft., and a kinetic energy of 285,000 foot-pounds. If this were suddenly deflected into the compression chamber it would just have energy enough to ram the air to 80 lb. and drive it out of the chamber at that pressure. It is evident that the lower 36 ft. of water would have gone to waste without accomplishing any work. This means a loss of 18%. The friction would take another 10%, and if we assume fibre stresses of 10,000 lb. per inch in the metal of the pipe-line at 80 lb., the volumetric expansion of pipe-line and chamber under the ramming stress would amount to ¼ cu. ft.; occasioning a further loss of 1%. This leaves the net theoretical efficiency about 70%. From the above it is apparent that the longer the ramming stroke the greater the loss both from waste water and pipe friction. If, however, the air be rammed in the chamber in three or four stages, the theoretical loss would be reduced from 30 to less than 10 per cent.

To accomplish this latter is the idea of the design shown. The penstock pipe curves upward and delivers the water to the compression chamber through an enlarged orifice, the throat of which is opened and closed by a plug controlled by a hydraulic cylinder over the chamber. The pulsations in the pipe-line are caused by a large annular exhaust valve the full size of the chamber. The exhaust valve rests in an annular casing surrounding the inflow and is opened and closed by a piston valve actuated as shown by a small water-motor. For the case cited above, the piston valve would pulsate about fifty beats per minute and four pulsations would fill the chamber. To prevent the water kicking back out of the com-

pression chamber during the overflow cycle a diaphragm with down closing wing valves hangs on a shoulder of the piston rod.

The operation of the compressor is as follows: The small water motor pulsates the piston valve at any desired rate, the rocker-arm raising it and the dash-pot snapping it back. When water is turned in the main pipe line, it rushes into the lower port of the hydraulic cylinder, which raises the plug and diaphragm. The water now makes three pulsations, the third bringing the water surface in the chamber to the upper float, opening the auxiliary air line. Depending on the height of the water surface, the opening of the small port of the float valve is much or little. In the former case the piston valve gets a quick cut-off and the final pulsation is short. If the pulsations were not sub-divided into stages and the last one approximately regulated to the work it has to accomplish, the unbalanced water hammer would severely strain the machine. Coincident with the last pulsation the auxiliary air line also shifts the top valves, reversing the hydraulic cylinder, lowering plug and diaphragm, and at the same time the exhaust valve opens wide, permitting the water in the chamber quickly to escape. The receding water level throws the lower float and releases the air from the auxiliary line, throwing the upper cylinder valves and starting a new cycle. A check in the right hand cylinder feed-pipe holds the piston and diaphragm in position during the pulsations of the compression cycle. The compressor is shown on a concrete foundation. A light foundation will answer the purpose equally well. It is only necessary to pack the piston of the hydraulic cylinder and use a wood or leather bearing-ring for the diaphragm. The exhaust and piston valve only need to be machined to a reasonably close fit in their casing. The leakage through them, compared to the large volume handled, would be unimportant and any scheme of packing rings would impede their free action and increase the expense and difficulty of construction.

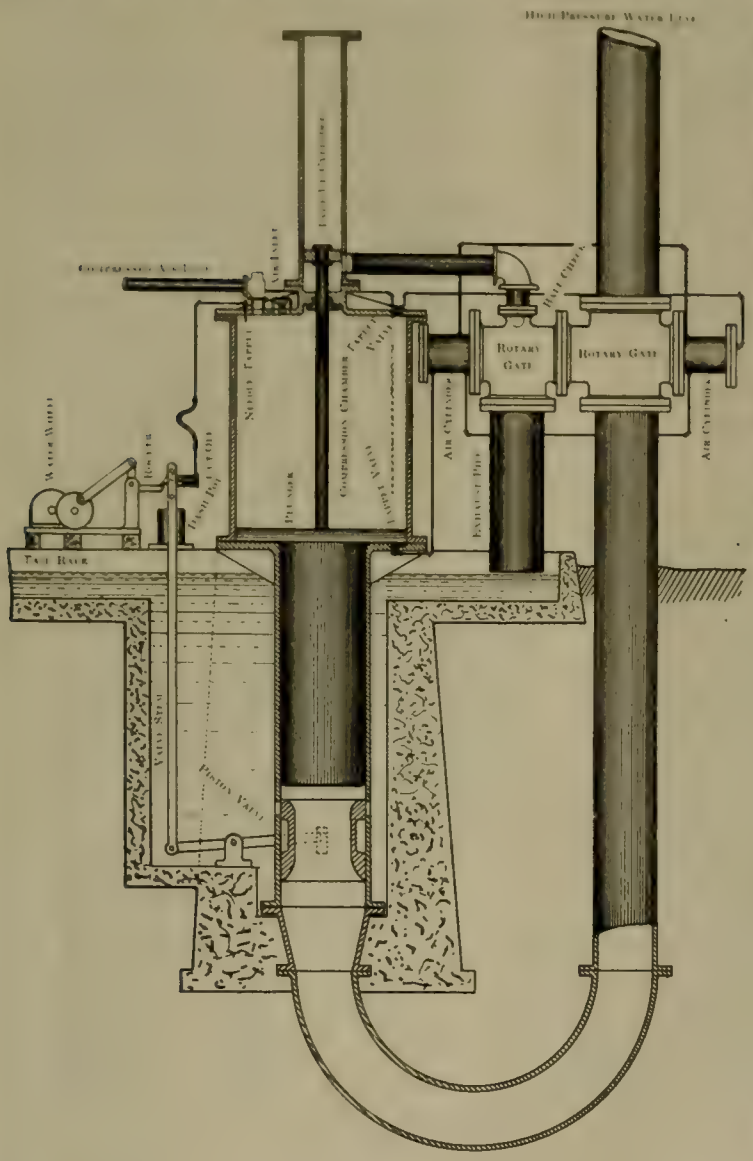


Fig. 3.

For utilizing high heads of water a direct-acting compressor similar to the one shown in Fig. 3, may be employed. This involves practically the same principles as the preceding one. As a pressure of 500 or 600 ft. of water would be too much to turn against the air, a hydraulic plunger is direct-connected to a piston of an air chamber of considerably larger diameter. Assuming the head of water at 300 ft. and the plunger 18 in., and the air piston 36 in. diam., if the water were admitted slowly to the plunger, 33 lb. of air at $^{7}/_{10}$ stroke would balance the water pressure. If the full pipe head were thrown on suddenly, the unbalanced pressure of the air in the first stages would allow the column of water in the pipe to acquire velocity head, which would carry the air pressure up to 70 lb. at $^{4}/_{5}$ stroke, allowing a good margin for friction and other losses. In the design shown, the last $^{1}/_{5}$ of the stroke of the air piston would be completed by three or four quick pulsations of overflow and water hammer. The arrangement is such that two rotary gate-valves, opened and closed by air pressure, alternately admit and release the pressure on the plunger. When the pressure is turned on, the plunger is shoved upward over three-quarters stroks, the water meanwhile flowing in the take-up cylinder. The air pressure gained is held by the ball check-valve in the take-up cylinder feed-pipe. At this juncture the air pressure is sufficient to crowd out the valve-stem dog and en-

gage the rocker-arm oscillated by the water motor, tripping the lower piston valve overflow, and causing three or four pulsations of water-hammer to completely expell the air into the air-line and receiver. At the end of the stroke the piston trips the tappet in the auxiliary air-line, causing the main valve to close. The exhaust then opens. As the exhaust gate opens, it unseats the ball valve in the cylinder feed-pipe, allowing the plunger to sink and the displaced water siphons into the tail race. The length of the last pulsation at the end of the compressing stroke is modified by the space to be traversed by the piston. If only a short distance, the needle tappet is raised higher, and a quick cut off given to the piston valve. The pistons in the air chamber and take-up cylinder would need to have metal packing rings, as they must be tight. The plunger would only need to be a machined fit as the leakage would spray the sides of the compression chamber and keep it reasonably cool. This latter design of machine would not furnish as good air as the preceding designs, because the air chamber would have to be lubricated and the air, not being in direct contact with the water, would be more or less heated and saturated with oil.

SAN MAURICIO MINES.

One of the most important undertakings in Philippine quartz mining has just reached the stage of assured success, according to *The Far Eastern Review*. This is the operation of the San Mauricio mine at Mambulao in the Province of Ambos Camarines on the Pacific coast of the Island of Luzon. Here there is a fine deep-water harbor in which large vessels can anchor within a quarter of a mile of the shore. The mine shaft is two-thirds of a mile from tide-water. The properties have an area of about 270 acres.

A 20-stamp mill from the Traylor Manufacturing Co. is practically completed and will be running in the early part of the coming year. It is the largest crushing plant in the Philippine Islands. The method of handling the ore and of extraction is described as follows: The ore is broken down into chutes, run into cars, and trammed to the shaft, which is equipped with a 65-hp. hoist of the Lidgerwood type. It is then hoisted to the surface and trammed to the grizzly and crusher floor of the mill building, the fine going through the grizzly and the oversize to the crusher to be reduced to 1½ in. From this point all the ore is handled by gravity. After leaving the crusher it enters the bin, which has a capacity of 150 tons. From the bin it is introduced to automatic feeders from which it goes to the stamps, of which there are four batteries of five each with a weight of 1050 lb. per stamp. It is there crushed so that it will pass through a 30-mesh screen. A certain amount of gold is amalgamated inside of the batteries. The rest of the free gold is caught on the plates. The pulp from the plates is run into launders which carry it to a classifier, where the pulp is separated into three different sizes and distributed from there by launders to the six Traylor concentrating tables on the first concentrating floor. The middling from these six tables is conducted to the lower concentrating floor on which there are two tables to be re-concentrated. The sand or tailing is then run to a dump and stacked for future disposal. The average value of the ore as reported upon by five engineers, H. W. L. Way, Carnegie Williams, E. Voigt, Charles Schneider, and Washington V. Vanderlip, is 1 oz. 16 gr. per ton. The cost of handling this ore, that is, mining, milling, concentrating, shipping of concentrate, smelting charges, and development work on the mine, should not be over $5 per ton of ore handled. It is expected that the mill will crush about 80 tons per day. The plant includes a well equipped assay office.

The San Mauricio mine is controlled by the Philippine Exploration Co., incorporated in the United States in 1908. Its head office is at 97 Water street, New York, with a branch office at 32 Plaza Moraga, Manila. The officers of the company are: F. H. Henry, president; James Cochran, vice-president; Vivian L. Outerbridge, secretary-treasurer; A. Heise, general manager. The other directors are Howard Gilbert and Halsey R. Carpenter. With the San Mauricio off its hands the Exploration company is starting in to develop two other properties in the same district, one of which is placer and the other quartz. One of these is the Batobalani dredging group. This property comprises 760 acres, and is situated on the Malaguit river in the well known Paracale mining district. It is about eight miles distant from the San Mauricio mine. The lower end of the group is just at the head of tide-water at a distance of about six miles from the sea. Materials for the building of dredges can easily be lightered or floated to this point. From 260 boring tests made on this ground the average per cubic yard of the dredgeable area is given as 24c. U. S. currency. The tests were made with a hand-boring machine, and it is the consensus of opinion of most mining men that this apparatus will not save more than two-thirds of the gold in the sample, which means that it would be safe to figure upward of 30c. per cubic yard. The before mentioned tests show the overburden to be handled to range from 2 to 7 ft. and the gravel or wash from 13 to 21 ft. This fixes the maximum depth of the dredgeable ground at 28 ft. and the minimum depth at 15, which are ideal conditions for dredging. To date, the entire area has not been proved, but tests are being pushed as fast as possible and a dredge will be ordered in the near future. The Exploration company has bonded this property for 18 months. The Robinson group is a tract of about 850 acres of mineral-bearing ground which forms an ell around the San Mauricio group, virtually making both properties one. There have been numerous shafts sunk and adits driven by native miners in the past on the Robinson group. The property is now being surveyed and active development will start on the same at the beginning of the coming year. The Exploration company has a three-year working bond on this group, guaranteeing to spend a fixed sum monthly, and at the end of the lease to install such machinery as the development work at that time justifies. While the property is as yet only a prospect, the surface indications are considered to justify the expenditure of considerable time and money.

Hanover Iron-Ore Deposits.

By Sidney Paige

*The Hanover district is in Grant county, New Mexico, 12 miles N.70 E. from Silver City and two miles northwest of Santa Rita. It may be reached from Deming, New Mexico, by the Atchison, Topeka & Santa Fe railway. The area is just within the borders of the mountainous district lying between Gila river on the north, the desert on the south, and Mimbres river on the east. The general elevation of the district is about 6500 ft., with peaks rising 800 to 2500 ft. higher. As a geologic unit the district may be described as a narrow basin occupying the upper valley of Hanover creek, the iron ores being arranged more or less regularly around the edges of an intrusive mass of quartz-diorite-porphyry. (See Fig. 1.) The basin is, roughly, 2½ miles long in a north-south direction and averages three-fourths of a mile in width. On its west side the ores occupy the summits of the ridges; on the east side they are formed along the slopes of a higher ridge. Hanover creek occupies a central position, flowing southward and exposing frequently in its valley the intrusive rock mass. This intrusive is a quartzose-diorite-porphyry, and its contact effects have been marked. There is evidence that metamorphism has been selective, the more calcareous sediments suffering the most. Evidence of fracturing as an explanation of intense metasomatism is lacking. Volume changes, if they have taken place, are not observable. In those beds which were less susceptible to pneumatolytic changes the alteration has been more in the nature of a re-crystallization, with possible silicious additions. It would seem reasonable to suppose that the purer limestones, as carbon dioxide was driven out, were invaded by magmatic solutions of high temperature, and that any tendency toward shrinkage was overcome by further accessions from the magma. In other words, those elements native to the intruded rock which were of a proper nature to form contact minerals (such as lime and silica) combined with materials from the magma, the whole forming a solution from which the present minerals originated.

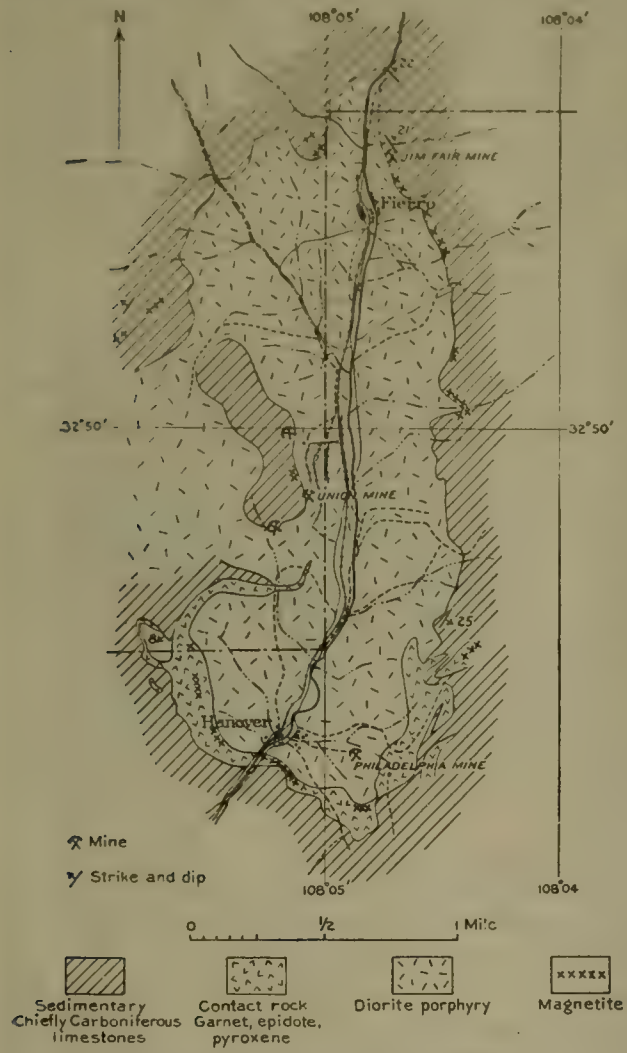


Fig. 1. Map Showing Relations of Hanover District.

The iron ores have been worked since 1899. In 1904 work was suspended because of labor difficulties, but since that time has proceeded nearly continuously. The principal mines are the Union and Jim Fair. They are leased by the Colorado Fuel & Iron Co., and all the ore is shipped to Pueblo, Colorado. The map (Fig. 1) shows clearly that the ores are arranged about the periphery of an intrusive stock, at or near its contact with sedimentary beds. With the exception of two localities, one in the northwestern part of the area, and the other in the northeastern part (not shown), where the ore deposit is believed to occupy former limestone beds between more silicious layers, the orebodies are immediately next to the contact. They are, in the main, irregular lenticular masses of magnetite, in one place partly hematite. Where exposed at the northern and southern pits of the Union mine they are decidedly long as compared with their width and depth. At the Jim Fair mine a shorter comparatively thicker lense is exposed. All three bodies pinch out in length, and in the northern pit of the Union mine ore has failed in depth. Besides these large bodies numerous outcrops may be observed, indicating the same mode of occurrence; that is, lentils of varying width and thickness, swelling and pinching in horizontal extension, and, it may be safely presumed, presenting similar though uncertain irregularities in depth. A second class of ore, which for convenience may be termed 'soft ore', likewise occurs along the contact. It is characterized by the disseminated nature of the magnetite, which exists as finely and coarsely crystalline material with a considerable admixture of limestone, and depends for its commercial value on local concentration, whereas the value of the hard ores depends more directly on the size of deposits and their freedom from impurities. Of the

*Abstract from 'Contributions to Economic Geology' 1908, U. S. Geol. Surv., Bull. 380.

hard ores three bodies have been worked on a large scale, the two pits of the Union mine and the Jim Fair mine; in the soft ores the principal work has been done immediately south of the southern Union pit, though soft ore, whose commercial value remains to be proved, occurs along the eastern border.

The principal ore of the region is magnetite, though at the Jim Fair mine considerable hematite has been extracted. Varying amounts of chalcopyrite and zinc blende are associated with the iron ore, but figures are not at hand to express their relation, which is variable. Limestone and contact rock form the most abundant gangue material. In the hard ores the magnetite is generally massive and granular, but the magnetite of the soft ores presents in many places a fine development of crystal form, usually the rhombic dodecahedron.

Some 4000 tons of iron ore which were shipped to the Colorado Fuel & Iron Co. at Pueblo, Colorado, showed the following composition, being the average of 80 carloads:

	Per cent.
Iron peroxide	76.00
Iron protoxide	12.85
Phosphoric acid	0.041
Titanic acid	Nil.
Manganese oxide	0.95
Alumina	0.73
Lime	0.58
Sulphur	0.02
Combined water	2.32
Copper	0.085
Iron	63.20
Phosphorus	0.018
Silica	4.32
Manganese	0.60

But a word is necessary regarding the origin of the ores. Primarily they must be considered as part of the effects of the quartz-diorite-porphyry intrusion. C. K. Leith and E. C. Harder* have shown that in some localities contact metamorphism without much doubt precedes the deposition of magnetite, and that the latter is distinctly an 'after effect'. The form of the orebodies is suggestive. Most of them are irregular lenses occurring at or near the contact. Joseph Barrell and others have shown the possibility of shrinkage in sedimentary strata due to metamorphism. Leith and Harder, to cite a concrete example, estimate that a horizontal radial shortening of 200 to 500 ft., depending on the depth of the laccolith, was possible as a result of cooling in the Iron Mountain mass. This mass is of the same order of magnetite as the one involved at Hanover. It might be argued, therefore, that lenses, large and small, represent the filling of such shrinkage spaces, and that therefore the magnetite is distinctly an 'after effect'.

Certain other relations of the ore may be significant. For example, where metamorphism is not especially pronounced in the limestones—that is, where zones of garnet, epidote, and pyroxene are lacking—soft ores have formed; in other words, ores which because of their disseminated character and perfect crystallization suggest an emanation of highly heated solutions of volatile magnetite, precipitated by reduced pressure and temperature. On the other hand, where contact rock occurs these soft ores are lacking. The first inference might be that they were unable to form in such places because of the compact nature of the walls, and the second, that they were, therefore, later than the metamorphism. Though magnetite filling undoubted fissures in either limestone or porphyry was nowhere noted, at certain localities the magnetite occurs as lenses surrounded entirely by contact rock.

Leaving open, then, for further study the consideration of the precise time relation of the magnetite to the contact metamorphism, the following condition may be tentatively supposed to have existed. On coming to place, the heated magma, by solutions probably above the critical temperature of water, impregnated certain strata of the surrounding rocks. Adjustments, due to cooling of the porphyry, to possible volume changes in the intruded sediments, and to gravity, served to make of the contact zone a favorable locus of superheated gases. Magnetite, a mineral which several investigators have shown might be precipitated from iron silicates by reactions with lime, collected, replacing limestone, filling openings that may have gradually grown, and replacing in part the porphyry mass. The concentration might also be conceived to have been influenced by those laws which regulate the selective growth of mineral masses where abundant material is supplied.

With the exception of ore extracted recently from the southern part of the Union mine by underground methods, the ore has been mined by open-cut. The Union mine is situated on a steep hillside and the Jim Fair is sufficiently elevated to permit hauling by gravity. Tunnels in the Union mine and an open-cut in the Jim Fair, driven through the contact wall, serve as a roadway for the ore, and trams convey the product to bunkers at the railroad. Mexican labor is used almost exclusively. According to 'Mineral Resources', the district yielded 1,010,779 tons of ore in the years 1901 to 1907, inclusive.

*Iron ores of the Iron Springs district, southern Utah. Bull. U. S. Geol. Surv. 338, 1908, pp. 25-27.

Mercury minerals that are of unusual interest to students of mineralogy or crystallography occur in the Terlingua, Texas, field. A recent bulletin of the United States Geological Survey (405), by W. F. Hillebrand and W. T. Schaller, discusses in detail five of these minerals, kleinite, montroydite, terlinguaite, eglestonite, and calomel. Of these the first four were but recently discovered, and the chemical character of kleinite is still somewhat uncertain, though it is known to be a mercury-ammonium compound, the first such compound recognized in nature. Terlinguaite and eglestonite are oxychlorides of mercury; montroydite is mercuric oxide; calomel is the long familiar chloride of mercury.

None of these minerals is important as an ore of mercury, the metal being obtained chiefly from cinnabar, but also in the native state. The present report must be regarded simply as a contribution to scientific knowledge, by means of which the physical and chemical properties and the crystallographic character of the minerals, so far as determined, are definitely and permanently recorded.

Recent Milling Practice.

Written for the Mining and Scientific Press
By A. E. Drucker

For more than a year past I have been visiting a few of the principal gold mining districts of the world for the purpose of making a detailed study of milling and cyaniding methods. A short description of some of the more important changes in these various places visited is here given. A more detailed account of the methods at Unsan, Benguet, Kolar, Waihi, Rand, and Kalgoorlie will be given in a series of articles to appear in *The Mining Magazine* and the Mining and Scientific Press within the near future.

Unsan, Korea.—The Oriental Consolidated Mining Co. possesses the most important gold quartz mines in eastern Asia. While other Korean mining properties are now recognized as possessing dividend-paying resources, the Oriental Consolidated mines have heretofore been the only ones operated continuously

An Old Korean Stamp-Mill.

on an extensive scale by modern methods in the Empire. It is safe to say that this company is the only one operating in Korea at the present time at a profit. Its mines are producing at present about $125,000 in bullion per month, and has produced to date over $12,000,000, of which about 40% has been paid in dividends. The success of the Oriental Consolidated Mining Co. has been largely due to the good management of K. F. Meserve, who has been its leader from the beginning. The company has a total of 230 stamps in five different plants, crushing about 30,000 tons of low-grade gold ore per month. It is quite base, containing from 5 to 6% of gold-bearing sulphides, with very little silver. Considering the methods of milling and cyaniding in the past, remarkably good extractions have been obtained. The present treatment consists in stamping, plate amalgamation, concentration on Frue or Union vanners, and cyanide treatment of the concentrate, after mixing with coarse sand, by the 18-day percolation method. This cyanide treatment gives an actual extraction of 84% of the gold. The above method, on a $5 to $6 ore, according to the 1909 annual report, gave an actual gold extraction of a little over 82%. Of this the recovery by plate amalgamation was 46%, by cyaniding the concentrate 36, and 6% was in the cyanide residue dumps, leaving only 12% actual loss.

During 1910 the O. C. M. Co. has decided to make extensive changes at its reduction plants. I shall shortly re-design and carry out these changes for the company, the intention being to bring the concentration plants up to a more efficient point by installing classifiers and grading into three products. Wilfley tables will be used for coarse sand, Frue vanners with corrugated belts for the fine sand and slime, and cement slime-tables to further treat the residue from the slime vanners. The final residue from the concentration plants is to flow to waste, being too low in grade for further profitable cyanide treatment.

The concentrate (200-mesh) is to be all-slimed in tube-mills in cyanide solution. The resulting slime, together with the slime sulphide collected from the vanners and cement-tables are to flow in cyanide solution direct to my patent air-agitation and continuous leaching vat. Upon completing the extraction here, the sulphide slime residue is to pass to my patent tangential vacuum filter (a continuous slime-filter), where the remaining dissolved metal is to be removed. An actual gold extraction of 90% is expected from this slime sulphide by the above treatment. Other important additions to be made by the company are plants for treating old cyanide residue dumps. There are three of these having a total value in gold of about $900,000. The material assays between $4 and $8 per ton. After completing a series of experiments on a practical scale, extending over a period of some four months, I came to the conclusion that the following method would be the most profitable for such a material: (1) Re-concentration on Wilfley tables, giving two products, namely, coarse sand residue, assaying $1.25, and sulphide, assaying $12 per ton. The product fed to the concentrators assays $4 to $5 per ton in gold. (2) All-sliming of the sulphide in tube-mills with water, so that all will pass a 200-mesh screen. (3) Dewatering the sulphide slime before cyanide treatment. (4) Cyanide treatment in tall vats designed to give an air-agitation and continuous leaching at the same time. (5) Filter-pressing or vacuum-filtering of the residue from the agitation vats to completely remove the dissolved gold.

The serious troubles in the direct all-sliming treatment are the presence of large amounts of ferrous sulphate from the oxidation of marcasite and arsenopyrite, and also the fine charcoal scattered through the dumps. A re-concentration on Wilfleys at once rids the sulphides of the fine charcoal and washes out the ferrous salts and other harmful cyanicides with the sand residue. The further grinding in tube-mills gives the sulphide a final wash and prepares it for successful cyanide treatment.

Benguet, Philippines.—The only two gold mines of importance here are situated in the Benguet district, and are controlled by the Benguet Consolidated and the Bua Mining companies, of which the former is now on a dividend-paying basis. At the time of my visit the Bua mine had a 30-ton plant, consisting

of two 3-stamp Hendy mills, and a cyanide plant. The treatment was simple plate-amalgamation, followed by a leaching of the sand by cyanide. The slime assayed from $1 to $1.50 per ton, and was allowed to run to waste. The ore milled averaged from $8 to $10 per ton, and was easy to treat, containing much calcite, some quartz, and a little sulphide. It has an alkaline reaction and consequently requires no lime previous to cyaniding. This company claims an 80 to 85% actual extraction of the gold in the ore.

The Benguet Consolidated is an up-to-date progressive concern, a great deal of credit being due C. M. Eye, the superintendent, for making the work a success. Formerly the reduction plant consisted of two 3-stamp Hendy batteries, amalgamating plates, spitzkasten, sand cyanide leaching vats, and mechanical slime agitators. The slime was treated by the decantation process with poor results. The ore consists of a large amount of quartz, some calcite, and from 2 to 3% of sulphide. It assays about $10 per ton in gold. The actual extraction was only about 65%. At the time of my visit numerous alterations in the plant were under way, including the addition of new sand-leaching vats, Wilfley tables, tube-mill, Ridgway slime-filter, and a special treatment plant for the concentrate. I understand that most of these improvements have now been made, and much better results are being obtained. The ore treatment is as follows: (1) Crushing in water with stamps. (2) Outside plate-amalgamation. (3) Separation of sand from slime by spitzkasten. (4) Cyanide percolation of sand after a previous concentration on Wilfleys. (5) Cyanide agitation of slime after dewatering. (6) Vacuum-filtering of slime. (7) Concentrate from the sand to be all-slimed in a tube-mill and given a special cyanide treatment. (8) Precipitation of gold from cyanide solutions by means of zinc shaving.

Kolar, India.—The most important gold quartz mines in this part of the world are situated at Kolar, in the State of Mysore, which are under the management of John Taylor & Sons. There are between 600 and 700 stamps in the district distributed among six different plants. The ore at Kolar is extremely simple to treat, and yields over 90% actual extraction by simple plate-amalgamation, followed by cyanidation of the sand in vats. There is only a fraction of 1% of sulphide in this hard quartz ore. It assays on an average about $16 to $17 per ton in gold. The extraction by amalgamation is between 70 and 80%, while that on the sand by cyanide leaching varies between 60 and 75%. For years the slime from the stamp-mills was stacked for future cyanide treatment. During the past year or so it has been the practice to mix as much of this slime as possible with the sand, and yet get satisfactory leaching in the vats, so as to prevent, as far as possible, the accumulation of further untreated slime. This is ancient practice, however, and besides I cannot see the economy in stacking slime for several months and allowing it to dry and cake before receiving a cyanide treatment with the sand. Would not the direct treatment of the slime alone yield a greater net profit? Evidently the Kolar people are beginning to think that it will, and have been doing their utmost to solve this problem. For more than a year past H. W. Leslie, consulting metallurgist to the Kolar group, has been experimenting on a commercial scale with the large untreated slime-dumps, trying to find the most profitable method. At the time of my visit to Kolar one Ridgway slime-filter and two tall Brown agitators were being experimented with, and as far as I could learn good extractions had been obtained. The Brown vats were quite satisfactory. The Ridgway was the first continuous vacuum-filter put to commercial use in dealing with large tonnages of gold-bearing slime. Mr. Ridgway deserves credit for his ingenious invention. What is wanted at the present time in a continuous vacuum-filter is a machine that is not only able to treat large tonnages of slime successfully, but also one that is simple in construction. No continuous filter has yet come to the front to take the place of the Moore or Butters type. Sooner or later some form of continuous filter will take the lead, for this method of slime-treatment is still in its infancy.

The Mysore, Champion Reef, and Ooregum mines, possess some well constructed stamp-mills built almost entirely of stone and steel. There are concrete mortar blocks and wooden battery frames at the Mysore. Stamps are being used at Kolar that weigh from 1100 to 1300 pounds. At the Mysore a new rock-breaker house has been constructed apart from the mill. Crushing is done in stages in large Blake crushers, and then in small Gates breakers, the whole arrangement being up-to-date. Although the Kolar district has been backward in its cyanide treatment during the past, I must say that I picked up many good points as regards mill construction, the arrangement of rock-breaker plants, melting and refining (furnace arrangement), and zinc extractor-house work. The zinc extractor-houses and the arrangement of furnaces, where crude-oil burners are in use, compares well with the best I have seen in other countries. The permanent manner in which the Kolar people construct their plants is most creditable. I have found, as in Kolar, that gold mining districts like the Waihi, Kalgoorlie, Unsan, and the Rand, have their own special strong and weak points in regard to ore treatment. If one wishes to study the best practice in stamp and tube-milling, go to the Rand; if it be slime-treatment (vacuum-filters and Brown agitators), go to Waihi; and for dry crushing, roasting, and pan grinding, see Kalgoorlie. I may sum up the chief gold producing districts, as regards efficiency in treatment, not taking into consideration Mexico and the United States, as follows: Rand leads in stamp and tube-milling; Kalgoorlie leads in dry crushing, roasting, and pan-grinding; Waihi leads in slime treatment, agitation, and vacuum-filters; Unsan leads in concentration and cyanidation of concentrate; Kolar compares well in mill construction, bullion melting, and refining equipment. It is doubtful whether tube-mills would pay to install for grinding the coarsest of the sands with the present milling methods, where 30 to 35-mesh battery screens are being used. However, if it were a case of getting through more ore with the present size plants, then instead of adding stamps, better install tube-mills and put on 10 or 15-mesh screens.

Montgomery-Shoshone Mine.

Written for the Mining and Scientific Press
By A. H. Marius

The mines and mill of the Montgomery Shoshone Consolidated Mines Co are located in the Bullfrog district, Nevada, a short distance from the town of Rhyolite the main commercial point of the district. The company owns a large tract of mineralized land comprising the original properties of the Montgomery-Shoshone, Shoshone Polaris, and Crystal Bullfrog companies. In addition the company also owns two mill-sites embracing 10 acres, water-rights with a flow of 500,000 gal. per day, and 500 acres of fertile farm land in Oasis valley. The mill, water-rights, and pipe-line are controlled by the Bullfrog Reduction & Power Co., a subsidiary corporation. The capitalization is for 500,000 shares of a par value of $5 each.

Montgomery-Shoshone Mine and Mill.

The most prominent and extensively developed mine of the company is the original Montgomery-Shoshone. This property was located in 1904 by E. A. Montgomery, and the property was opened by driving a cross-cut tunnel. The original discovery of ore was made by A. James, who received $10,000 as a reward from Montgomery. The cross-cut opened an immense body of talcose ore early in 1905. In 1906 the consolidation of this mine with the Shoshone Polaris and the Crystal Bullfrog was effected by Charles M. Schwab, the New York steel king. The deep development of the mine and the erection of the reduction works commenced almost immediately. As the company's treasury did not contain sufficient funds, sufficient capital for the construction of the mill was advanced by Mr. Schwab, the amount being about $300,000. This debt has been largely paid off and the company is rapidly approaching the period when dividends should be declared.

The formation is rhyolitic, with a huge fault-dike of basalt cutting into the rhyolite and breaking the formation badly. The ore occurs principally in the talcose formation lying south of the basalt fault. Cutting across the property is a hugh zone of crushed ore irregularly traversed by seams of quartz and ore-laden talc. The ore-zone has been opened in the centre of the glory hole for a width of 250 ft., but its length remains undetermined. In the glory hole the ore is quarried and shipped direct to the mill. Development and breaking costs are kept low, while the ore will average about $8 per ton. The glory hole is the principal source of production at the present time, with systematic development constantly augmenting the extent of the wonderful deposit.

The Montgomery-Shoshone shaft is north of the glory hole and has been sunk to a depth of 700 ft. It is triple-compartment, and has opened excellent bodies of rich talcose ore at several levels. At the 600-ft. point a heavy flow of water was encountered, while the talc shows a large percentage of sulphides. Levels have been run from several points and extensive orebodies intersected. The shaft is equipped with a Hendrie & Bolthoff double-drum geared hoisting engine with 12-in. cylinders and 16-in. stroke. A speed of 600 ft. per minute is generated, and with single cages 300 tons of ore are handled every 16 hours. A Chicago Pneumatic Co. compressor operates ten 3-in. drills. Two 100-hp. Heine water-tube boilers, using oil for fuel, furnish the steam for the compressor. The mill is operated throughout by electricity taken from the wires of the Nevada-California Power Co., the company contracting to furnish 300 hp. per day for a period of five years.

South of the glory hole the formation is less irregular, and a series of promising parallel southerly veins has been demonstrated to a considerable extent. These have been cut at varying depths, and are among the richest yet opened by the company. Farther west the Polaris fissure-vein has been demonstrated to a limited extent by a shaft. Considerable ore of fair grade is exposed. It is conservatively estimated that ore to the value of $1,000,000 is blocked in the various workings of the Montgomery-Shoshone mine proper, while systematic developments are adding to the estimated reserve. It is estimated that the developed ore will average $10 to $11 per ton. The company is directing particular attention to the development of the orebodies opened in the shaft, and to the enlargement of the glory hole, where the ore is exceptionally good. Later on the deposits of the Crystal Bullfrog and Polaris claims will be given more attention. About 100 men are employed.

The ore is received from the mine by two 13 by 24-in. Blake jaw crushers and reduced to a maximum size of $1\frac{1}{2}$ in. It is then elevated to a storage bin commanding a set of 14 by 42 Traylor rolls, crushing through a ½-in. punched steel screen. The undersize passes to a second row of rolls of the same size and type, and the oversize is returned to the first battery for re-grinding. From the second rolls the reject returns to the first line for further reduction, while the undersize, reduced to 6-mesh, passes to the fine-grinding department. This consists of a battery

of fine-grinding Traylor rolls and two Chilean mills. About 75 tons of material are handled every 24 hours, all the ore having to pass a 40-mesh Tyler double-crimped screen. Crushing is performed in cyanide solution and has proved quite satisfactory. From the re-grinding department the pulp passes to two Dorr classifiers dividing the product into concentrate, sand, and slime. The concentrate is delivered to a 4 by 9-ft. Allis-Chalmers tube-mill and treated for 24 hr. It is then discharged into five 12 by 16-ft. cone-tanks and kept in constant agitation by compressed air fed through an ordinary ½-in. pipe. This method has proved particularly effective. The extraction ranges from 97 to 99.57%. After passing from the two Dorr classifiers, the sand is received by seven Wilfley tables and delivered to a series of sand-collecting tanks. From these it is elevated to the strong-solution tanks by a Blaisdell excavator, Robins belt-conveyor, and Blaisdell distributor. The sand is kept in action four days, sufficient cyanide being added to the solution to make it sufficiently strong. The pulp next passes to the weak-solution tanks, where it remains six days.

The slime from the Dorr classifiers is received by 10 Frue vanners. From these the pulp passes to the collecting tanks. A Trent agitator next receives the pulp and keeps it in constant agitation for 8 hr. It is then transferred to the settling tanks and the solution decanted. It is now delivered to the filtering department. This contains two presses of 50 Butters leaves each, and one press of 40 Blaisdell leaves. The final solution is delivered to 10 zinc precipitating boxes, constructed of iron. The usual zinc precipitating process is used. The extraction runs from 89 to 90%. Milling costs are about $2.25 per ton, and efforts are being made to reduce this. The water is received through a 14-in. pipe-line from Goss Spring, which furnishes a constant supply throughout the year. The ore assays about 1 oz. gold to 12 silver, while the capacity of the mill is about 200 tons per day. The total costs of mining, developing, and milling are kept down to about $5 per ton, and late reports of the management indicate that the company is earning profits at the rate of $226,000 per year.

The mill was designed and installed by the Traylor Engineering Co. The gold-silver bullion is shipped by express from Rhyolite. A spur of the Las Vegas & Tonopah railroad connects the mine with Rhyolite, the line going direct to the ore-bins and mill warehouses. Supplies are accordingly handled at low cost. Timber is somewhat scarce, but the excellent transportation facilities enable this and other supplies to be brought in at comparatively low rates. John G. Kirchen is general manager of the property and E. M. Kirchen superintendent of the mill.

Rapid advancement of the large gas-engine was made possible by improvements in the production of cheap gas directly from fuel by means of the gas producer. A few scattered producer-gas plants were installed for power production in the United States before 1900, but the application of engines of this type to the production of power in any general sense has been developed since that date.

Stacker for Hydraulicking.

Written for the MINING AND SCIENTIFIC PRESS
By SUMNER S. SMITH.

In hydraulic mining one of the largest problems is the disposal of the tailing. In many situations there is not sufficient room to handle it by gravity, and some form of stacker must be introduced. Hydraulicking, where at all available, is such a cheap and successful method of work that stackers capable of handling the coarse material at low cost are much to be desired. W. R. Heslewood, of the Big Creek and Chanchula Placer Mining companies, operating in Hayfork valley, Trinity county, California, has devised one which is admirably suited to a number of such situations. While the general principle of the machine is old, credit for the device as a whole should be given to him. The form of stacker shown in Fig. 1 was designed to handle gravel from creek-bed where there was a heavy seepage and no other way to dispose of the tailing. The companies named owned an ample supply of water, which is essential to the working of the machine. Besides the ordinary hydraulic equipment, enough ⅛ or $^3/_{16}$-in. sheet iron for an elevator, ⅜-in. sheet iron for liners, and ⅜ by 2½-in. strap-iron for riffles is necessary.

To install the apparatus a site near the centre of one end of the channel is selected and a space of 30 ft. across washed clear to bedrock by one of the giants, an auxiliary lift keeping the pit free from any excess of water. A 3-ft. sump is dug in the bedrock to accommodate a hydraulic elevator. This is fitted with a ball joint to prevent the constant jarring and settling, throwing it out of line. Fig. 2. The bell of the elevator is 30 in. diam., tapering to a 12-in. throat, which in turn is connected to a 15-in. pipe with a reverse taper. The nozzle is of the ordinary 5-in. giant type. Working with a 90-ft. head the machine elevated the seepage, fine, and the water from two field giants 16 ft. vertically. The bell of the elevator is constructed of the ordinary hydraulic-pipe iron with ¼-in. liners riveted in position. These last for a season's run and occasion little trouble. The elevator thus constructed is so light that four men can carry it.

To stack the tailing a chute was built at right angles to the line of the elevator and sloping upward at an angle of 30°. It is 4 ft. wide, 24 ft. long, and constructed of 1¼-in. plank on a frame of 4 by 4-in. pieces which rest on 6 by 6-in. sills. The lower portion of the sides is lined with 1¼-in. plank spiked in position. In each corner and in the centre is a 2 by 4-in. stringer on edge, Fig. 2, on which the riffles rest. These are also made of 2 by 4-in. pieces spaced 2 in. apart and beveled off so as to give a drop of 2½ in. between. They are covered with ⅜-in. strap-iron 2½ in. wide. The grizzly, Fig. 3, and side-boards, or wings, not shown, were then built over the elevator, and a 3-in. drive giant set up 20 ft. in front of the chute. Just back of the nozzle at a convenient point a gate-valve was placed that connected with an auxiliary lift that kept the pit free from water when the elevator stopped. Two 4-in.

field giants wash the gravel to the chute and the drive giant forces it up stack, the fine material falling through the grizzly or riffles to be raised to the sluice-boxes by the elevator. These are of the ordinary type, but the small amount of material handled permits a short length and nice adjustment.

The field giants handled 600 cu. yd. per 24 hours and the drive giant could have taken care of a third in addition, as it was idle a large part of the time.

Fig. 1. General View.

Fig. 2. Stacker Showing Riffles.

When the tailing stack reached the top of the chute a couple of heavy plank were spiked to the frame and the gravel easily driven to a vertical height of 25 ft. The cost of handling the material exclusive of equipment was less than 5c. per cubic yard, but with the introduction of a large elevator with a 6-in. nozzle and an extra field giant Mr. Heslewood expected to reduce this to 3 or 4c. per cubic yard.

The advantages of this method are: (1) It can be used in many places where the ordinary form of hydraulic mining is restricted on account of the tailing. (2) It easily disposes of a large amount of seepage and separates and stacks the tailing in one operation. Its advantage is that it is only applicable where a large supply of water can be obtained.

Fig. 3. View of Grizzly and Pipe to Sluices.

Radium in Australia.

Written for the Mining and Scientific Press
By John Plummer.

At a recent meeting of the Royal Society of New South Wales, T. H. Laby read a paper on Australian minerals containing radium. In the course of his paper, Mr. Laby stated that late in 1904 he received from an Australian mineralogist a specimen to test for radio-activity, and it was found to be so strongly radio-active as to indicate the presence of radium. Some uncertainty exists respecting the place from whence the mineral was obtained, it having been found among a quantity of silver ore shipped to Germany. A fairly large percentage of pitch-blende had been obtained in the ore. It is now believed to have come from the northern districts of New South Wales. The chemical and physical characteristics of the mineral experimented upon showed that it differed in certain particulars from those of the well known German pitch-blende, containing more water and being more dense, and being evidently a secondary pitch-blende. Its radio-activity was marked, the mineral being 1% more active than the German variety, and there could be no question of the presence of helium. Since it had the composition of a secondary pitch-blende, it was to be expected that helium might occur in such quantities as to make its recovery payable. Moreover, the mineral contained only such elements as were readily separated from one another by the methods used to obtain uranium and radium from German pitch-blende. The attention of prospectors in the Australian silver-bearing districts is now becoming directed to the possibility of tracing the lost mineral. Mr. Laby also mentioned a specimen of monazite from Pilbarra, Western Australia, which gave off radium emanation when heated.

A couple of prospectors from Radium Hill, in Central Australia, about 300 miles from Broken Hill, visited Sydney this winter with mineral specimens from a radio-active orebody examined some time ago by D. Rawson, mineralogist to the Shackleton Antarctic Expedition. Mr. Rawson gave the locality its name and found the orebody to be from 3 to 5 ft. thick. The deposit was discovered in 1906 by a prospector, and subsequently ascertained to be carnotite of the best quality. The importance and value of the discovery were unreservedly recognized, but, for some reason or other, the mine, on which a shaft had been sunk 50 ft., was abandoned by its lessee, who subsequently proceeded to Western Australia. Some few months ago the claim was re-located by a couple of prospectors in search of pitch-blende. Descending the shaft they found the deposit as the original discoverer had left it. The mineral was extremely hard, but they managed to break off a hundred pounds, portions being sent to several schools of mines, Melbourne and Sydney Universities, and various scientific men. The discovery is regarded as one of the most important of its kind yet made in the Commonwealth, and further development will be watched with interest. The discoverers have decided to extend their shaft down to the sulphide zone beneath the water-level, above which minerals invariably become oxidized, the deposits lower being expected to prove extremely rich. Bulk samples are to be forwarded to America or Europe for treatment, and should the results prove favorable, steps will be taken to place the radium-extracting industry on a business footing.

Vanadium, another radio-active mineral, is believed to have been discovered in the Antarctic by the Shackleton Expedition. At present there is only one specimen in Australia, which is in the possession of T. W. E. David, who accompanied the explorers as mineralogist. It was discovered on a large moraine on the coast of Victoria Land, where it occurred as a thin film on joint faces of igneous rock. The films, although numerous, were thin as note paper, but their color readily caught the eye with their bright green tint. Mr. David explained that although vanadium is most valuable in itself and has hitherto been obtained for industrial purposes from Colorado and Peru, its chief interest consists in the fact that wherever it is found, radio-active substances, if not radium itself, are generally present. In color vanadium is an asparagus green until exposed to the air, when it becomes an orange yellow. In reference to the discovery of the mineral, and the possibility of finding others, Mr. David said: "The general geological structure of the immense coastal ranges of the Antarctic, and the character of the rocks of which they are composed, renders it probable that minerals of the rarer earths will be found there. Of course, vanadium is one of these minerals. But I would discourage any hopes at present of a commercial value attaching to the discovery. It is entirely premature for the belief that the mineral found necessarily belongs to any deposit of commercial value. The immense coastal range of Victoria Land rises almost sheer from the sea to a height of from 8000 to 12,000 ft., and is formed chiefly of granite and gneiss, together with slate, schist, and limestone. The steep slopes of this range are almost bare of snow and ice for several months in the year, and during a period of from three to four weeks, commencing a few days before Christmas, there is usually a thaw, the effect of which is to soften the sands and the gravels reposing on the sides of the ranges. Soon after the thaw sets in, torrrents of water rush down the rocky gullies in the ranges, and thus it would be possible during these few weeks in the year to prospect the sands and gravels." The delay in connection with the return from the magnetic pole prevented Mr. David and his party from doing any prospecting, the sands and gravels having again become frozen and hard as a rock. Some promising quartz was, however, obtained.

Mining is declared to be a 'public utility' by the fundamental mining law of Mexico. This admits of protection of a superior order. Incidentally it greatly facilitates economical operation through the servitudes and easements which logically follow from this principle. It also precludes locking up mineral resources by the owners of land when discovery is made by others. In the United States it has not been made legally a public utility, though there are some court decisions looking that way.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Copper Stocks and Their Value.

The Editor:

Sir—The copper industry is apparently in the throes of consolidation. It is obvious to an onlooker that the reason for this consolidation lies in three factors: (1) over production; (2) so-called porphyry coppers; (3) stock inflation and manipulation.

Before the advent of the porphyry coppers there had been a long period of comparative calm and peace in the copper industry. With the advent of the porphyries, however, and the contemporaneous panic of 1907, conditions changed. Because of the enormous tonnage and small copper content, it has been necessary to handle heretofore unheard of quantities of material to justify the investment in the porphyries. This condition has led to hysterical expansion beyond all sound reason. Figures have been made that show that the larger the tonnage produced, the greater the profit, based, of course, upon the fact that interest never sleeps. Carried to its absurdity, it might show that if the 80,000,000 tons of Utah ore were all extracted and worked in one year the profit would be enormous, and it is exactly this absurd proposition that is in a measure governing the price of porphyry copper stocks. Regardless of prosperity and copper consumption, a mad rush to extract the greatest tonnage in the least possible time has been entered upon. The result can only be a production of copper that cannot be easily assimilated. Of course, this is done with an eye single to the stock market. Anything to boost shares and create speculation is welcomed, regardless of the best interests of the property. The result of it all has been the necessity for something new in order to maintain prices. Therefore, it is now proposed to put all, not only the porphyries, but also the Cole-Ryan and Amalgamated properties, into one merger that we are told will also include the Cerro de Pasco and other properties outside of the United States. It is the intent to control the price of copper, possibly fixing it at 15 or 16c. per pound. This is so impossible that it is bound to end sooner or later in disaster, in which case the public will probably be holding the sack. The table herewith furnishes food for reflection. It is in a measure unfair to Nevada Consolidated and Utah Copper, because they are producing. Ray, Chino, and Miami are not and will not be for some time to come.

INVESTOR.

San Francisco, February 2.

The Yaqui Country Revisited.

The Editor:

Sir—Writing three years ago I described the then existing situation in respect to the Yaqui 'uprising', comparing it with the uncertain mood of an individual who might be watching the antics of a dog which was growling and wagging its tail at the same time; it was difficult to know which end to believe. Referring to the same simile, I took occasion to warn my fellow men in mining that the tail of the Yaqui dog was wagging deceitfully. Subsequent events have proved that this was a right estimate of the situation. And what of it today? It is with the idea of setting at rest some controversion on the subject that I am contributing these notes which deal with well attested facts. They have been collected in an extended visit to the Yaqui river.

Iron Cropping Near Rialto in the Yaqui Country.

The question of the real situation respecting the Yaqui's disposition toward the native of Mexico as well as toward the American visitor, still admits of a variety of opinion, emanating from people more or less informed upon the subject. Some of the latter are numbered among those who signed the 'round robin' which did such criminal injury in circulating false representations of security, a notion of security which was brutally contradicted by frequent depre-

PRESENT VALUE OF STOCK.

TO RETURN PRINCIPAL AND 7% INTEREST, PROVIDED DIVIDENDS ARE RE-INVESTED AT 4% INTEREST.

	Total tonnage....	Assay value, lb..	Recovery, per ton	Yearly, lb.....	Costs, cents.....	Profit, 13½c. cop. per, cents.....	Investment life, years	Capital stock....	Present value per share. Utah Copper.	Nevada Con..	Ray Con.....	Chino Copper..	Miami Copper.
Utah Copper ..	80,000,000	30	20	60,000,000	10	3½	26	$750,000	$31.00				
Nevada Con...	40,000,000	40	29	70,000,000	8	5½	16	2,000,000		$17.17			
Ray Con.....	40,000,000	44	30	60,000,000	10	3½	20	1,000,000			$20.26		
Chino Copper..	7,500,000	48	32	30,600,000	10	3½	8	700,000				$8.40	
Miami Copper.	14,000,000	55	39	27,300,000	10	3½	20	600,000					$15.34

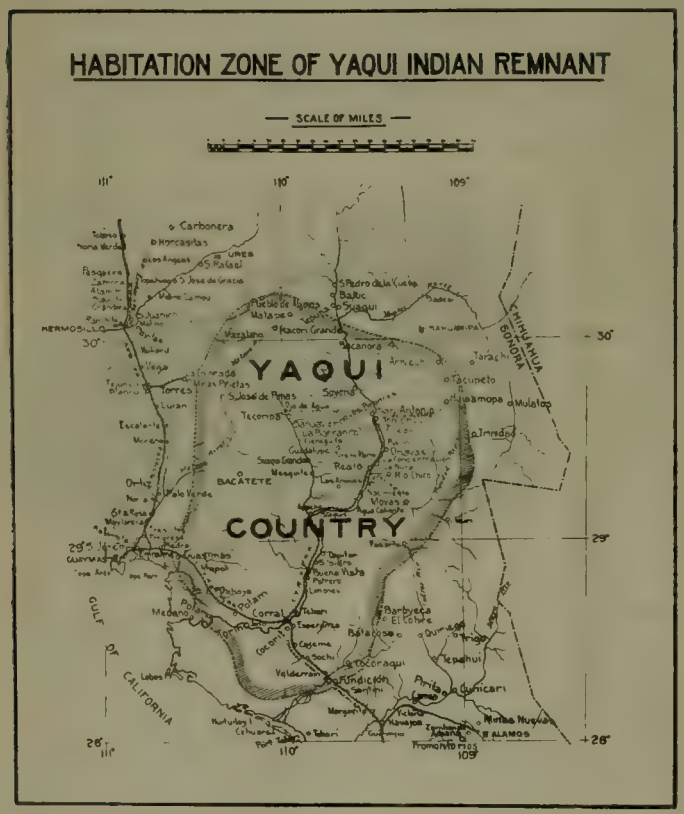
dations and by the taking, from ambush and otherwise, of a great number of human lives, mostly native Mexicans. I repeat what I have indicated before, that when the United States Consulate of Hermosillo, Sonora, lent its aid and gave countenance to the petition then circulated for signatures, its agency put a blot upon the escutcheon which decorates the American Consulate; for in the act of signing there was withdrawn from the American citizen the protection and the rights which a consular agent is supposed to be and is paid to be safeguarding. This is unforgiveable.

By treaty-terms, under negotiations of about two years ago, the Yaqui Indian was to be restricted in his movements and not allowed to go north of Torres. His pay was fixed at a minimum of ₱1.25 per diem; and anyone employing a Yaqui at a less scale of wage was to be made subject to fine. The same treaty required the Yaqui to deliver up his arms and ammunition, for which he was to be compensated upon the basis of a fair valuation. The tribe was to colonize in a newly made pueblo below Torres and was to have a church of its own denomination.

Neither church nor pueblo has materialized, and the treaty went glimmering. The pacifying effect of the negotiations has been evidenced in that small colonies of Yaquis are in many places employed in mining and railroad work, principally about the towns of Chihuahua, Cananea, Phoenix, and Bisbee; and on section gangs on the Santa Fe and Southern Pacific railroad systems.

The Yaqui situation today resembles an armistice, but is not peace. It is an armistice in which the quartermaster's department of the Mexican army provides the remnant of the Yaqui tribe with subsistence, failing which the Indian snatches a 'beef' from the nearest bunch of cattle whenever he wants it and without compensation to the rancher, who in turn has no recourse from his Government. The traveler's security is a sort of 'full-stomach' security, with the interesting possibilities of another uprising if aggravating circumstances should come about. There is a Yaqui remnant, in numbers from 400 to 500, which is to this day unconquered. They can no more change their nature than the leopard can change his spots. This remnant will remain faithful to the traditions of the race, and unconquered, until its extermination.

The Government is building houses for those who came down from their mountain fastnesses, at Bican; but Yaquis to the number above given cling to their strongholds and refuse to put themselves in touch with the Mexican Government agents. Most of this band are in the Bacatete mountains. For more than a year there has been no killing reported. The most recent attack occurred in front of Bacatete, at a point called Las Burras, near the town of Las Guiasimas. Another at Lencho, in which instance the officer nominally in command of the troops was absent from duty and was court-martialed in consequence. The attack was delivered about sundown and resulted in the killing of 14 natives. About December 1, 1909, the Mexican Government sent to the mines of La Dura a party of 50 Yaquis, with their families, who had been held as prisoners in Guaymas during war-time. That depredations have been almost unknown for a period of more than one year is a fact that affords encouragement, but grants no license to the traveler to ignore the element of danger that still exists. In no case, in the Yaqui country or in any other, is danger diminished by ignoring it. A traveler in the country which the accompanying map illustrates should know the conditions of travel and should be on his guard against emergency.



Since this contribution might be considered incomplete without reference to a series of articles appearing in a contemporary journal, under title of 'Barbarous Mexico' viciously attacking the social and political life of Mexico, I have to say of it that the claim that such articles are humanitarian in scope does not remove the question whether they were prompted by the spirit of speculation and newspaper enterprise, which brooks no obstacles to its thrift, even to playing the part of the wolf in sheep's clothing when that suits the necessities. The correspondent admits getting his information under the guise of a capitalist looking for land and seeking to make a purchase for tobacco culture. Have we not in this country been so well schooled in the lessons of newspaper sensationalism that we recognize the fact that sensationalism is the capital stock of some phases of journalism? More often than not the clear

stream of truth is lost in the muddy waters of any journalism that trades on the sensational in the way that does the parent mind of 'Barbarous Mexico'

Crime, injustice, and scandal are not confined to any one nation, and the ventilation of one evil and another in the flaring colors of yellow journalism does more harm than good, this for the reason of circulating false impressions and overdrawing the real conditions, until truth becomes distorted by the creations of an over-wrought brain. Apart from the question of the over-drawing of an unhappy subject, it is a question, of which I can call to mind at least one parallel in the old life insurance scandals, whether the exploiting of crime and things criminal accomplishes any real good unless it points to the cure or provides the means of remedy for the evil which it decries. In the case of the 'Barbarous Mexico' publications it certainly does not; instead, it has the effect of embarrassing many a countryman whose business and political ends are not served by such an attack upon Mexican institutions, its Government, and the rule of its penal settlements. De-

Route of the Yaquis.

portations of the Yaqui fighting man and his family have been made to Yucatan over a period of years. The small map shows the route from Yaqui territory to the penal settlement. Yucatan is 1000 miles south of New Orleans; it has an area of 80,000 sq. mi. The capitol city is Mérida, with a population of 60,000. The laborers on tobacco, sugar, and other plantations consist of native Mayas and some Chinese, besides Yaqui importations and exiles. The latter have been estimated to number from 6000 to 7000 out of a total of 100,000 men and women. Deportation has gone on apace to tobacco fields and to mines, to Yucatan, Campeche, Chiapas, and Tabasco, and the mortality has been shockingly high, but is it not always high in penal colonies? When were health resorts and penal colonies synonymous?

In the question of the righteousness of the Indian cause there is debatable ground for Mexican, American, and Englishman alike, for all have been confronted with a situation in which each has separately justified to himself his own particular method of extermination of a race which, numerically small, stood in the way of the annexation of its lands by a powerful aggressor and a traditional enemy. History repeats itself. In all these instances has there not inevitably and relentlessly resulted, first, the absorption, and then the virtual extermination, of the race which must give way to superior numbers, to overwhelming power, and to the crushing force of the invading party? In an article in *Harper's Monthly* for January 1910, entitled 'The Vanishing People of the Land of Fire', by Charles Wellington Furlong, a closely similar case is mentioned. In the closing paragraphs he writes, "Who can blame the Onas for resisting being literally pushed off the edge of the world? Fewer and fewer smoke wreaths of their wigwams have sent their violet haze against the dark wet forests, and like the dying embers of their camp fires the last of the Onas are going out." The North American Indian, the Boer, and the Yaqui are fast losing their happy hunting grounds and the lands which gave them birth.

FORBES RICKARD.

Denver, January 31.

California Eight-Hour Law.

The Editor:

Sir—Both the opinion recently handed down by the State Supreme Court and the comment of the technical press upon the eight hour law, overlook the essential dissimilarity of the bases of the demands for the legislation applying to mines upon the one hand and 'reduction works' upon the other. Although in its ultimate sociological analysis the enactment of an eight-hour law applying to underground work in mines, is but a manifestation of the universal tendency toward a shorter working day, yet such legislation rests immediately upon the undeniably hazardous and unhealthful nature of the occupation. But it is not seriously urged that metallurgical works are inherently unhealthful: they are certainly no more so than industrial plants in general. Most of the labor is not ardous, and nowadays the noxious gases and injurious dust are pretty nearly eliminated. Even lead smelters have become nearly free from poisoning, and the stamp-mill man can but smile at the theoretical dust raised by the Supreme Court. The real demand and the real justification for limiting by law the hours of labor in mills, smelters, and reduction works, to eight, rest upon the persistence of that pernicious relic of the industrial dark ages, the twelve-hour shift, 7 days per week, 52 weeks and the odd day per year, and half of them night shifts.

The operation of smelting and roasting furnaces is obviously, of necessity, continuous; interruption of the operation of many other forms of reduction works is often inconvenient and expensive; yet when one beholds huge factories, costing millions of dollars and employing thousands of men, working but a single day shift of 8, 9, or 10 hours, closing on Sundays and the leading holidays, one wonders wherein lies the strenuous necessity compelling every little stamp-mill to run every possible one of the 525,000 and odd minutes per year. Yet so deeply rooted has the custom become that even to suggest that a mill might close on any day but the Fourth of July would be sacrilegious, and it would be deemed a sign of insanity even to think of closing on Sunday.

Assuming the necessity for uninterrupted operation, it surely is not a righteous and justifiable order of things to compel a man to devote half his life to

the actual performance of his labor, yet the eight-hour day for mill and smelter work has nowhere in this country been voluntarily granted on a large scale. It has usually been obtained by the violent and costly method of strikes; only in a few cases by the peaceful means of legislation.

The mill and smelter man, eating his 6 o'clock breakfast and his 8 o'clock supper by January lamplight has a saying that the 12-hour shift permits a man only to work, eat, and sleep; in July, tossing about on his midday bed, beating the flies and cursing the heat between his fitful and futile attempts to obtain a transient forgetfulness of his 12, or 12½, or even 13-hour night-shift, he modifies his January axiom; he can only work and eat.

I said that the labor of reduction works, with its half-your-life working day was not inherently unhealthful or injurious, but who ever saw a fat millman?

J. E. Collie.

San Francisco, January 12.

Small Ore Shippers.

The Editor:

Sir—The accompanying letter from a small shipper is offered in the vernacular because in its native dress it reveals the point of view of a supposedly injured person, and at the same time discloses an intellectual obstacle to explaining the situation so as to carry conviction of the smelter's honesty. The fact is that no smelter should accept a shipment which was not sampled in the presence of the shipper or his representative. If a lot of ore is too small for that purpose, it were better to leave it alone. In this case the ore was received at a sampling works, and with intent to favor a small shipper it was accepted without control sampling. The result follows in the words of the unfortunate prospector:

"Your letter of the 28 at hand and I note contents now all I ask of you is to send me the finals and a statement of it so I can send the statement to the party that I have leased the ground from so they can see that I am honest with them in regards to the royalty so you see I have bin keeping them posted what the ore assayed as I was taken it out. Certenly If I would have got fair treatment from you people my ore ought to have assayed $20 a ton or better. I would not have thought bad of your assay of the ore but I had it assayed right along as I was taking out and put nothing in the pile but what would pay me to shipp do you all think that if I new the ore would only go what it did that I would have shipped it no it would have stayed right here in a pile. Mr. Harris told me when he heard that I shipped the ore to you people the best thing I could to be thare and see you all sample it and he said if I did not my return would very small I told that I would trust to you people to give me fair treatment but I have found out to my sorrow the other day Mr. Harris asked how my returns turned out and I told him that you shot it to me in long jerks and then he told me some years ago he shipped some ore and he had trouble with you all. Certenly for me to come up to see you make another cut of the sample would only be wasting time and money and money is as scarce as hens teeth to me at present so please send me what you intend to send and I will call it enough certenly I am no hog I know when I have enough."

This tale of disappointed hopes carries its own moral, and shows how the ore-buyers come to suffer ill-repute.

Colorado.

Denver, January 14.

Mining and Metallurgical Society.

The Editor:

Sir—As a member of the Mining and Metallurgical Society of America, I am in receipt of the index to the first 18 bulletins issued by that Society and covering the period from June 1908 to December 1909. On glancing at the records of this new organization I note that 'discussion by members' is indexed carefully, giving the names of each member participating in the debates on matters of professional interest. I note, however, that only the names of New York and Philadelphia members are given, and chiefly those resident on Manhattan island or its suburbs. There was a rumor that the Society had members elsewhere, as at San Francisco, and that its representatives in the City by the Golden Gate had occasionally foregathered in earnest conclave, but then, you know, rumors are so often wrong, are they not? Joking apart, the Society will suffer if—by its index or by other means—the idea goes forth that it is a New York affair and confined to a coterie of reformers dwelling among the sky-scrapers of Broadway. The records of the San Francisco section were printed in detail in the Mining and Scientific Press, where they were read by most of those likely to derive benefit from the discussion on professional ethics, instead of reaching merely the handful of earnest men constituting the present membership of the new society. Thus one of the functions of the Society was fulfilled, as it is not by the issuance of an index devoted almost entirely to the remarks printed in bulletins that are read by the 165 members. Recently the discussions of the San Francisco contingent have been represented by a couple of short paragraphs in the secretary's bulletin, and in those paragraphs only the bare skeleton of a lively debate is preserved, together with the hint that the members have taken suitable nourishment before venturing to contribute remarks apparently unworthy of being put into cold print. The new society is not flourishing, and it will not flourish until it is conducted on broader and more generous lines.

T. A. Rickard.

London, January 25.

The Boston Stock Exchange has admitted to its unlisted department 777,723 shares of the authorized capital stock of 1,000,000 shares of the Ray Consolidated Copper Co. The par value of the stock is $10, but recently 188,727 shares were subscribed for at $15 each, payable in three installments of $5 each, December 30, 1909, January 7 and March 7, 1910. The Exchange has also admitted to the unlisted department 80,000 shares of the 100,000 shares of the capital stock of the Indiana Mining Company.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling and smelting.

Potash salts have not been discovered in Japan, and owing to the moist climate it is not expected that they will be found.

Foreign coins are made from time to time at the United States Mints by agreement and as a matter of courtesy. In 1909 the San Francisco Mint made 693,170 silver pesos for the Government of San Salvador.

Calumet & Hecla has paid $109,750,000 in dividends on an issued capital of $2,500,000, and in 1909 earned $37.26 per share on a copper production of 69,000,000 lb. From January 1, 1905, to January 1, 1910, the average annual dividend was $47.20 on shares having a par value of $25 each.

Goldfield Consolidated Mines Co. is capitalized for $50,000,000 in shares having a par value of $10 each. According to the report for the year ended October 31, 1909, 3,558,848 shares had been issued. The gross earnings for the last fiscal year were $6,598,870, with net profits amounting to $5,026,619. The stock was quoted February 11 at $7.60 per share.

Standardization continues. The Institution of Mining and Metallurgy (London) has decided that the word 'gallon', as used by its members, shall represent the imperial gallon measure of 10 lb. water; that temperatures be expressed in degrees Centigrade, and returns of gold and silver be expressed in terms of fine gold and silver, not as 'bullion'.

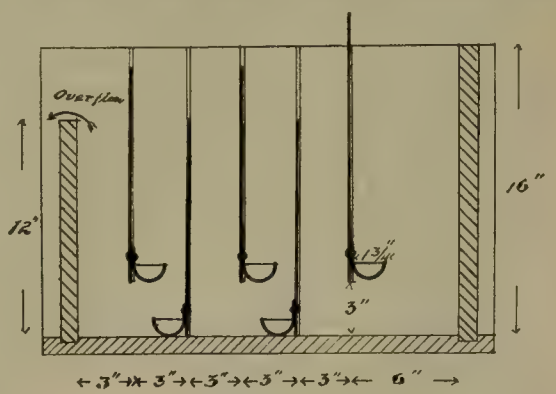
Original deposits of gold to the amount of $142,124,941 were made with the United States Mint and Assay Offices during the fiscal year ended June 30, 1909. In addition, under-current and mutilated United States gold coin containing 184,486 standard ounces was received for re-coinage, the coining value of which in new coin was $3,432,288. The difference between the face value of the old coins and the new coins made from them amounted to $26,049.

Federal laws providing for development of water-powers on public lands have so far consisted merely of clauses or phrases in certain acts regarding rights of way. They provided for no regulation of water-power except in the National Forests. The principal laws are, 26 Stat., 1095, and 'an Act relating to rights of way through certain park reservations and other public lands' (Stat. L., vol. 31, p. 790). There are also regulations issued by the General Land Office, approved June 6, 1908.

Grooves, channels, or other minor riffles on a concentrating table, such as a canvas-table, or buddle, usually prove of benefit only in so far as they compensate for inequalities in the density and volume of the pulp fed. Because of the great difficulty in regulating these in ordinary mill-practice they find a place in practical work. Shallow grooving in herring-bone pattern on a cement surface has recently been adopted by A. E. Drucker with advantage. The great success attained in slime concentration on Rittinger side-bump tables by Charles B. Parsons at Bonne Terre, Missouri, was due primarily to the close approximation to uniformity in the feed which he reached with his distributor. This was of the overflow type from a rising column, split at the overflow lip into equal parts for the several tables.

Canvas-tables, so-called, depend for their efficiency largely upon proper friction of the surface. The firmness with which the heavy minerals are held varies greatly with different substances. Of all types of cloth-covering the best yet found are linoleums and rubber, either of which surpass common canvas. The ideal surface, however, is ground glass. The cost of this material, and the frequency of breakage prohibit is use. Cement is sometimes employed. Perfect homogenity is difficult to attain with ordinary portland cement. A better grain, more nearly approaching that of ground glass, together with uniform density, insuring more even wear, is obtained by using hard white plaster, such as is employed for the finish of interior walls in houses.

The amalgamation trap sketched below is a modified form of the well known 'Homestake' trap, used by H. S. Reed, Jr., who describes it as follows: "It consists of the regulation box made of 1-in. lumber, planed and well jointed to make water tight, with grooves in the sides for the baffles to slide in freely. The baffles are of ⅛-in. black iron, to which are riveted cups made from copper plate. The cups are made by bending the plate over a piece of 1½-in. shaft or 1¼-in. pipe, one side being as high as the centre of the circle, while the other side extends a couple of inches higher for riveting. The ends are closed by half circles of wood ½ in. thick and the cups may be used with or without mercury. The



first baffle is 15 in. high to prevent splashing and to give head to the pulp, the others all being 12 in. and interchangeable. No handles are provided, for I find that if the sand is packed around the cups sufficiently to require handles for removing, the cups would be pulled off or at least bent. The last two cups catch nothing and the greatest amount is found in the first. This trap, 22 in. long by 14 wide and 16 deep, will handle 50 tons of pulp per day, which should be delivered by a sluice the width of the trap instead of from a pipe."

Special Correspondence.

JOHANNESBURG, TRANSVAAL.

The New Year Opens. — East Rand Shaft Sinking. — Bore-Holes and Developmen'.—Base Metals.—Rand Dividends.

The opening of the new year finds things on the Rand in a state of quiet progress, unbroken by any startling events or revolutionary changes. One can only sympathize with the editor of the *South African Mining Journal* in his efforts to fill his pages with novel information or opinions, without falling back upon the stock padding of the 'beneficial influence of amalgamations', or the revival of platitudinous chairman's speeches. Even the Stope Drill Competition fails to provide grist to the journalistic mill. It is true that occasionally some fragments of drilling statistics are published, but these are about as useful and interesting as the assay-values of single sections in development reported by some mining companies in evidence of their good fortune. At the same time, it cannot be said that work is slack upon the Rand. A year ago, when the stock market was brighter and funds readily available for new projects, much work was commenced, which is now steadily proceeding. The starting of vertical shafts is an item of imimportant news which is only followed by another announcement of extreme interest months or even years later, at the striking of the reef. In the Far East Rand today shaft sinking is proceeding upon two properties—the Springs Mines and the Grootvlei Proprietary—which is of the most vital concern to the whole industry, and yet, in its purely current aspect, is of small technical significance. Upon the results obtained in these shafts will largely depend the chances of an enormous area in the East Rand basin being rapidly exploited. Development indications will reflect upon an area, capable of supporting some twenty producing companies, of which at present our knowledge is meagre and only represented by notoriously untrustworthy bore-hole cores. This eastern region, to the south of the better known portion of the East Rand basin that includes the New Modderfontein, Kleinfontein, Van Ryn, Brakpan, and Geduld, constitutes the greatest speculative factor in calculating the Rand's probabilities of long life. Success or failure in the area between and south of Springs and Grootvlei will make a difference of twenty years at least in the estimate. At the meeting of the Lace Proprietary, J. Dale Lace (chairman) referred to the contradictory results of development and diamond-drilling in the East Rand. His own company has been signally unfortunate in its bore-hole assays, so that he has good occasion to express the hope that shafts, if sunk, would produce more encouraging results. It is certainly true that development results in the Brakpan, Modder B, and Van Ryn Deep have been far better than previous drilling led one to anticipate. Though the gold is patchily distributed, the law of averages should have put things straight, and one must still acknowledge the probability of large stretches of unpayable ground occurring in the Far East Rand basin. In the course of his speech Mr. Lace touched upon the labor shortage, and remarked "the labor will be found in an equitable, reasonable, honorable, honest, definite, and uniform native policy." Shareholders at least cannot complain that they do not get good value for their money in the matter of redundant verbiage.

The records of base-metal production in the Transvaal show a small but steady improvement. Results in the tin district of the Rooiberg have been disappointing in some cases, notably the Weynek, whose mill is shut down. The total yield of copper ore, tin ore, galena, lime, and other minerals has been as follows for the years ending June 30: 1906, £88,435; 1907, £147,875; 1908, £218,926; 1909, £321,734; half year ended December 1909, £235,000 (approximated).

F. W. Harbord, the well known steel expert, is now investigating and reporting upon the iron and steel manufacturing prospects of the Transvaal. His caution was indicated by the few remarks he made at a scientific meeting recently. It is recognized that his findings will be as conclusive as anyone's verdict could be in the light of present knowledge. The rumor current, to the effect that his report will be found unfavorable, is therefore most unwelcome.

Compilations of the aggregate Rand dividend distributions for the year show a result of £9,238,396, in respect of 56 companies. This total marks a satisfactory increase on previous returns, as indicated by the following summary.

Year.	Total dividends.
1901	£415,813
1902	2,148,715
1903	3,285,499
1904	3,937,624
1905	4,754,348
1906	5,565,969
1907	6,962,416
1908	8,569,916
1909	9,238,396

The 1909 declaration brings the Rand aggregate from 1887 to date up to £62,982,239. The new contributors are the Main Reef West (the Neumann mine, which has been developing an exceptionally high-grade zone of Main Reef Leader), the New Goch, the West Rand Consolidated (a newly equipped mine), and the Jupiter, which is the 4000-ft. deep property owning part of the famous Simmer Deep mill. After eleven years' absence, the Wolhuter returns to the dividend-paying list with a modest 5% declaration. This mine owes much of its present prosperity to good management, and to an improvement in the lower levels.

PHOENIX, ARIZONA.

Yuma County Mines.—Clara Con. — Bonanza & Golden Eagle.—Planet.—Mack's Ruby.

The mines in Yuma county are now especially active. The Clara Consolidated Gold & Copper Co. is operating at Swansea, 25 miles north from Bouse, the latter a station on the Wickenburg-Parker line of the Santa Fe. Swansea is four miles south of the Bill Williams, among a series of hills, low ranges and ravines drained by that stream. Eight miles farther north is the Planet mine, and still farther is the McCracken, the former principally copper and the latter mainly lead. The Clara Consolidated is one of the enterprises of George Mitchell and his associates, who within two years have developed their mining property, erected a smelting plant, and built a railroad from Bouse to Swansea. The railroad is nearly finished and will have train service inaugurated by March 1. The smelting plant probably will be ready to operate in April. The surface holdings of the company comprise 165 claims, the principal development being on a copper-bearing lode that strikes northeast between a gneiss foot-wall and a schist hanging wall. The lode has a width between walls of 90 to 180 ft., and a dip of 33° northwest. While all the vein filling is claimed to be mineralized, the richest ore occurs in lenses and shoots. It is stated, however, that the greater part of the body of ore will be hoisted and smelted. The composition of the ore, as given by the company's metallurgist, includes the following: iron, 36 to 40%; lime, 3 to 8; silica, 33 to 36; copper, 6 to 8; gold, $1 to $3 per ton. The oxidized and carbonate ores extend, generally, to a depth of 200 ft., and below this depth is a chalcopyrite in the main, though small lenses and streaks of cuprite and carbonate ore are found mixed with the sulphides. The cropping of the lode above described is traceable one mile on the company's ground. The mine openings consist of four shafts. No. 1 sinks vertically to a depth of 408 ft. Starting in the hanging wall, it strikes the vein at 65 ft., and the foot-wall at 310-ft. depth. No. 2 is a 45° incline that is down 285 ft. in the foot-wall. No. 3 is a prospecting shaft not in use. No. 4 is 600 ft. southwest from No. 1, and is to be sunk to 1000 ft. vertically and will become the principal working shaft. It is being sunk in the hanging wall, is now down about 125 ft., and it will strike the vein on its dip at 500 ft. below the surface. This shaft has three compartments, two 4½ by 5 ft. each for cages, and one 4 by 5 ft. for manway. Shafts No. 1, 2, and 4 are each equipped with a gasoline hoist, but No. 4 is to have a 125-hp. geared steam-hoist, which is on the ground ready to be installed. The present wood head-frame will be

replaced by a 99 ft. steel structure. It is stated that there are 1800 ft. of driving from the 200 ft. station and 900 ft. of similar work from the 300 ft. station in shaft No. 1. This includes cross-cuts from wall to wall at a number of places. There is a 6 drill air compressor at No. 1, though the gangue material is soft and does not require power drills to any great extent. The drifts are timbered with 8 by 8 in. tunnel sets and the stope sets are of 10 by 10 in. timbers. The collars of the three working shafts are at the same level, the trackage from them extending to the storage bins at the smelter. Two Jeffrey electric locomotives will be used for hauling ore. At the smelting plant a 700 ton copper furnace, 44 by 280 in., is in position and ready for work. The furnace opens at the top into a Mitchell steel hood, 10 by 26 ft., to serve as a device for precipitating as much as possible of the flue dust. This opens into a main flue, 8 ft. diam. leading into two balloon flues, each 5 by 7 ft. Following this is the brick and concrete dust chamber, 20 ft. wide, 12 ft. high, and 90 ft. long, opening into the steel stack, which when finished will be 150 ft. high. The floor of the dust chamber is of concrete, having hoppers for discharging the flue dust into cars underneath. It is understood that a second furnace will be installed as soon as it can be shipped in over the railroad. Two blowers, to supply the blast for the furnaces, have been set in place, and a third has been shipped. The foundations are in for the steel converter building, which is to contain a 50 ton electric crane and two stands of copper converters. The blast for these will be supplied by a Nordberg low pressure air-compressor. A Westinghouse steam electric generator will serve to operate the electric crane and supply power for the trolley lines of ore and slag cars. The converters are to be manipulated by electric power instead of by hydraulic power. A crusher, set of rolls, and a mud-mill are being installed for preparing the silicious ore for converter lining. The charging cars to be used are to have automatic weighing attachments for weighing the ore and coke before they are dumped directly into the furnaces.

The water supply for smelter, mines, and domestic use is obtained in a well close to Bill Williams river, four miles away, a lift of 600 ft. being necessary. At present a gasoline pump is used to force the water through a 3-in. pipe-line into one wood and two iron tanks situated on a hill above the camp. A steam-pump of larger capacity is to be put in at another place on the river, and a 6-in. pipe-line laid, and much larger storage tanks built.

The Clara and Mora groups, two miles east of Swansea, form a part of the main property. These are being developed and it is expected that they will supply a considerable tonnage of silicious ore for the smelter. Sampling the ore in 100-ton lots from this group is said to have shown that it carries 50% silica and satisfactory amounts of copper and gold. On the staff of the Clara Consolidated are H. L. Browne, general superintendent; Harry Mitchell, superintendent of smelting plant; and N. E. Siprell, mine superintendent.

John B. and Ancil Martin, of Phoenix, control the Bonanza and Golden Eagle M. Co., which owns the old Harqua Hala mines and mill, situated eight miles south of Salome. The property was a rich producer from 1888 to 1894. The two mines in the group, one mile apart, are connected by a tramway. The deepest workings are 400 ft., and on this level is a body of sulphide ore which is said to have assayed 4.8% copper, 1.22 oz. gold, and 5 oz. silver. The equipment includes a 40-stamp mill having amalgamation plates, but no concentrators. During the last three years the property was operated by lessees, but not successfully. It has reverted to the owners, who are developing.

The Planet mine, situated near the Bill Williams, and which is under bond to the Lewisohns, is being explored and developed, with Thomas Varden in charge. The equipment consists of a Rand air-compressor, two Sullivan drills, and two churn-drills for prospecting. A new working shaft is being sunk, and about 30 men are employed.

Near Vicksburg the Yuma Copper Co., owned by Michigan men, is developing some copper claims, and L. S. Judd, in charge of the La Belle M. Co.'s interests, is doing similar work, with a showing of copper and silver in a gangue of limestone and manganese. He has sunk a shaft to a depth of 300 ft. and will now install a gasoline hoist. Mack's Ruby mine, five miles east from Parker, is being explored and developed in the interest of Eastern parties who have it under bond. W. P. Blake, consulting engineer, states that the property has a contact vein, between limestone and schist, the ore consisting of quartz carrying copper and gold.

MEXICO.

Dos Estrellas. — Guanajuato-Chapala Power Agreement. — Amparo. — Nueva Luz Shaft. — Railway Matter. — Oaxaca. — Hamilton-San Juan Litigation.

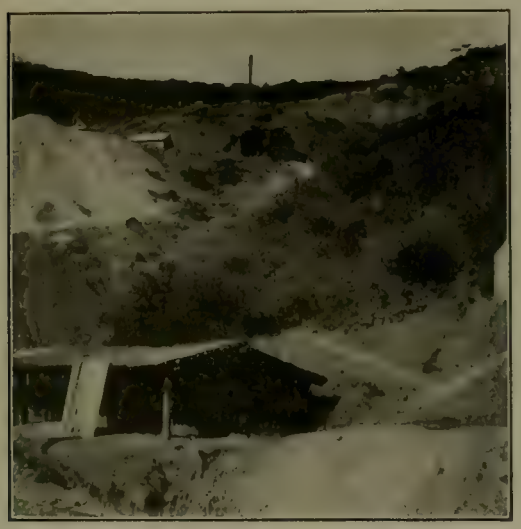
The great Dos Estrellas mine in the El Oro district yielded profits in 1909 of ₱4,226,635. Out of these net returns handsome dividends were paid. In December, which was one of the best months of the year, the ore handled in the two reduction plants amounted to 10,070 tons. The Dos Estrellas is a new mine, and its phenomenal success recalls the fact that in the early days of the Dos Estrellas company the stock, which had a par value of ₱100, and which later reached a value of ₱10,000, sold for a song. The property was located by Francisco J. Fournier, a French engineer, in 1900, and the company formed with a capital of ₱300,000, there being 3000 shares. Two adits were started, but it was not until three years later that these cut the veins, and in the meantime it was with difficulty that the enterprise was sustained. Three veins were developed, and one of these, La Veta Nueva, yields ore running as high as ₱20,000 per ton. This orebody is being held as reserve. When the Dos Estrellas shares reached a value of ₱10,000 each they were deemed unwieldy for trading purposes, and the company was reorganized with shares at a par value of ₱1 each. Fournier's dividends from Dos Estrellas stock, the bulk of which he holds, have made him a multi-millionaire.

An agreement for a division of territory has been entered into by the Guanajuato Power & Electric Co., of Guanajuato, and the Chapala Hydro-Electric & Irrigation Co., of Guadalajara, and as a result the Chapala company will not undertake to transmit power to San Luis Potosí, as proposed, leaving the State to the Guanajuato concern. The agreement covers the States of Guanajuato, Michoacán, Jalisco, Aguascalientes, Zacatecas, and San Luis Potosí. The Chapala company will transmit power to Aguascalientes and Zacatecas, and will start work on the transmission line within a few months. It is estimated that the cost will be ₱1,500,000. The length of the line to Aguascalientes will be 180 kilometres, and from that point to Zacatecas 125 kilometres. The Asientos and Tepezala mining districts of Aguascalientes and the old Zacatecas district will be supplied. The Sultepec Light & Power Co., which recently started the transmission of electric power to the Seguranza Mining Co. in the Zacualpán district of the State of Mexico, is contracting with other concerns in the district, and may transmit power to the Taxco district of Guerrero. Taxco mining men are greatly interested.

The Amparo Mining Co., the only American concern of the State of Jalisco now on a dividend basis, had a production of ₱1,445,000 in 1909. Dividends of 2½% per quarter were paid on a capitalization of more than $2,500,000. Recently the company won a Chancery Court decision involving title to over 500,000 shares of stock held by the Paxon estate of Philadelphia, and this stock has been retired, leaving the capital $2,000,000. It is estimated that the company will this year earn 16% on the present capitalization, and dividends of 3% per quarter will be paid. The company will increase the capacity of its reduction plant more than 1000 tons monthly by the installation of two Krupp tube-mills, three Wilfley concentrators, two Dorr classifiers, one Dorr thickener, and three Pachuca tanks. An average of 5500 tons per month is now handled. Power is promised the company by the Chapala Hydro-Electric & Irrigation Co. in May, and a saving of more than half in operating expenses will result. The ore reserves in the Amparo mines are estimated at 365,000 tons, and the company has 45,000 tons of dump-ore. The Magistral-Ameca Copper Co. expects

to have its 100-ton concentrating plant, using the Elmore process, in commission in April. The crushing equipment is for a capacity of 200 tons daily, and the concentrating equipment will be increased to 200 tons within a year. Later a smelter will be built to handle the concentrate and some ore. The company owns the Magistral mines in the Ameca district of Jalisco, purchased for ₱100,000. The ore in sight comprises 35,000 tons that will assay better than 7% copper, and 150,000 tons that contain 4%. A 25-ton cyanide plant has been erected for experimental purposes by the Philadelphia Copper & Gold Mining Co. The company, which has been developing copper veins for several years, is now opening what promises to be a big gold-silver deposit.

The Nueva Luz shaft of the Mineral Development Co. in the Guanajuato district has reached a depth of 500 metres (1640 ft). The shaft will be put down to a depth of at least 2300 ft., when a cross-cut will be run to intersect the mother lode of the Guanajuato district. The fact that the shaft will prove the district at great depth interested the Government and secured for the company a subsidy. The company is controlled by the Mines Proprietary Company of



The Magistral Mine, Ameca, Jalisco.

America, which also controls the Tajo de Dolores enterprise in the Guanajuato district.

The Southern Pacific extension, building south, has reached the Santiago river in Tepic, 1004 kilometres from Guaymas. The construction forces are being transferred across the river, and the work of carrying the extension on to the city of Tepic, a distance of 96 kilometres, will be soon under way. The distance from the Santiago river to the end of the Southern Pacific track in the State of Jalisco is 271 kilometres (168 miles). In this stretch is included the 20 miles of canyon railroad that will require at least two years to construct and cost from $4,000,000 to $5,000,000. The Southern Pacific has in operation in Jalisco 61 kilometres of track, from Orendain, the junction with the National Railways, 25 miles from Guadalajara, to Magdalena. The National Railways has just let a contract for the construction of a railroad from the city of Durango west to Llano Grande, a distance of 100 kilometres. The line will be of benefit to some Durango mining districts. The mining interests of Mexico are following with much concern the controversy between the National Railways and the foreign employees, which threatens to result in a walk-out of all foreign conductors and engineers. The controversy is over a question of future employment, and is the result of an announcement by Minister Limantour that it is the desire of the Government to Mexicanize the merger roads. As the supply of Mexican engineers and trainmen is limited, a walk-out of foreigners will seriously affect freight traffic, and the mining industry will suffer as a result.

Oaxaca and vicinity suffered a rude shock a week or ten days past. It is hard to conceive of the great majority of the mines of a district the size and extent of Oaxaca all closing, or nearly all, seemingly with one accord, and all at the same time, with no previous arrangement or agreement. But that is just what happened. On January 26 the United States Banking Co., a local branch of the bank of that name in the City of Mexico, closed. Being the only bank managed by English speaking people in Oaxaca, it was the depository of practically all the mining operators in this section. The payroll had gone out for the week before to all the mines. The messengers had not yet come in for the following week. No one, with the exception of one fortunate owner, had the least idea that trouble was impending at the home bank, until the morning that the doors did not open. Even the local manager was uninformed. As the average Mexican mine laborer does not care to know anything about bank failures, there was a mighty gathering of managers to see where the money was coming from for the following Saturday payroll. Only money talks with the Indians, and it is not always safe to disappoint them. Telegrams were sent galore, and by hook or crook, all were provided with money, but the greater part of the work was closed that same night, to await receipt of money. In some cases of smaller prospectors work will stop till the bank reopens, and this may be a matter of months.

The recent decision of Judge Calderón, granting amparo in the appeal of C. A. Hamilton to recover the San Juan mine, again brings up this well known case, which is not wholly understood by the majority of mining men. The San Juan property consists of ten claims, located about 1902 in the heart of the Taviche district. The original and then owner was Juan Baigts, who was also owner of the nearby Escuadra group of mines. Mr. Hamilton was responsible for the forming of a company for the purchase of the Escuadra group in 1902, which company took them over on a payment of ₱100,000, a further payment of ₱350,000 to be made at a later date. About the same time another company, officered in part by the same men, took over the San Juan mines, on payment of ₱10,000, receiving a deed with a clause therein that the latter deal was contingent on the Escuadra purchase, and it is supposed that the San Juan property was merely given as a commission at a nominal price, to Mr. Hamilton and associates, for having engineered the Escuadra sale. The latter sale never went beyond the first payment, of ₱100,000, operators being forced to give up possession after having taken out probably much more ore than was in the original payment, but they did receive an extension of some months on the option, when the second payment was not promptly forthcoming. The last fact is supposed to have an important legal bearing on the claims of the Hamilton interests as to the validity of their title to the San Juan property. Mr. Hamilton, for the San Juan company, as soon as they acquired the property, began taking out ore, and during their occupancy of nearly four years, extracted in the neighborhood of ₱1,000,000, but soon after the sale of the Escuadra was declared void, Baigts began action for the recovery of the San Juan, alleging that the conditions of the transfer had not been fulfilled. In the early part of 1907 a decision was given, which had the effect, later in the year, of recovering for Mr. Baigts, the San Juan properties.

In the summer of 1909, Mr. Hamilton made a trip to the United States, and returned with L. R. Wilfley, well known in connection with the United States courts in China and the Philippines, who at once assumed active charge of the case in Mr. Hamilton's interest. Rumors are current that Mr. Hamilton reached the Presidential ear in securing the help of Judge Wilfley, which, however, is apart from the merits of the case. In November of last year, application was made in the district court of Mexico City, for re-opening of the case, commonly known as amparo. This was granted January 5, 1910. The decision of the lower court is now in the Supreme Court and if confirmed it will have the effect of re-opening the case, and may result in the recovery of the San Juan by Mr. Hamilton and associates.

This would have a wide influence on the Oaxaca camp. The work as conducted under Mr. Baigts' administration, has been with no idea of treating the low-grade ores, and

the property is not being developed for a treatment plant. The fact of the property having been lost to Mr. Hamilton has undoubtedly influenced others to suspend or drag meritorious properties, partly with the non-completion of the Favreche railroad, which Mr. Hamilton was also exploiting. Now, however, the road is being completed by the Mexican Southern Railroad Co., and if Mr. Hamilton should recover the property, it would mean a vigorous revival for the Oaxaca camp. The merits of the case are very hard to analyze, and I have no desire to pass on the same pro or con, but it seems certain that it would benefit mining in Oaxaca should Hamilton recover the property in litigation.

BUTTE, MONTANA.

January Production.—Zinc Mining. — Idaho-Montana. — Corbin Mines.

The Butte mines started 1910 with a monthly production of copper about 8,000,000 lb. below the normal, and production probably will be curtailed for some time by agreement. Because of labor troubles and other hindering causes the production in December was reduced to a little more than 14,000,000 lb., compared with a normal production of 28,000,000. In January it was increased to a little more than 19,000,000, and a few million pounds may be added in February, but under present conditions the production will be held down from 15 to 20% below the normal. A few of the mines in which the cost of production is above the average will remain closed. The total tonnage of ore and the production of copper by companies in January were as follows:

Companies.	Tons of Ore.	Pounds of Copper.
Boston & Montana	50,000	3,500,000
Anaconda	106,950	6,523,950
Butte & Boston	5,400	334,800
Washoe	6,200	378,200
Parrot	3,875	248,000
Trenton	12,400	744,000
North Butte	37,200	2,604,000
Butte Coalition	49,600	3,224,000
Original	15,000	990,000
East Butte	9,300	576,600
Miscellaneous	1,500	100,750
Totals	297,425	19,224,300

The growing activity in zinc mining in the Butte district has revived interest in the old Emma mine, once the property of the Butte Mining & Development Co., and now owned by the Butte Copper & Zinc Co. It has been reported that fully half a million tons of zinc ore is in sight in the mine, and that the ore carries a high percentage of that mineral. In order to make an examination of the vein and sample the ore a contract has been let to unwater the mine to the 200-ft. level. The shaft itself is 1200 ft. deep. It is possible, if examinations sustain the report of engineers, made some years ago, that new capital will become interested in the Emma.

Development is going on at the Raven mine, the shaft, an incline, having reached a depth of 1500 ft., at which point a new level is to be opened. This gives a vertical depth of 1300 ft., and ought to be deep enough to show an encouraging or discouraging condition of the vein, though it will hardly be deep enough to disclose commercial ore. The stockholders of the Ida-Montana Mining Co., at a special meeting, voted to transfer all of the property, consisting of three good claims on the east side of the Butte district, to a new company to be organized with a capitalization of $3,000,000. The reorganization was necessary in order to raise money with which to pay off the obligations of the old company and provide a working fund. The mine has been developed to a depth of 480 ft., and one level, at the 250, has been opened on the vein where some good commercial ore was found. The panic of 1907 compelled a suspension of operations. The Corbin Copper Co. will install the machinery for the first 100-ton unit of its concentrator as soon as it arrives. It was shipped from Milwaukee several weeks ago. The foundation for the mill has been completed, and the superintendent says there is ore enough blocked out in the Dewey adit to keep the mill running for nine months, while more ore is being added to the reserve at the rate of 110 ft. per month the vein being fully 20 ft. wide. Another adit is being driven on the same claim farther down the hill, and another vein series is being developed on the opposite side of the gulch. The Robert Emmet Copper Co. is now supplying the Blue Bird mine, in the Corbin-Wickes district, with electric power. The Robert Emmet is also preparing to furnish power to other mines in the district. It is the first company operating there to install a complete power plant of its own. The high-tension line of the United Missouri River Power Co. passes close to the property. The Michigan & Montana Development Co., operating the Blue Bird, is the largest shipper of the district. Its contract with the Robert Emmet is for five years and secures power at a cost of about one-third that of steam.

RHYOLITE, NEVADA.

Mayflower Con.—Bullfrog Pioneer.—Johnnie.—Tecopa.

At a special stockholders' meeting of the Mayflower Consolidated Mining Co., held at Rhyolite on February 5, a complete reorganization of the company was effected in directorate and management, the directors electing the following officers: Charles T. Dunbar, president; E. S. Drury, vice-president; Charles F. Ryan, secretary; and F. H. Stickney treasurer. The First National Bank of Rhyolite was designated as the stock repository and transfer office, in stead of the Mercantile Trust Co. of San Francisco. In order to provide for the indebtedness created by the previous management a resolution was adopted authorizing the directors to lease or bond the property. Subsequently some of the principal stockholders organized the Mayflower Leasing Co., to which the directors granted a lease of the Mayflower estate for four years. The leasing company will assume all indebtedness of the mining company, and will pay 25% of the first profits to the treasury of the Mayflower Consolidated Mining Co., and 25% to liquidate its indebtedness until all is cancelled, when 50% of the profit will be paid as royalty. The leasing company is capitalized at 100,000 shares of the par value of $1, and a block of 30,000 shares if offered pro rata to the stockholders of the mining company until March 1 at par. A. Sydney Additon is consulting engineer and will have charge of mining operations. At the annual meeting of the Bullfrog Pioneer Leasing & Milling Co., held at Rhyolite on February 7, the following officers were elected for the ensuing year: F. H. Stickney, president and treasurer; Samuel H. Bradbury, vice-president; F. P. Hearns, secretary; and E. L. Jernaghan, assistant secretary. The company is now shipping five cars of ore of about 35 tons each per week. Extension of drifts in a northeasterly direction have opened on the 110 and 156-ft. levels a better grade of ore than has been found for some time. On the 110-ft. level a 30-ft. shoot of high-grade ore has been opened. A circular letter will be sent soon to the stockholders, containing reports of treasurer, president, superintendent, and chairman of executive committee. The mill of the Nevada Ore Treating Co. at Beatty is nearing completion, and will be in operation shortly. The Wiswell electro-chemical amalgamation process is to be used. It is reported that the capacity of the mill of the Crystal Bullfrog Milling Co., near Gold Center, is to be doubled. The management of the Johnnie Mining & Milling Co., at Johnnie, has undergone a change by which A. D. Myers and associates again come into control. The new officers are: L. J. Cristopher, president; A. P. Pohnson, vice-president; M. S. Gregory, treasurer; F. A. Johnston, general manager; with A. D. Myers on the directorate. It is claimed that the present output of the mine is 100 tons per day of ore assaying from $4 to $15 per ton, which is mined and treated at a cost of $3.50; and it is announced that the mill will be increased to treat 200 tons per day, practically requiring a doubling of the present equipment. In doing the annual assessment work on the property of the Tecopa Gunsight Mining Co., situated about six miles east of Tecopa, Inyo county, California, J. C. Kennedy, of Rhyolite, cut the apex of a blind vein of good shipping ore. The ore at present is

mainly lead carbonate, containing large chunks of galena, and assays well in silver with a small amount of gold. The company owns a group of nine claims joining the property of the Tecopa Consolidated Mining Co. on the north. Ore has been found in several places on the group. The latest and best find is near the Gunsight mine and lies in the same limestone which is here underlaid by a laminated granite cut at a number of places by dikes of diorite. The Consolidated company has finished its railway line to its mines, and has got in its own rolling stock, while the construction of the balanced tramway leading from the receiving to the loading bin is well under way. It is expected that the extraction and shipping of ore will soon be started.

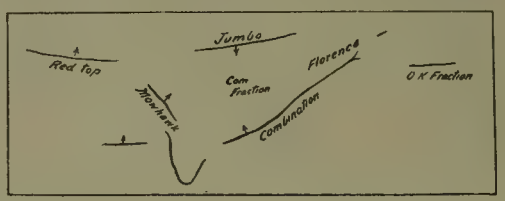
GOLDFIELD, NEVADA.

Copper Rumor False. — Consolidated Mill and Development.—Florence.—Poleverde.—Black Butte.—Yellow Tiger.—Sandstorm.—Kendall Consolidated.

Reports that copper is being found to replace gold in the ore at deeper levels of the Consolidated mines, are emphatically refuted by the manager, J. R. Finlay, and by others who are familiar with the geological conditions. Mr. Finlay gives the most convincing assurances that the copper content of the ore and the vein at the 1000-ft. level is no greater proportionately than elsewhere. The rumor has been used to bear stocks and has aroused widespread interest and no little alarm. It emanated from an irresponsible source. Copper, chiefly in the form of tetrahedrite, is present in nearly all the ore mined in the Goldfield district, but is negligible in quantity excepting for occasional small seams or nodules which afford samples rich in the metal. But one small shipment of ore has been made from which there was a return for copper. This came from a depth of out 150 ft. in the Victor workings of the C. O. D. Consolidated. Copper in larger proportion than elsewhere is found in the Victor, in the Annex shaft on the Poleverde claim, and in parts of the Florence mine, particularly in the workings of the former Rogers syndicate lease, south of the Florence hill. At the 200-ft. level of the Florence there is, in places, far more copper than at any point in the Consolidated mines. At no point, however, is the copper content sufficient to materially affect the treatment of the product. The Consolidated mill is reported to be treating over 850 tons of ore daily, and the mill heads have been maintained at nearly the former figure, above $35 per ton. A heavy production is now being made from the orebodies exposed in the Clermont where stoping is in progress at the 600, 750, and 900-ft., as well as at two intermediate levels. The orebody at the 750 has been opened to great width and affords reserves in volume far exceeding anything anticipated. On the 900-ft. level the vein has been opened for over 300 ft. showing ore of excellent quality for good width. It has not yet been cut at the 1000-ft. level, but another week's driving may bring the face of the drift into the ore-shoot. There has been no expectation that the ore would be cut before this time, despite the many published reports to the contrary, and the manager is authority for the statement that conditions of formation at the 900 and 1000-ft. levels are identical and there is no indication that the ore-shoot will be found less productive at 1000 than at 900 ft. George Wingfield, president of the Consolidated company, is now in Goldfield and will leave shortly, accompanied by A. H. Howe, for New York, to attend the regular quarterly meeting of directors. They will be joined at Reno, probably, by W. C. Ralston and J. H. Mackenzie, and it is expected that all the directors will attend the meeting which is of particular interest from the fact that the amount of the next and of future dividends will be determined upon as also the prospect of establishing regular payments of 50, instead of 30c., quarterly.

In the Florence mine the reserves of good ore are being constantly augmented by development. Willis Lawrence, the manager, is having the large stopes near the Little-Florence shaft filled with broken ore with which to supply the mill over the aerial tramway during the time when the work of enlarging the main shaft is in progress. Stopes of large size are being opened near the main workings and two of the strongest ore-shoots are being mined at three levels. He says that two machine-drills are breaking sufficient ore to supply the mill, which is treating over 160 tons daily, and that enough ore is broken and ready to hoist to occupy the plant to its full capacity for over two months, with additional reserves blocked and in condition to break at short notice sufficient to run the mill for several months. At the northern extremity of the Florence claim the ground formerly embraced in the rich Reilly lease is being opened from a drift at the 350-ft. level. All of this lease's production of nearly $1,000,000 in high-grade ore came from above the depth of 260 ft. Immediately adjoining the boundary line the Consolidated miners are stoping ore from this vein at the No. 4 and No. 5 levels.

Driving on the vein exposed near the 800-ft. level of the Annex workings on the Poleverde claim will be begun immediately upon the completion of the large station at that depth. In cutting the station the ore-shoot passed through by the shaft in sinking, has again been found, and shows 5 ft. of ore averaging above $50 per ton. The shaft will be continued to the 1000-ft. level at least, and a second cable has been placed on the double-drum hoist to permit of sinking and driving simultaneously. The Grizzly Bear shaft, on the Jumbo, is down 945 ft., and it is expected,



Relations of Veins at Goldfield.

from indications in the Clermont, that the hanging wall of the Mohawk vein will be penetrated near the 1000-ft. level. The shaft is being sunk 5 ft. daily with three shifts and power-drills. The ore-shoot recently opened in a winze on the Diamondfield Black Butte will be tapped by means of a raise driven from the lower tunnel in the hill on the north side. The vein has shown consistent improvement in the winze, carrying 36 in. of pay-ore some of which has assayed $500 per ton and the walls, porphyry and quartzite, are well defined at the deepest point reached. The reorganization of the Black Butte company on the assessable stock basis is progressing and is meeting with a gratifying response from stockholders, many of whom are sending in their shares for exchange, accompanied by the additional payment required of 1c. per share. The Combination Fraction shaft is nearing a depth of 800 ft. under the supervision of the new manager, Charles D. Wilkinson. Operations have been resumed on the Yellow Tiger and the shaft is being unwatered below the 700-ft. level where a vein of large size and containing ore of medium grade was developed at a point 380 ft. west of the shaft. The re-constructed company, headed by John F. Campion, of Colorado, has provided a fund of $50,000 for further work. W. F. Gray and B. E. Thomas are sacking ore of excellent quality in the Gold Bar workings of the C. O. D. Consolidated, upon which they have a five-year lease. Mr. Thomas will go, in a few days, to Denver, where experiments on a quantity of the ore are being conducted to determine the character of mill to be installed by the lessees. This mill will also treat the product of the Thomas lease on Columbia mountain where a raise will be driven from the 1100-ft. tunnel to reach the ore-shoot opened at 140 ft. in the shaft. The manner of organization of the Sandstorm-Kendall Consolidated Mining Co. has been determined and will be carried into effect at once. The John S. Cook bank, of which Mr. Wingfield is president and to which the two mining companies owe over $50,000, will proceed at once to secure a judgment against the companies. The property will be turned over to Wingfield for the sum of the indebtedness. The companies will then be merged under the above name and re-incorporated upon the assessable stock basis with 1,500,000 shares exchangeable at equal value for the old stock.

LONDON.

West Coast of Africa and G. A. Stockfeld's Work.—Taquah and Abosso Show Good Results.

The African West Coast now occupies a good deal of the attention of the London mining market. In much that has been written recently on the subject, I do not consider that enough has been said about the services of G. A. Stockfeld exerted in the proper opening up of this country. Mr. Stockfeld has been associated with the country continuously for a longer period than most engineers that have been there, and he probably knows more of the country than anybody now living. It was entirely due to his success in the Tarkwa district that the Consolidated Gold Fields, Wernher, Beit & Co., and others came to the conclusion that the adjoining properties should be developed and purchased. A history of the work done by Mr. Stockfeld's companies, the Taquah and the Abosso, is interesting reading at the present time. These two mines were originally brought to the notice of English investors as long ago as 1888, during the first of the three West African booms, and for many years with indifferent results. However, since 1901 when the two mines were taken over by separate organizations progress has been rapid. The report of the Taquah for the year ended June 30, 1909, shows that operations have been considerably impeded by shortness of labor, and the mill was not working more than 67% of its capacity. The amount of ore treated was 56,793 tons and the production in the mill and cyanide plant was 37,197 oz. realizing £157,904, being an extraction of 13.09 dwt. or £2 15s. 7d. per ton. During the early months of 1909 the mill ran below its capacity, but since the close of the financial year conditions have greatly improved. Under the circumstances it has not been possible to reduce the cost to the extent contemplated and naturally the profits have been less than if the mill had been at work continuously. The mining cost was £111,555 and £18,457 was allowed for redemption of development account. After paying London office and other expenses, a balance of profit of £24,381 was made on the year's work. The sum of £22,859 was written off for depreciation, and on the other side of the account there is the additional income of £12,000 being a dividend of 10% on the company's holding in the Abosso company. The company began the year with a balance in hand of £56,748, and £38,747 has been distributed to shareholders and holders of income boards, being at the rate of 10% on both classes of holding. The sum of £13,971 is carried forward. Mr. Stockfeld reports that during the year under review the development work has consisted chiefly of sinking another shaft to the south of the main shaft and making the necessary connections between the two. He intends to commence a third shaft to the north and to work the three conjointly. At the present time only 40% of the length of the lode has been exploited, but with the three shafts the entire length will be opened up. The main shaft is now down 1096 ft. and the levels No. 6 and No. 7 are being developed. The ore reserve on June 30 was estimated at 141,187 tons averaging 15.6 dwt. The company has sold its dredging rights on the Ancobra river to the newly formed Ancobra Exploration & Dredging Co. During the year Arthur Wilkinson, acting for Wernher, Beit & Co., paid a visit of inspection to the Taquah and Abosso mines and reported in flattering terms on the mines and the method of development.

The Abosso mine is at a short distance from the Taquah, and is separated from it by the Abbontiakoon and the Fanti. The report for the year covering the same period shows that 60,702 tons of ore yielded by amalgamation and cyanide 32,607 oz. of gold of the value of £138,466, the extraction being 10.74 dwt. or 45s. 7d. per ton. Trouble has been experienced at this mine as well as at the Taquah, owing to the shortage of labor. Rock-drills had to be used for stoping and close sorting was impossible, so that the average ore sent to the mill was of lower grade than it would have been had more labor been available. Also some repairs had to be made in the battery foundations. These two causes made the output of the plant less than usual. Since the end of the year covered by the report, better labor supplies have been obtained, and the output costs and profits are normal. The mine is opening well and the reserve on June 30 was 350,888 tons of milling ore averaging 14.4 dwt. The main shaft is down 1359 ft. and the vein is strong and continuous on all the levels from the No. 6 to No. 9. At the 1200 ft. level No. 10 has been commenced and is giving good results. The prospects are so good that Mr. Stockfeld has recommended doubling the number of stamps from 50 to 100, the new stamps to be 1500 lb. in weight as compared with 1250 lb. in the present mill. The enlarged plant will then treat 200,000 tons per year. In order to provide the necessary funds 50,491 shares have been issued at 11s. each and sold among the present shareholders. It has been decided also to erect a slime plant, and experiments are being made in re-grinding with a view to increasing the capacity of the plant. During the year under review the cost at the mine was £81,861 and £13,657 was charged against development. The allowance for depreciation, etc., was £13,246 and taxes absorbed £5459. The dividends paid have amounted to £54,950. The outlook for this company is excellent, and the only cause for anxiety is the supply of labor. However, as the association for recruiting has been formed and the active support of the Government has been given, this disadvantage will be overcome.

DENVER.

Accidents in Mines.—Cripple Creek News.—Isabella and Portland Annual Meetings.

On January 16 a peculiar accident happened to the miners who were trimming the sides and roof of the Gunnison tunnel. They had placed several shots and had retreated to a safe distance. The force of the explosion reversed the air current, and eleven of the men engaged in the work were either smothered at once, or so badly overcome by the gases that they died in a few days. The explosion at the Primero coal mine in the Trinidad field on January 31 was the worst that has occurred in Colorado for some years. At least seventy-five men were killed. On January 29, 1907, a similar explosion in this mine killed twenty-four men. Knowing that the mine was dangerous, the Colorado Fuel & Iron Co. had taken every possible precaution as regards ventilation, safety lamps, and mine regulations. The State mine inspector had examined the mine in December last and pronounced it in first-class condition. The cause of the explosion may never be known.

The Cripple Creek deep drainage tunnel advanced 282 ft. during January, and is now in 12,378 ft. from the portal. It is estimated that it will take eight months to complete the remaining 3122 ft. to the main water course of the district. The production from the camp for January amounted to $1,290,440, which was very satisfactory considering that the surface work and hauling had to be suspended on many days because of the intense cold. Three companies paid dividends in January, amounting to $112,500. The Doctor-Jack Pot has announced a one-half cent per share dividend payable March 1. The Midget-Bonanza Gold Mining & Milling Co. of St. Louis, has purchased the properties of the Midget Mining & Milling Co., and the Gold Hill Bonanza Mining Co., in the Cripple Creek district. The property contains about 30 acres situated on Gold hill. The Midget is one of the best small producers in the camp, and sends its milling ore to the Gold Issue mill two miles distant by aerial tram.

Reports of a find in the Isabella mine have been freely circulated of late. It was said that 'picture ore' of the same high value as that of a famous shipment which realized in excess of $200,000 for one single carload had been found. The ore is reported as coming from the 1000-ft. level of the Lee shaft. The report is evidently wrong as the only work of any importance that is being done is between the third and fourth levels from the Lee shaft, where moderately good returns are being obtained. The Empire ground of the Isabella company is under lease to the Western Investment Co. In Cheyenne, Wyoming, on February 7, the Portland and Isabella annual meetings of stockholders were held. While the Portland meeting developed no sensation and resulted in the returning of the old board of directors, there was a protesting faction in the picturesque figure of James F.

Burns, who has opposed the present management since the time that he was deposed from the presidency of this company several years ago. Mr. Burns loudly declaims against what he characterizes as 'company mismanagement', and freely predicts that the new Portland mill will not successfully handle the ore. This is in keeping with his 'rule or ruin' policy. The Portland company's net earnings for 1909 were $425,444, of which $350,000 was distributed in dividends. The gross production was 83,908 tons of a value of $1,438,650. The Isabella meeting developed a contest which is still in the hands of the credentials committee, with a duplication of several hundred proxies which are going into the 'trouble pile' for subsequent consideration. A *viva voce* vote was taken at the meeting in respect to a substitute motion in which James F. Burns sought to increase the number of the credentials committee to three persons. This show of strength developed the fact that the Burns-Hays factions, which are allied in this contest, were in minority and no third member was elected to this committee. While the votes represented showed largely in excess of the total outstanding stock, this was accounted for by proxies subject to revocation on both sides. Thomas Kelley, E. E. Guentin, A. J. Stybr, A. C. Gardner, and Tyson Dines were finally elected as directors. The annual report of the Isabella Mines Co. shows a cash balance of $81,434. The gross receipts from ore sales for the year are given at $187,542, and total expenditure aggregated $204,516, showing a deficit in mine operation for the year 1909. In his report Mr. Kilborn, the manager, announces that the indebtedness of the company to the extent of more than $100,000 has been paid in the last few years, a cyanide mill has been built and paid for, and additional machinery has been installed in the mine. The meeting of the El Paso company is expected to be bitterly contested between the Burris and Bernard factions. This meeting will be held in Cheyenne in the next few days. The holing that was made from the Burleigh tunnel and west Phillips drift into the shaft workings of the Seven Thirty mine early in December has left in its wake so much rock and refuse that the Burleigh bore is blocked for nearly 3000 ft. The west Phillips drift is badly wrecked and numerous caves will have to be caught up before the production from lessees in the mine can be handled through the main tunnel. It is estimated that it will require 60 days to clean up and get working access to the lower workings of the Seven Thirty vein. Several of the lessees, particularly those operating at the zero level on the Seven Thirty, report a good showing and high assays in silver ores.

NEW YORK.

Copper Producers Figures.—Golden Cycle Sold.—Campo Morado and Tajo de Dolores.—Ely-Central.

The showing made by the figures of the Copper Producers' Association given out February 10, are gratifying, and a much firmer tone is anticipated in the copper metal market. While it was expected that a healthy decrease in surplus stocks would be shown, probably about 30,000,000 lb., it was thought that such result would be due in no small part to curtailed production. It is something of a surprise, therefore, to note that, while surplus stocks have been cut down something more than 43,000,000 lb., such inroad was made not through a cutting down of production but by a wonderful increase in consumption, both for domestic account and for export. Production for the month just past was 116,547,287 lb., as compared with December's production of 117,282,655, showing only a nominal curtailment of 1,281,368 lb. The consumption for January for domestic account was 78,158,387, as against a consumption in December of 69,519,501, an increase of 8,638,886 lb. A still greater increase in consumption was scored in the account for export, being for January, 81,691,672, as against exports for December of 59,540,570, an increase of 22,151,102 lb. The figures show that there was a rush of metal abroad toward the close of the month, which was too late to get into the Government export reports. The cutting down of surplus stocks is the first material inroad made in the copper surplus since last July, when there was a decrease of 32,261,454 lb. The forecast is for a further lessening of production for the present month, and were it not for the large accumulations of copper abroad, there would unquestionably be a sharp advance in the market, and 15c. copper is expected before midsummer. A strong market for copper is one of the prequisites to successful flotation of the much discussed copper merger, as it will be necessary to show the public a profit in the operation of some of the high-cost producers that must of necessity be taken into the consolidation. As to the copper merger itself, it seems to be pretty generally taken for granted that the larger plans have been shelved indefinitely. The Guggenheim interests appear to have abandoned efforts to secure complete control of Nevada Con., while as to the plans for the enlarged Anaconda company, no further steps can be taken until the meeting of the stockholders to be held March 23. Adolph Lewisohn resigned from the board of directors of the British Columbia Copper Co. at the annual meeting held on Tuesday of this week. John T. Milliken, of St. Louis, announces that he has sold the Golden Cycle of Cripple Creek to the Consolidated Goldfields Co. of London, on a basis of $4 per share for the 2,000,000 shares. In the deal Mr. Milliken, with whom is associated Frank G. Logan, formerly of the firm of Logan & Bryan, has formed a syndicate for the underwriting of one-third of the stock. They and their associates have completed the purchase of the Provincial mine at Cobalt, and have organized the Cobalt Provincial Mining Co., Limited.

Advices by letter from Mexico City state that the engineers of the Exploration Co., Ltd., of London, have completed their examination of the Campo Morado, in the State of Guerrero, Mexico; and that, upon the report; the Exploration company has offered José M. Ortiz $8,000,000 gold for the property. The price asked by him is $10,000,000, and mining men who are familiar with the property have been offering to wager their friends in the Engineers' Club here that the offer will be rejected. American shareholders of Camp Bird, Ltd., were sent application blanks and notified that all shareholders would have preferential treatment in the issue of new shares and debentures. These blanks reached the United States about January 10 to 15. Those who promptly filled them out and returned them to the company with checks were advised that their applications were too late, the books having closed January 6. The machinery for the mill being erected at the Tajo de Dolores mine at Guanajuato has been ordered, and Mr. McCord, the manager, has returned to Mexico. The mill will have 250 tons daily capacity, with 40 stamps set for coarse crushing; Diester concentrating tables; Schmidt tube-mills; Pachuca tanks, and Sweetland filter-presses. The iron and steel parts have been bought from the Midvale Steel Co., the Chrome Steel Works, the Hammond Iron Works, the George E. Cresson Co., and the El Paso Foundry & Machine Co. Twelve Westinghouse motors will be used; the compressor plant is furnished by the Ingersoll-Rand Co., and the conveyor plant by the Robins Conveying Belt Co. The funds for the erection of the mill are being furnished by the Proprietary Mines Co. of America, the holding company which also controls the Mineral Development Co., operating the Nueva Luz mine in the same camp. The Nueva Luz shaft is reported to be now 1687 ft. deep.

The articles appearing in *The Engineering & Mining Journal* on November 6, 1909, and previously, relating to the Ely Central Copper Co. and the manner of its promotion and the personnel of the promoters, B. H. Scheftels & Co., are made the grounds for lawsuits against the periodical by B. H. Scheftels & Co. and by its president, B. H. Scheftels personally, for $750,000 and $100,000 respectively. The good faith of *The Engineering & Mining Journal* in the publication of the articles mentioned is attacked, and the claim is made that such publication was for the purpose of depressing the market in the stock. The episode created a great deal of discussion at the time, and the market in Ely Central sold down from $4 to $1.50. The ensuing controversy was such that the stock has never recovered its former price-levels. It is now stated that B. H. Scheftels & Co. intend to use the recently completed report of Walter Harvey Weed as ammunition in proving the statements made by *The Engineering & Mining Journal* to have been without foundation.

General Mining News.

ALASKA.

Joseph H. Houston and associates of Seward have secured four sections of hydraulic and placer ground suitable for dredging along the line of the Alaska Central railroad about 23 miles from Seward. The ground has been thoroughly prospected and the operators have acquired two water rights, giving an adequate supply for hydraulic mining. New hydraulic equipment will be installed and a dredge erected on the property this spring.

ARIZONA.

COCHISE COUNTY.

The orebody that was opened recently on the 400-ft. level of the Copper Queen property at Bisbee, between the Czar and Holbrook shafts, has been found in drift No. 364 on the 300-ft. level, and work has now been started to cut the same shoot on the 500-ft. level. The drift on the 600-ft. level of the Spray shaft to the Holbrook has been completed and a pump station is being cut. At the Sacramento 2010 tons of ore have been hoisted in two 8-hr. shifts, and as soon as the chute is finished on the 1400-ft. level of the Lowell shaft, all the ore will be hoisted this way. —A new level has been started at the 450-ft. point in the Mag shaft of the Calumet & Arizona property.——At the Briggs shaft of the Superior & Pittsburg, sinking has been stopped temporarily at the 1200-ft. level, as considerable water has been found and new pumps will be installed to handle the extra flow ——The adit of the Bisbee-Sonora Mining Co., in the Bisbee district, is nearly completed. The ore will be cut at a depth of 275 ft., and the company is preparing to ship a large amount of high-grade ore that has been stored on the upper dump. The new hoist has been installed at the Bisbee Extension and sinking resumed at the 600-ft. level.

GILA COUNTY.

(Special Correspondence).—The 185-hp. hoist has arrived at the Inspiration Copper Co.'s tunnel site in Keystone gulch, and is now being installed, the concrete foundation having been completed for several days. At the Joe Bush shaft, the new 60-hp. hoist installation is well under way. Ten mine cars and two skips have just arrived at this shaft. T. R. Drummond is general manager.——Timber sets for the second tramming level are being put in the No. 4 shaft of the Miami Copper Co. The capacity of the concentrator now under construction will be 3000 tons of ore per day, the foundations for three additional units being under construction at the present time. The foundation work for the engines to be installed in the new power house is well under way and the setting of the concrete for the walls of the building has been commenced. On the 370-ft. level of the mine, driving toward the Captain claim, at the southwest corner of the property, is in progress, but this work has not yet reached the orebody drilled into at this part of the property by the churn-drills.——Five working faces are being advanced on the 300-ft. level of the Live Oak property. Four of these are drifts and the fifth is a raise, now 90 ft. high. All five of these workings have been in ore assaying about 2.7% copper. A 10-drill air-compressor which arrived last week will be installed at the Sulphide adit within a few days and two 100-hp. boilers are expected to arrive soon. A. Ball is superintendent.——An inclined, double-compartment shaft is to be sunk on the Old Dominion vein at the Arizona-Michigan property to connect with the drift from the 500-ft. level of the Telfair shaft, about 950 ft. northward. N. A. Nelson is superintendent.——Shipments of 50 tons per day of 9% copper ore are being made regularly by the Superior & Boston Copper Co. to the Arizona-Commercial smelter, situated a short distance west of the McGaw shaft, through which all of the ore from the Superior & Boston mine will be hoisted in the future. Two levels have been established from this shaft, one at a depth of 400 ft.; the other at 600 ft. Most of the ore shipped is being mined at the 600-ft. level near the Great Eastern winze which connects the two levels and follows the Great Eastern vein 20 ft. below the 500-ft. Sinking will be resumed in the McGaw shaft as soon as the 1000-gal. pump has been installed at the 500-ft. level and a 3000-gal. sump has been cut. J. D. Warwick is superintendent.

Globe, February 11.

MOHAVE COUNTY.

The Gold Road mill, which was very much hampered throughout December and a part of January by the unusually severe cold, has picked up steadily the last 15 days and is now shipping precipitate aggregating $60,000 per month. Nearly all the ore is being drawn from the 500-ft. stopes and since the ore blocked out in the three lower levels is known to be of a better grade, the mill output is expected to increase from this time. The No. 2 air shaft, 700 ft. west from the Billy Bryan shaft, is down 29 ft., and is being equipped with hoist and machine drills preparatory to sinking about 600 ft.——E. H. Barton, superintendent of the Gold Crown mine at Union Pass, is making an examination of the Ruth mine in the Silver Creek district for a New York company.— The Bi Metal mine is no longer under bond to John Hays Hammond. The manager, E. M. Lamont, returned from a final conference with B. F. Keith representing Hammond in Los Angeles, and announced that though the mine had held up to all examinations, terms could not be agreed upon. Mr. Lamont left at once for Denver to arrange for the erection of a larger mill, which will probably include 40 stamps and four Huntingtons.—— The Bellflower prospect, three miles west of the Bi Metal, has been bonded by Rothe & Jones to H. M. Bowen and associates of Los Angeles.——S. R. Porter, of Los Angeles, has put a small force of men at work at the old Keystone mine pending the arrival of machinery, several cars of which are already on the way.——The Golconda zinc mine paid its fifth dividend of 1c. per share on February 10.

CALIFORNIA.

EL DORADO COUNTY.

Work is soon to commence upon the Lady Edner mine, a new property near Omo ranch, which has excellent prospects.

KERN COUNTY.

(Special Correspondence).—F. E. Norton, who is operating a lease on a portion of the Butte mine, received $250 from a run of 2½ tons that he sent to the mill last week. ——The return on 24 tons from the lease of Edward Shipsey on a portion of the Butte property amounted to $1400. ——While doing the assessment work on the William R. claim, of Houser, Byrne & Williams, Frank Feldman, who has a two-year lease on the property, took out four tons of ore that milled $450.——This week C. G. Illingsworth sent 10 tons of ore from the Pearl Wedge mine, in the Stringer district, to the mill for which he received $1700. This is the third lot of ore from this property that has been milled since last November, the other two netting $1800 and $1300, respectively. The present discovery was opened when cutting into the foot-wall on the 79-ft. level. The property is credited with a production of $200,000 since 1898.——Work is being continued at the Merced property adjoining the Pearl Wedge.——The Carona Mining Co. has shipped a lot of ore from its property to the Red Dog mill at Johannesburg to test its value.——The adit being driven by Gunderson Brothers on the Golden Link property, in the Stringer district, has cut a large body of low-grade ore.

Randsburg, February 14.

NEVADA COUNTY.

The Morydena Mining Co. is planning to resume operations at its property on Kentucky ridge southwest of Grass Valley. Preliminary work has been started, and in a short time an adit will be commenced that will cut the ore opened by the old shaft at considerable depth.——At the Pittsburg the mill is idle, temporarily, while the ore recently opened on the 1000-ft. level is being further explored. The shaft is down 1060 ft., and a cross-cut will be driven to the vein as soon as it reaches the 1100-ft. level. Both north and south drifts on the 900 and the north drift on the 700-ft. levels are being advanced with good results.

PLACER COUNTY.

A 4-ft. vein has been opened on the Kenyon ranch two miles from Auburn. A prospect shaft has been started on the ore which assays from $10 to $57 per ton.

SAN BERNARDINO COUNTY.

(Special Correspondence).—The Stanford Mining & Milling Co. is installing new machinery, including a Woodbury concentrator, at its Red Dog mill in an effort to save the tungsten occurring in its ores. The company operates the Stanford, Napoleon, and Gold Coin mines in the Stringer district. A small vein of ore, reported to run $300 per ton, has been opened in the Gold Coin mine. C. P. Christensen is manager.——The Bagdad Mining & Milling Co. is arranging for active work on the Orange Blossom. The shaft is down 600 ft. and will be sunk deeper. It is expected to keep a portion of the 20-stamp mill in operation while developments are going on.——The Eastern interests which recently took over the Eagle Mountain iron deposits are arranging for work along extensive lines. The deposits are the largest known in this portion of California.——The capacity of the Needles smelter is being increased from 150 to 400 tons per day. A 100-ton concentrator will be built;

also a plant to treat zinc and base ores. It is expected to have the plant in operation in May. The old unit will continue to treat ore while the construction of the new addition is under way. L. D. Godshall is manager.——The Yellow Aster officials state that the capacity of the plant will be increased and operations at the mines conducted on a larger scale.

San Bernardino, February 14.

SHASTA COUNTY.

The executive committee of the Shasta County Farmers' Protective Association, together with the Association's attorney, T. W. H. Shanahan, conferred with George W. Metcalfe, general manager for the Mammoth Copper company, and D. G. Reid, of Redding, and Alfred Sutro, of San Francisco, attorneys for the company. An agreement was reached upon the matter that is to be incorporated in the complaint in a friendly suit that is to be brought in the United States Circuit Court in San Francisco. An agreement was also reached as to the answer that would be filed to this complaint. Upon this complaint and answer will be based the decree of the court, containing all the provisions of Judge Marshall's decree in the Utah smoke case. In addition it was agreed that the farmers would waive no claim for damages that have accrued from smelter smoke or that may accrue before the installation of the bag-house, or smoke-consuming device, at the smelter at Kennett. This is to be in operation on or before July 1. T. W. H. Shanahan, as attorney for the Association, is to have 90 days in which to prepare and file the complaint and the answer will be filed practically at the same time.

TUOLUMNE COUNTY.

(Special Correspondence).—The North Fork Mining Co. is installing a 2-stamp mill at the Donelli mine, near Arastraville. The property has been extensively developed and the outlook is said to be good.——Milling the Confidence mine dump has been commenced, 20 stamps being used.——The Ralph mine, situated two miles northwest of Tuolumne, has been bonded to R. H. Fordsman, of Sacramento, and operations will be commenced at once with Charles Saunders, of Soulsbyville, as superintendent. It is the intention to install new machinery at the earliest possible time.——A compressor has been installed at the Rising Sun mine, near Arastraville, and machine-drills are being used for the first time.——Work has been commenced at the Nervi mine, above Columbia, with a small crew of men. The property was recently bonded to a company of Italian capitalists.——It is expected that the large crew of men making extensive repairs to the mill at the Black Oak mine will finish the work in a few days, when milling operations will be resumed.——A new 30-hp. motor has just been installed to operate the Draper mill, which has been thoroughly overhauled and started again.——It is reported that a discovery of sufficient importance to insure the resumption of operations has been made in the Republican mine.——Hoisting machinery for the Golden Dawn mine, situated one mile west of Soulsbyville and owned by Nicholls Brothers and Thomas Webster, has arrived at the property and development work will be resumed.

Tuolumne, February 14.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—A shipment of 43 tons of lead-zinc ore sent to the Linn mill last week for separation resulted in 31 tons of zinc and two tons lead concentrate. The zinc was sold for $48 per ton, while the lead brought $72. R. J. O'Connell, the operator, expects to ship 100 tons per month.——Shipments of smelting ore were started this week from the Capital mines, the product being valued at $140 per ton gold, silver, lead, and copper. ——During the next week a big force of men will be put to work at the Scepter adit on Democrat mountain. The workings are to be placed in safe condition, while the grade of the adit will be reduced to 1%. The raise being put through to connect with the Sunburst workings will be completed during the next 30 days.

Georgetown, February 12.

(Special Correspondence).—Work has been resumed upon the placer ground below the Silver Age mill by F. Annis & Co. Operations will be carried on through three shafts that were sunk last year and where pay gravel is exposed. ——Ericson & Co., leasing on the 100-ft. level of the Gem mine, have opened an 18-in. streak of smelting ore that is worth $65 per ton in gold.——Barnard Bub & Co., of Denver, have started work on the Barbarossa property on Floyd hill.——An agent for the North American Smelter & Mines Co. has been in camp during the last week signing contracts with mine owners for ore to be delivered at the pyritic smelter at Golden. The furnaces will be blown-in March 1. G. G. Vivian has been appointed general manager of the plant.

Idaho Springs, February 12.

GILPIN COUNTY.

(Special Correspondence).—Laterals are being driven from the Newhouse tunnel on the Illinois, Roderick Dhu, and Dyke veins. A fine body of ore is exposed on the last named property. Work in the breast of the bore has been suspended for the present.——A local pool has secured a lease on the Star of the West mine in the Russell district. ——Cecil C. Morgan, manager for the Great Bonanza Gold Mining Co., (Ltd.), has taken over the Foot & Simmons

property in the Gregory district. A gold retort weighing 79 oz. was sold last week to the Rocky Mountain bank. The gold was secured from the ore being mined from the Egyptian mine on Quartz hill, the product being treated in the Fifty mill at Black Hawk. The Pearl Eaton Gold Mining Co. last week sold a gold retort weighing 54 oz., a clean-up from Sleepy Hollow ore which had been treated at the Fifty mill. Floyd Weed is manager.

Central City, February 11.

TELLER COUNTY.

The Western Investment Co. operating the main shaft and workings of the Mary McKinney Mining Co., on the Republic claim, made a production of 725 tons during January with a gross bullion value of $18,125. This ore was chiefly mined from the main Mary McKinney vein, northeast of the shaft at the bottom of the 650-ft. level. Fogleman & Roach, the lessees of the W. P. H. mine, of the United Gold Mines Co., have finished sinking with the main shaft down about 600 ft. The work of cutting the station at this depth has commenced and when completed cross-cuts will be driven to the two new flat veins met in sinking. These veins have produced high-grade ore in the Jerry Johnson mine adjoining the W. P. H., and though the assays obtained from samples taken from the W. P. H. shaft were low, the shoots should be cut when the veins are opened.——At a meeting of the directors of the Doctor Jack Pot Mining Co., held at Colorado Springs on February 5, dividend No. 6, was declared payable on March 1, to all stockholders of record of February 20, at the rate of ½c. per share. The amount to be distributed is $15,000.— The Gold Sovereign mine, on Bull hill, operated by the Clements Leasing Co., and sub-lessees, produced during January 28 cars of ore or about 850 tons, assaying from $10 to $25 per ton.

IDAHO.

IDAHO COUNTY.

The west drift from the cross-cut adit at the Golden Crown property, in the Elk City district, recently opened four feet of ore that assays over $27 per ton.

OWYHEE COUNTY.

Arrangements are about completed for the erection of a sampling plant and reduction works in Silver City. It will be equipped with machinery for working any kind of ore, and will give an opportunity for many miners to work the different prospects surrounding Silver City, and to get their ore treated at a low price.

SHOSHONE COUNTY.

(Special Correspondence).—The Caledonia Mining Co., operating in the Coeur d'Alene district, has interested Eastern capitalists and a syndicate, headed by United States Senator Carter, has secured 520,000 shares at a price ranging from $1.50 to $1.67½. The company is capitalized at $1,500,000, of which 200,000 shares are in the treasury. There will not be any change in the management, but E. J. Carter, brother of the Senator, has been selected as vice-president in place of John Keating, who has resigned. The property has been under development for two years, during which time about $150,000 worth of ore has been shipped and of this amount not less than $30,000 worth was sent out last month. It is stated that the company is in good financial condition and in a position to start paying dividends at any time.——The East Snowstorm mine, which adjoins the Snowstorm, has resumed operations after a suspension of two years brought about by the financial depression at that time. An adit is now in 315 ft., and the vein, which has been cut twice, is said to have a width of 28 ft. It is estimated that more than $300,000 worth of ore has been blocked out, and it is proposed to drive the adit 200 ft. farther to explore another vein.

Warren, February 12.

MONTANA.

BROADWATER COUNTY.

(Special Correspondence).—The Keating Gold Mining Co., operating near Radersburg, is engaged in installing a complete new surface plant which it is expected will be in operation the latter part of next month. The new machinery will include an electric hoist and air compressor. High-grade ore is now being mined and the last 10 cars shipped to the reduction works at Butte gave an average net return of $10,000. As soon as the new plant is in operation the shipments will be increased to 250 tons per day. The company announces that it is intended to issue frequent statements to the stockholders showing the receipts and expenditures, and whether or not a profit is being made.

Radersburg, February 11.

JEFFERSON COUNTY.

(Special Correspondence). The farmers of the Boulder valley are threatening to give F. Augustus Heinze trouble and possibly tie up the operations of his concentrator at Basin. A meeting of the ranchers has been held and a preliminary organization effected with a view to bringing proceedings to have an injunction secured against the management restraining the company from running waste into the Jefferson river, which it is claimed renders the water unfit for use. Three prominent attorneys have been engaged and are now at work on the papers. The people of Basin are much worked up over the proposed action, as the men employed in the concentrator are really the life of the little town, and should the ranchers succeed in their action and the concentrator be compelled to close down, a large number of men will be thrown out of work.——The Robert Emmet Copper company, in the Corbin-Wickes district, has announced its intention to build a concentrator at once. The company has been carrying on development work for the past two years and has a shaft 350 ft. deep. Two levels have been opened at the 200 and 300-ft. levels. Two veins, 5 to 15 ft. wide, containing 3% copper, 60 oz. silver, 5% lead, and $1.10 gold per ton are found. The shaft is now being sunk to the 500-ft. point, at which depth another level will be opened.——The Corbin Copper company, two miles west of Wickes, is expected to have its concentrator in operation the latter end of April. The Corbin company owns 51 claims with a total ground of about 1000 acres. Many of the claims are heavily timbered and there are also some valuable water rights with sufficient water available to supply a 1000-ton concentrator all through the year. The rock somewhat resembles that found in the mines of Butte.

Basin, February 11.

MADISON COUNTY.

(Special Correspondence).—One of the largest dredges in the United States is to be installed on the property of the Conrey Placer Mining Co., at Ruby. An order has just been placed for a dredge to cost $250,000 that will dig to the depth of 60 ft., and will handle 200,000 cu. yd. of gravel per month. The company has every confidence in the future prospects of dredging operations at the mouth of Alder gulch.

Ruby, February 11.

SILVER BOW COUNTY.

(Special Correspondence).—The Butte & Superior is shipping about 200 tons of ore at present and expects to increase the output to 400 tons per day very soon. Plans are being drawn for a machine shop and dry room which will accommodate 200 men.——The Butte-Alex Scott has struck a body of ore on the 1400-ft. level averaging 6 to 7% copper, and although this orebody has been cut 10 ft., the other wall has not yet been struck. The company is making regular shipments of high-grade ore assaying from 15 to 20% copper.

Butte, February 12.

NEVADA.

ESMERALDA COUNTY.

Active work on the Yellow Tiger, on company account, has been started and the electric company has turned on the current to the Yellow Tiger equipment.——H. B. Lind, president of the Nevada Hills Extension Co., has secured from George Wingfield a lease on the central part of the Booth ground. The block is 400 ft. long and the entire width of the claim, embracing the old Booth shaft. It is

along the westerly side of the Nighthawk property, which Mr. Lind, for his company, has under lease, and upon which he is now sinking a shaft.——The Las Vegas & Tonopah railroad has a force of men at work laying a spur track from its main line, crossing the C. O. D. property, to the Gold Bar lease. The spur will be about 400 ft. long. The Tonopah & Goldfield railroad is now figuring with the management of the Goldfield Annex lease regarding a proposed spur extending to the bins of that company, now operating on the Poleverde claim of the Jumbo Extension.

NYE COUNTY.

(Special Correspondence).—The Mayflower Extension Leasing Co. is opening milling ore on the 300-ft. level and keeping the mill busy. Connections have been made between the mine and the Mayflower Consolidated workings. ——The bondholders of the Homestake King Mining Co. have asked the courts to appoint a receiver for the property. An action to foreclose on the property to recover the indebtedness of $172,700 has been filed with Judge Averill of the District Court. A. S. Dingee, of Fort Worth, is the plaintiff, and represents the bondholders as trustee.—— The Crystal Bullfrog company is to double the capacity of its mill. A large amount of custom ore is awaiting treatment.——The Tonopah has erected an electric hoist at the Sand Grass shaft, which is down about 50 ft. The main Tonopah workings are producing at the rate of 3500 tons per week, practically all the ore coming from the Mizpah, Silver Top, and Valley View veins.——The Sphinx, at Round Mountain, will resume production as soon as the Daisy pipe-line can be cleared of ice.——The warm weather now prevailing at Manhattan has resulted in resumption of activities at most of the placers. The Wilson lease, on Wolftone Extension, continues to be one of the heaviest producers in the camp.——The San Francisco Placer Co. is arranging for extensive operations this spring.——The Barney Francisco lease, on Mustang Extension, and the Biseli lease, on September, are extracting excellent grade gravel. These companies have conducted operations throughout the winter, despite the cold weather.

Tonopah, February 12.

(Special Correspondence).—The new 10-stamp amalgamation and cyanide mill of the Eclipse Development Co. is well under way, the frame being covered and the concrete base for the batteries and other foundation work finished. This company has a four-year lease on the larger part of the Tramp Consolidated estate, embracing claims of the original Eclipse and Denver Bullfrog Annex companies that include the Eclipse and most of the Hobo or Tramp vein. From the outlet of the Eclipse adit on the south end of Bonanza mountain the ore will be trammed over a short trestle to the top of the mill, and discharged over a grizzly to a 10 by 16 in. crusher of Blake pattern. The product from crusher and grizzly drops into a bin from which it passes by automatic feeders to two 5-stamp batteries of Hendy pattern with low discharge. The screens used will be quite coarse. The discharge from the mortars pass over plates to the tailing reservoirs. In these reservoirs the tailing is dewatered and allowed to dry for a month or more, the sand being cultivated or stirred to render it friable and homogeneous, and to allow of as much oxidation as possible. From the bottoms of the reservoir tanks the sand is drawn off through screens to cars which transport it to standard tanks where it is treated by ordinary percolation. Any lumps or damp materials remaining on the screens are returned to the reservoirs for further stirring and aeration. The life of the lease allows the exploration of the lower levels of the Eclipse vein, from which portion the directors expect ore of better grade and uniformity than that heretofore found.

Rhyolite, February 12.

STOREY COUNTY.

A new 8-in. column pipe has been installed in the pump-compartment of the C. & C. shaft. T. F. McCormick is superintendent.——On the south end of the lode a drift is to be run from the 2100-ft. level of the Ward shaft toward the Yellow Jacket mine for 250 or 300 ft., and the workings tapped by diamond-drill holes and drained. One of the main features of the work is the unwatering of the 1700-ft. level of the Yellow Jacket where rich ore was found before the mine was flooded. It is expected to drain the lode 4000 ft. along its length and 400 ft. below the present water-level.

WHITE PINE COUNTY

The northwest cross-cut on the 400-ft. level of the Ely Consolidated opened a body of copper ore with a fair gold content. The north drift on the same level opened 6 ft. of ore. ——At the Chainman property James Willoughby and Neil McGill, operating the mine under lease, have started the two Chilean mills in the plant and are reported to be making a good saving.——The adit at the Ely Resurrection is in 150 ft., and it is the intention of the company to commence prospecting with a churn-drill in the spring.

NEW MEXICO.

OTERO COUNTY.

The Tularosa Copper Co., operating near Bent, is remodeling its mill and enlarging the plant to handle 100 tons per day. A hydro-electric plant is also being installed to furnish power for the mine and mill.

UTAH.

JUAB COUNTY.

(Special Correspondence).—The Colorado and Iron Blossom companies posted their first quarterly dividends last week. Colorado is to pay 10c. per share, aggregating $100,000, on March 20, and Iron Blossom will pay 8c. per share, aggregating $79,200, on March 30. Sioux Consolidated has not announced what its first quarterly dividend would be, but the directors have issued a financial statement covering the results of last year's operations. At the beginning of the year the company had a cash balance of $63,457.30, and the ore mined and marketed during 1909 amounted to $685,482.39. The total distributions, including $566,495.64 paid in dividends, amounted to $741,834.01, leaving a cash balance at the beginning of the year of $8105.68. The mine has been producing heavily since the first of the year, and it is presumed that there is sufficient money on hand to pay the regular dividend in March. On the 400-ft. level, 910 ft. of driving and 160 of raises has been completed; on the 450-ft. level, 682 ft. of driving and 222 of raises, practically all in ore: and on the second level, a drift to the west has been driven 600 ft. and cross-cuts 130 ft. have been run, but no ore opened. The company will not sink to greater depth unless more ore is found in the lower workings of the adjoining Iron Blossom property.

Tintic, February 12.

SALT LAKE COUNTY.

(Special Correspondence).—The Ohio Copper Co. is now treating between 1000 and 1100 tons of ore per day, though the management expects to run the first half of the mill, now completed, up to 1500 tons. The remainder of the mill cannot be completed until the company raises additional funds. The drawback to getting financiers interested is the fact that the Mascotte tunnel, through which the ores are mined and transported to the mill, is owned entirely by F. Augustus Heinze. Until the consent of Mr. Heinze is obtained to sell the tunnel for a reasonable sum, the owners of Ohio Copper are completely at his mercy.——E. P. Mathewson, general manager of the International Smelting plant, inspected the plant at the head of Pine canyon, and gave out a statement before leaving to the effect that the International would be ready to receive ores contracted for by April 1. The Utah Consolidated is to deliver from 1000 to 1200 tons of ore per day to the International plant.

Salt Lake, February 12.

CANADA.

BRITISH COLUMBIA.

(Special Correspondence).—The report of the Le Roi Mining Co. for the fiscal year ended September 30 is rather a favorable one when the limited operations of mine and smelter during that period are considered. The amount of ore taken from the mine while working amounted to 26,935 tons, which averaged 0.642 oz. gold, 0.33 oz. silver, and 0.85% copper, having an approximate value of $51.48 per ton.

During the year £71,026 8s 3d was written off £20,142 5s 1d for exploration and development £1,258 8s 1d depreciation of machinery plant etc and £2,625 1s 11d for sundry items. The lessees of the Mayflower property have opened some good shipping ore and will make a small shipment to Trail smelter within a week or ten days. A small shipment of gold ore was made from the I. X. L. property in the western part of the Rossland district which is being worked under lease. The situation at the Granby Mother Lode Snowshoe and Oro Denoro in the Phoenix district remained unchanged during the past week all four properties shipping ore to the smelter. The conciliation board will convene in Greenwood in a few days to settle the differences between the B. C. Copper Co. and its employees. About 35 men are working in the No. 7 mine of the Consolidated company, though work has not as yet been started on the tramway or concentrator. The diamond drilling on the Rawhide property of the New Dominion Copper Co. is giving good results, and buildings and machinery are being arranged with a view to starting shipments. The Brooklyn mine, belonging to the same company, will also be prospected by diamond drilling. The consulting engineer for the Hedley Gold Mining Co. states that the assays of 350 samples taken on the Nickel Plate mine show that there is about 130,000 tons of ore in sight at the property, of an average value of $12 per ton. Permission has been granted the liquidator of the Dominion Copper Co. to call a meeting of creditors, by the Supreme Court, and the application of J. D. Spence and John Seward, of the New Dominion Copper Co., to have the liquidator discharged has been set aside. The application of the liquidator to be permitted to take action against the directors of the company in the Supreme Court of New York was held over. — Twenty two men are now working in the Greenwood Phoenix adit.——One of the shareholders in the Sullivan Group Mining Co. is suing the company for $500 that he paid for stock in 1906. He alleges that instead of having a cash deposit of $900, an operating profit of $138,000, and a net gain of $102,000, the company was bankrupt.——A new coal washing plant will be installed at the Hosmer coal mines in the near future, at a figure of about $25,000.——On the group of copper claims being operated by the Tasso Harbor Mining & Smelting Co., on the west coast of Moresby island, it is reported the adit has been driven through ore for 225 ft.——The Ontario group has been bonded to Nelson capitalists for $60,000.——Near Massett, on Graham island, the diamond-drills have cut three seams of excellent coking and steam coal at the Queen Charlotte group, at 600-ft. depth, the thickest seam measuring 9 ft. 6 in.——J. A. Moore, president of the Irondale Smelting Co., has spent $60,000 for coal lands on Graham island, and $75,000 for a deposit of magnesite near Atlin. His company intends building a steel works on Vancouver island to treat the iron deposits there.——The Pacific Tin Mining & Smelting Co. intends building a $20,000 smelter near Nanaimo.——About $30,000 per month is being spent on the Britannia mine.

Rossland, February 11.

MEXICO.

CHIHUAHUA.

(Special Correspondence).—The Compañia Minera de Naica, the principal concern of the Naica district, will increase its reserve fund from ₱500,000 to ₱700,000, and devote the money to the erection of the proposed 600-ton smelter at Concho, a station on the main line of the National Railways. The plans include a total expenditure of ₱1,000,000. The company is producing from 300 to 400 tons per day, and shipping over 4000 tons per month. It has had great success and is a big dividend payer.——The American Smelting & Refining Co. is erecting two additional furnaces at its Chihuahua plant, and expects to have them ready to blow-in by the latter part of July. The two furnaces will raise the capacity of the plant to 750 tons per day.——A reorganization of the Veta Colorado Mining & Smelting Co. has been effected, and the 80-stamp mill and cyanide plant of that concern in the Parral district will be completed. The company owns the big Quebradillas and other properties. The enterprise has been at a standstill since 1906. The Dolores Mines Co., operating the Dolores gold mines in western Chihuahua, is now paying dividends at the rate of 18% per year on a capitalization of $2,000,000. The production during the last three years totals over $3,000,000. A contract for doubling the capacity of the smelter at the Rio Tinto copper mines in the Terrazas district has been let, and work will be started immediately. A 25-ton copper converter will be installed. The enterprise is controlled by Corrigan, McKinney & Co., of Cleveland.

Chinipas, Chihuahua.

Chihuahua, February 11.

GUANAJUATO.

(Special Correspondence).—The Guanajuato Reduction & Mines Co., which is operating exclusively on dump ore, has commenced to show profits of $10,000 per month above operating expenses and bond interest. The company recently built an electric line to give the mill connection with the Rayas property, and a big tonnage from the Rayas dumps is now being treated.——The Cubo Mining & Milling Co., of the Guanajuato district, has under consideration with the Peregrina Mining & Milling Co., the delivery of 200 tons of ore per day to the Peregrina plant. The Cubo company is now in shape to produce heavily.——The Flores de Oro Mining & Milling Co. has made the final payment on the San Luis Flores de Oro mines, in the La Luz camp, and is now planning the erection of a mill. The company has been developing with good success, and has sufficient ore in sight to justify the erection of a small plant.

Guanajuato, February 11.

SAN LUIS POTOSI.

(Special Correspondence).—The American Smelting & Refining Co. has secured control in the Matehuala district by the purchase of the properties of the National Metallurgical Co., an American concern organized in 1901 with a capital of $1,000,000. These include a custom smelter with a capacity of 550 tons per day, copper and lead-silver mines, and a water system that cost more than ₱350,000 and that supplies the town of Matehuala. The water system is of the utmost importance, as in former years the failure of water supplies often caused the temporary abandonment of the camp.

Matehuala, February 10.

SONORA.

(Special Correspondence).—The Pacific Smelting & Mining Co., the concern organized several months ago with a capital of $8,000,000 to take over the holdings of the Douglas Copper Co. and subsidiary companies, and the mines of the Mexican Exploration & Mining Co., is preparing to blow-in the custom smelter at Fundición, on the main line of the Southern Pacific extension, during the month of March. The smelter has a capacity of 350 tons per day, and it is expected to keep the plant in continuous operation on not less than 250 tons per day. Contracts for custom ores are being signed.——The 180-ton custom smelter of the Yaqui River Smelting & Refining Co., at Toledo, on the Yaqui river extension of the Southern Pacific, will be in operation at an early date, all preparations for blowing in having been made.

Fundicion, February 10.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

L. A. GREENE is at Denver.

W. A. SCOTT is at Ray, Arizona.

A. E. DRUCKER is at Aberdeen, Washington.

GELASIO CAETANI has returned from Goldfield, Neveda.

WAYLAND H. YOUNG has returned to Oakland from Mexico.

C. M. FUELLER, of Los Angeles, is visiting San Francisco.

H. F. A. RIEMLING, of Denver, is in Wyoming on an examination trip.

EDWIN E. CHASE has gone to Houghton, Michigan, to examine copper mines.

HIRAM W. HIXON is lecturing on metallurgy at the University of Pennsylvania.

HENRY P. DUNBAR has moved to Plainfield, New Jersey, from Mammoth, California.

ELWOOD J. WILSON, of Goldfield, Nevada, is at the Stratford hotel in San Francisco.

S. R. TRENGOVE, of the Iron King mine, in Yavapai county, Arizona, recently was at Globe.

J. W. JUDD delivered the jubilee address before the Liverpool Geological Society, January 10.

JAMES DOUGLAS, of the Phelps-Dodge Co., was at the Old Dominion mine, Globe, Arizona, last week.

ARTHUR D. FOOTE, of Grass Valley, has been elected a director of the American Society of Civil Engineers.

R. B. LAMB is in Nicaragua, where he is making examinations for the C. L. Constant Co., of New York.

Sir WEETMAN PEARSON, Bart., head of the house of S. Pearson & Son, has sailed from England for Mexico.

W. S. SULLIVAN and HOWARD T. WAYNE, of Globe, Arizona, have become partners in mining engineering practice.

D. T. SWATLING, of the Commonwealth M. & M. Co., operating at Pearce, Arizona, is seriously ill in Los Angeles.

ALBERT JOHANNSEN has been appointed assistant professor of mineralogy and petrography at the University of Chicago.

GEORGE HOHAGEN has resigned his post as Director of the Mint at La Paz, Bolivia, and resumed practice as mining engineer.

W. G. RICE, president of the Superior & Boston Copper Co., was visiting the property of the company at Globe, Arizona, last week.

S. A. HEMPLE, of Valdez, Alaska, is at San Francisco in the interests of the Knight Island Copper Mining Co., of which he is president.

WILEY B. AKERS, formerly superintendent at the Rincon mine, Temascaltepec, Mexico, is at 51st street and Telegraph avenue, Oakland, California.

W. H. MCCORD, who has been at New York making contracts for the equipment of the mill to be built on the Tajo de Dolores mine at Guanajuato, is returning to Guanajuato this week.

WALTER HARVEY WEED has returned from Ely, Nevada, to New York, where he has completed his report upon the Ely Central property, which he examined in behalf of a committee of the largest stockholders.

E. K. SOPER has resigned his position as instructor in economic geology at Cornell University to take similar work in the Minnesota School of Mines. He may be addressed in care of the geological department of the University.

JOHN T. MILLIKEN, of St. Louis, president of the Golden Cycle Mining Co., of Cripple Creek, is at New York on business connected with the Cobalt Provincial Mines, Ltd., of Cobalt, of which he has recently secured control.

The San Francisco Section of the Mining & Metallurgical Society of America will meet following dinner at 6:30 p. m. at the Palace Hotel, February 21, instead of 22 as previously announced.

Market Reports.

LOCAL METAL PRICES.

San Francisco, February 17.

Antimony	12—12¾c	Quicksilver (flask)	49½—50¼
Electrolytic Copper	15¼—16½c	Spelter	7⅛—8¼c
Pig Lead	4.95—5.90c	Tin	36—37½c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver per oz.
Feb. 10	13 38	4.63	5.58	51¼
" 11	13.38	4.63	5.63	51¼
" 12	Holiday.	No market.		
" 13	Sunday.	No market.		
" 14	13.31	4.60	5.48	51½
" 15	13.31	4.60	5.45	52
" 16	13.31	4.55	5 43	51⅞

ANGLO-AMERICAN SHARES.

Cabled from London.

	Feb. 10. £ s. d.	Feb. 17. £ s. d.
Camp Bird	1 8 0	1 8 6
El Oro	1 8 3	1 8 6
Esperanza	2 18 9	2 18 9
Dolores	1 8 9	1 8 9
Oroville Dredging	0 8 6 ex div.	0 8 6
Mexico Mines	8 10 0	8 11 3
Tomboy	0 17 6	0 17 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing Prices. February 17.		Closing Prices. February 17.
Adventure	8	Mohawk	65
Allouez	53	North Butte	32½
Atlantic	7	Old Dominion	44
Calumet & Arizona	70	Osceola	161
Calumet & Hecla	635	Parrot	20
Centennial	26	Santa Fe	2
Copper Range	76¼	Shannon	15½
Daly West	7½	Superior & Pittsburg	13¾
Franklin	19¼	Tamarack	74⅜
Granby	89	Trinity	8¼
Greene-Cananea, ctf	9⅜	Utah Con	31
Isle Royale	22	Victoria	4
La Salle	15½	Winona	10
Mass Copper	7	Wolverine	141

(By courtesy of J. C. Wilson, Mills Building.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices. February 17.		Closing prices. February 17.
Amalgamated Copper	76	Miami Copper	24
A. S. & R. Co.	83⅛	Mines Co. of America	½
Boston Copper	19⅝	Montgomery-Shoshone	1
B. C. Copper Co.	7	Nevada Con.	23
Butte Coalition	23⅞	Nevada Utah	1½
Cumberland-Ely	7½	Nipissing	10⅛
Davis-Daly	3½	Ohio Copper	4⅛
Dolores	6½	Ray Central	3⅜
El Rayo	2½	Ray Con	21⅛
Ely Central	1⅞	South Utah	2⅞
First National	5	Superior & Pittsburg	14
Giroux	97⅛	Tenn. Copper	32⅞
Guanajuato Con	1¾	Trinity	8½
Inspiration	8⅝	Tuolumne Copper	3⅝
Kerr Lake	9¼	United Copper	6⅝
La Rose	4⅜	Utah Copper	50¾
Mason Valley	2	Yukon Gold	4⅝

SOUTHERN NEVADA STOCKS.

San Francisco, February 17.

Atlanta	$ 17	Mayflower	$ 4
Belmont	1.70	Midway	26
Booth	15	Montana Tonopah	87
Columbia Mtn	6	Nevada Hills	50
Combination Fraction	32	Pittsburg Silver Peak	70
Daisy	8	Rawhide Coalition	15
Fairview Eagle	10	Rawhide Queen	20
Florence	2.15	Round Mountain	64
Goldfield Con	7.35	Sandstorm	4
Gold Kewenas	8	Silver Pick	11
Great Bend	3	St. Ives	17
Jim Butler	11	Tonopah Extension	70
Jumbo Extension	30	Tonopah of Nevada	6.65
MacNamara	28	West End	33

(By courtesy of the San Francisco Stock & Exchange Board.)

World's Silver Market in 1909

The annual London letter by Pixley & Abell dealing with the silver market of the world during 1909 is here given as being one of the most authoritative statements available.

A feature of the year has been the comparative steadiness of the silver market. The average price of the year is 23 11 16d, the lowest on record, against 24 11 32d in 1908 and 30 3 16d in 1907. The previous lowest annual average was 24 1 16d in 1902.

The improvement which took place during December, 1908, was continued during the early weeks of January, and the quotation rose from 23 3 16d, the opening price of the year, to 24⅛d on the eighteenth of that month. From that point the market declined, mainly on sales by China, until, on March 4, 23 1 16d was quoted. During March fluctuations were small, but April and the first week of May saw a steady improvement, due to purchases both by China and the Indian bazaars, which carried the quotations up to 24⅛d. The tendency was then again downward until early in July, when, at about 23½d, the market remained very steady, with insignificant fluctuations for a period of about seven weeks. From then there was a slight improvement to 24d, which was quoted on August 31, but during September and October the market sagged slowly, until, in November, prices steadied at about 23⅝d. During December, on important buying for the Continent and extensive covering by Indian speculators, there was decided improvement, which carried the quotation to 24 5 16.

Shipments to India, though less than in 1908, have continued on a large scale, and amount to about £6,750,000, while the stock held in Bombay is now £1,000,000, with nearly £500,000 on the water, against a stock of £400,000 and £840,000 in transit at the end of 1908. With the excellent crops of cotton and other produce in India, it is anticipated that there will be a large demand for silver for jewelry and hoarding during the coming year, though, judging from the increased shipments of gold to India during the last few months, it is probable that a greater proportion of gold than usual will absorb the savings of the people.

The speculation to which we referred last year continued until recently, and at one time it was estimated that Indian speculators had sold short on this market to the extent of £2,000,000. During the last few months, however, this has been largely liquidated, and the amount now open can be but trifling. This buying was probably the principal cause of the steadiness of the market during the later months.

China has been a larger and more important buyer this year than usual, though at times, when quotations have suited, she has sold freely. In addition to her operations on this market, she has also bought and sold largely in Bombay, while from San Francisco she has received upward of £1,500,000, against £1,100,000 in 1908. The low rates of exchange ruling in China have again adversely affected the import trade, while exports for the same reason have been stimulated. The country has been favored with excellent crops and the banks have been obliged to buy and import silver freely to pay for their exports. Shipments of silver from London to China during the year amount to nearly £2,000,000, against £821,000 in 1908, but these figures are not necessarily correct, for silver shipped to China from London is often diverted while in transit to India, while shipments to India are in the same way diverted to China. A few purchases have been made by the countries comprising the Latin Union, but purchases by the American, French, and Mexican governments have been insignificant.

Though it is always difficult to forecast the future of the market with any degree of confidence, yet it seems probable that apart from any unforeseen factor that may arise, the average price for the coming year will be somewhat higher than that of 1909. The general improvement in trade, which is now becoming evident the world over, especially in India and China, where silver plays a most important part, and the tendency of several States to increase the amounts of silver subsidiary coinage in circulation, and so relieve the pressure on their gold reserves with profit to themselves, should lead to a good general demand for silver during the year 1910.

Publications Received.

Any of the books noticed in these columns are for sale by or can be procured from the MINING AND SCIENTIFIC PRESS.

MEXICAN TRAILS. By Stanton Davis Kirkham. 8vo, pp. 293, ill., index. G. P. Putnam's Sons, New York, 1909. Price $1.75.

The author of 'Mexican Trails' journeyed to Mexico equipped with a facile pen, a camera, some knowledge of Spanish, and much charming enthusiasm. He describes in pleasing manner the trails over which he traveled and on which he camped for three years, and he faithfully portrays in word and picture which he calls the "real Mexico." He has experienced the beauty of her deserts and taken part in the life of her cities. He has seen the Republic in the one way to see a country—by tramping and riding over her highways and byways. Mr. Kirkham compliments President Diaz as "the most forceful character in Mexico—the Man of Iron. What is effected in Mexico today is the work of Porfirio Diaz. In himself the central power, reaching out to every State, and controlling it, this one man has established law and order, and maintained it as only a Man of Iron could." The pictures of the toilful lives of the native Mexicans, their many privations and their few joys, move to compassion, in spite of the author's assurance that these grown-up children are too simple to realize how poor they are. The unquenchable thirst of the collector is increased by descriptions of curious relics to be obtained in the 'Thieves' market' in the City, and which one occasionally runs across in out of the way places. A strange quest is 'Hunting Titians in a dugout'. The author does not present a flattering picture of Mexican theatres, Mexican music, hotels, or cookery. On these matters, however, there are differences of opinion. No doubt they are 'good for those who like them', but Mr. Kirkham did not happen to like them. There are charming descriptions of cathedrals scattered over New Spain, and attractive views of Mexican patios and gardens. An interesting chapter is on the potter and the pot. Another describes pilgrimages—wearisome and useless journeys in expiation of sin. Ancient ruins "worthy to be classed with the best work of antiquity" are adequately described. The author has cross-cut a pay-streak of humor in the chapter on a certain Guadalajara school where he tells of unwashed urchins gathering scraps of knowledge, while pigs, hens, and chickens wander in and pick up crumbs, the versatile *maestro* meanwhile varying his pedagogic vocation by shearing the locks of street-car conductors while car and passengers wait without the door. American writers on things Mexican might well consult a grammar more freely for Spanish phraseology, and a dictionary for Spanish orthography. One seldom picks up a book on Mexico without finding ignorance of the language exposed. The important subject of Mexican mines, the source of so much wealth, is lightly dwelt upon, as the author's intent was not to exploit the country, but to give a glimpse of the picturesque little cities of New Spain, and of the village life of the Indian people who were before New Spain. In this he has been wholly successful, and the volume can be heartily recommended to those who would travel through Mexico in imagination over unbeaten trails.

CEMENT RESOURCES OF VIRGINIA. By R. S. Bassler. Bull. 11-A, Virginia Geol. Surv. Pp. 309, ill. Charlottsville, 1909.

In this report the resources west of the Blue Ridge only are discussed. Studies looking to similar reports on the Piedmont and Coastal Plain regions are under way, and similar reports on them are promised later by T. L. Watson, the energetic director of the Virgina Survey. The present volume is introduced by a chapter on the materials and manufacture of hydraulic cements, by E. C. Eckel. This is followed by a particularly full and valuable description of the geology of the cement rocks, by Mr. Bassler. The work is authoritative and will doubtless prove of large service to people interested in the development of the region.

GRAPHITE AS A LUBRICANT. By Joseph Dixon Crucible Co. Pamphlet. Pp. 60. Jersey City, 1909.

This is the eleventh edition of a little handbook known to

all engineers. It has been revised and brought up to date and contains a great quantity of interesting information difficult to obtain elsewhere.

PROCEEDINGS OF THE SELECT STANDING COMMITTEE OF THE HOUSE OF COMMONS ON MINES AND MINERALS. Pp. 66. Public Printer, Ottawa, 1909.

The importance of the mineral industry of the Dominion was recently recognized by the constitution of a standing committee of the House of Commons. At the hearings of the committee there have been most interesting discussions of land laws, of administration, and various other topics relating to mining.

THIRTIETH ANNUAL REPORT OF THE DIRECTOR OF THE UNITED STATES GEOLOGICAL SURVEY, FOR THE YEAR ENDING JUNE 30, 1909. By George Otis Smith. U. S. Geol. Surv. Pp. 128. Maps. Washington, 1909.

An adminstrative report giving details of the work of this great organization.

TESTS OF RUN-OF-MINE AND BRIQUETTED COAL IN A LOCOMOTIVE BOILER. By W. T. Ray and Henry Kreisinger. U. S. Geol. Surv., Bull. 412. Pp. 32. Washington, 1909.

Commercial Paragraphs.

SPURR & COX, INC., have taken the management of Socorro Mines at Mogollon, New Mexico. W. Rowland Cox is at present at the property.

GELASIO CAETANI and ERROL MACBOYLE have taken offices in the Crocker building, San Francisco, and will engage in general consulting work.

T. H. PROSKE, Denver, Colorado, recently shipped to the Dolores Mines Co., Madera, Chihuahua, Mexico, a section alized Ajax drill sharpener for mule-back transportation.

E. B. SPALDING, C. E. SLOAN, and F. T. ROBSON have opened a civil and mining engineering office at 802 Union Trust building under the firm name of Spalding, Sloan & Robson.

The HENDRYX CYANIDE MACHINERY CO., Denver, Colorado, advises that Wilbur A. Hendryx, its manager, is at Newmire, Colorado, installing an 8-ft. combination agitator and filter for the Primos Chemical Co., for use in treating vanadium ore.

The PACIFIC FOUNDRY CO., San Francisco, reports the shipment of four Kilker's matte tapping cars to the Consolidated Arizona Smelting Co., Humboldt, Arizona. This device is indeed, as the manufacturers claim, meeting with enthusiastic approval all over the country.

THOMAS J. JONES has moved to San Francisco after some years service as general mining superintendent for the Mountain Copper Co., and while retaining a place on the staff of Lewis T. Wright, will engage in general practice as a mining engineer, with an office at 150 Pine Street.

The annual conference of managers and agents of the INGERSOLL RAND CO., was held from February 1 to 5. A trip of inspection included one day each at the Easton, Pennsylvania, the Phillipsburg, New Jersey, and the Painted Post, New York, plants of the company. The last two days were devoted to business meetings at the Astor hotel in New York City. A banquet and theatre party closed the conference. Representatives from all parts of this country and from England, France, Italy, Mexico, and Canada were present.

THE JEFFREY MFG. CO., held its annual sales convention of the Mining Department at Columbus, February 3 and 4. The program included numerous inspection trips and tests as well as speeches and discussions by the officers of the company and district managers. An interesting and stimulating little booklet commemorative of the event is being distributed. Among the many good things in it, the following bits of philosophy will bear repetition: "The man who has nothing to advertise has nothing to sell." "Advertising is salesmanship plus publicity." "The man who is satisfied with what comes to him unsolicited answers few knocks at the door."

The Prospector.

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

T. J. R., Hornitos, California: Quartzite.

H. W., Burrough, California: Albite granite.

F. P., Octave, Arizona: Specular hematite in quartz.

R. C. M., Amador City, California: Massive arsenopyrite mixed with quartz.

T. C. C., Atlanta, Idaho: No. 1, serpentine; No. 2, black serpentinized diorite or gabbro.

W. H. S., Eureka, California: No. 1, quartzite rock containing pyrite oxidized to limonite; No. 2, decomposed mica schist.

J. H. P., Golcondo, Nevada: No. 1, mineralized feldspathic rock with much pyrite; No. 2, altered shale; No. 3, altered schist; No. 4, altered amphibolite; No. 5, altered schist; No. 6, altered anthophyllite schist; No. 7, feldspathic rock; No. 8, similar to No. 7. These rocks have lost their original character by metamorphism and kaolinization.

V. G., Promontorio, Mexico: No. 1, rhyolite or quartz porphyry; No. 2, same as No. 1, with veinlets of serpentine; No. 3, 4, and 5, same as No. 1 and 2, somewhat kaolinized; No. 6, calcite and pyrite with brown umber formed by the oxidation of the pyrite; No. 7, granodiorite; No. 8, rock kaolinized by the action of decomposing sulphides.

Dividends.

On Friday, February 4, the Bunker Hill & Sullivan M. & C. Co. paid dividend No. 149 of $60,000. This makes the amount of dividends paid since January 1, 1910, $105,000, and the total to date $11,391,000.

DIVIDENDS FROM UTAH MINES.

Name of company.	Paid in 1908.	Paid in 1909.
Bullion-Beck (Tintic)	$80,000	.....
Boston-Sunshine (Mercur)	.....	13,500
Colorado Mining (Tintic)	450,000	960,000
Daly West (Park City)	.....	162,000
Grand Central (Tintic)	.....	20,000
Iron Blossom (Tintic)	.....	400,000
Little Bell (Park City)	.....	15,000
Lower Mammoth Extension (Tintic)	.....	2,000
Mammoth (Tintic)	60,000	.....
May Day (Tintic)	44,000	.....
Puritan (Tintic)	2,500	.....
Silver King Coalition (Park City)	562,500	750,000
Sioux Consolidated (Tintic)	126,716	573,342
Uncle Sam Consolidated (Tintic)	100,000	50,000
United States S., R. & M. (Tintic)	2,183,600	2,183,600
Utah Consolidated (Bingham)	600,000	600,000
Utah Copper (Bingham)	702,500	1,097,200
Utah Mine Co. (Fish Springs)	34,000	2,000
Victoria (Tintic)	.....	5,000
West Mountain Placer (Bingham)	5,000	2,500
Totals	$4,950,816	$6,836,142
Increase for 1909	.....	$1,885,326

L. VOGELSTEIN & Co. give the following figures of German consumption of foreign copper for the year 1909:

	Tons.
Imports of copper	157,795
Exports of copper	8,053
Consumption of copper	149,742

as compared with consumption during the year 1908 of 151,715 tons. Of the above quantity 143,717 tons were imported from the United States.

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EDITORIAL.

LOS ANGELES is to entertain the American Mining Congress this year, but the whole of California will extend a welcome. We can assure the members and delegates that they will be well entertained by our sister city.

GOLD production for the world in 1909 is now ascertained to have been approximately 22,200,000 fine ounces. On January 1 we predicted a slight excess over 22 million. We assumed, however, that Mexico would show a decrease, whereas reports to date demonstrate an increase from 1,082,210 ounces in 1908 to at least 1,250,000 last year.

OPPONENTS of the Bureau of Mines now urge that there is no necessity for such an organization since the United States Geological Survey is doing already the work that is proper to such a bureau. This is interesting since many of these same opponents have previously argued that the Geological Survey should confine its work to geology and let technology alone.

SUGAR once broke the 'Solid South', when Louisiana saw her interests threatened. Now Los Angeles, through its Chamber of Commerce, declares for an open door to Chinese and Japanese immigrants. Hands are scarce for picking the golden orange. Thus theories fade under the strong light of necessity, and even race-prejudice weakens. If the pro-Oriental spirit should finally prevail in the West, it would produce great changes in the operation of the mines.

ALUMINUM seems not to be coming into more extended use despite the low price of the metal, which is now selling in Europe on a parity with copper. The depression in the market is due to active competition on the one side, the efforts to effect a great aluminum trust having failed, and on the other to the knowledge that a great demand for purposes where it could supplant copper would immediately force up the quotations to prohibitory figures. The ore reserves suitable for the manufacture of aluminum by the existing process are too small to admit of sustained production on a scale commensurate with copper.

EXPECTATIONS are apparently well founded that the 'oil-war' in Mexico between S. Pearson & Son and the Waters Pierce Oil Company, will terminate soon after the arrival of Sir Weetman Pearson, who is now on his way from England to Mexico. The contest has been so bitter that oil is selling, even at a considerable distance from the railroads, for less than the cost of production and refining. The com-

pany of which Sir Weetman is the head has been constructing a railroad, and a pipe-line having a capacity of 12,000 barrels of oil per diem, to bring oil from the Furbero fields to Tuxpám, and thence to the refinery at Minatitlán. These improvements are just being completed. It is thought that S. Pearson & Son now consider that they have reached a point where they can cease importing crude oil with which to fulfil their contracts, and that adjustment between the rival concerns may be reached.

GERMAN commercial aggression, cutting into markets that would prove open to Americans if sufficient enterprise were displayed in taking advantage of them, is again shown by the establishment of a fast mail and passenger service between Callao, Peru, and Europe. New vessels of the Kosmos line have been put on the West Coast run, having a register of 14,000 tons. Passengers are transferred at Valparaiso, Chile, and taken by rail to Buenos Aires, Argentine Republic, where close connection is made with other steamers of the same company for trans-Atlantic ports. Twelve days are saved by this arrangement, as against the old Magellan route.

KIMBERLY, Nevada, was the scene of a rich discovery last week. The Battle Mountain region has long been known for small bodies of high-grade, free-milling gold ore. Last summer at Bannock very rich ore was discovered by Mr. Alexander Walker, and the vein is now being mined by the Nevada-Omaha Mining & Milling Company. The geology of the deposits was described by Mr. C. S. Thomas in the MINING AND SCIENTIFIC PRESS December 18. So far, doubt of the ultimate value of the deposits has rested on the known 'spotted' character of the high-grade ore and the presence in at least some cases of unaltered sulphides at shallow depth. Irregular distribution is natural in the case of rich ore, and has not proved elsewhere a sufficient obstacle to development. As to the sulphides, it is probably fair to say that too little is yet known to warrant final decision as to the value of the deposits. Kimberly and Battle Mountain are likely to be the focus of considerable excitement this year.

SOMEWHAT misleading accounts have been published in the daily newspapers concerning the recent decision of Judge F. J. Murasky in San Francisco in the case of James R. Ainsa, B. V. García, *et al.*, against the Alvinza Hayward estate and others, involving a controversy over a concession to coal lands in Sonora, Mexico. Confiscation of the coal lands has been carelessly alleged, and it has been stated that the decision exonerates the stockholders from liability for the disappearance of assets which constituted the security for bonds issued in payment for the property. The truth seems to be that certain citizens of Mexico, holding a concession for approximately one million acres of supposed coal lands in the districts of Urés, Hermosillo, Guaymas, and Alamos, in the State of Sonora, assigned these rights to a corporation organized under the laws of Arizona, accepting bonds of the corporation in payment for the lands. The bonds were coupled with an agreement as to exploration and development of the coal deposits. The organizers of the company spent more than $200,000 in such explorations. As a result it appeared to them impracticable to make a financial success of the enterprise. They therefore abandoned it, and allowed the concessions to lapse by non-payment of taxes. The contest involved many complications, but in effect the effort was to recover the face value of the bonds, on the ground that the company, in allowing the property to revert to the Mexican Government, had not kept faith with the bond-holders. The case was decided against the plaintiffs.

Labor Troubles at Butte.

Butte is disturbed at present by labor troubles. Not that this is unusual; indeed it has been growing chronic. This time, however, Butte seems seriously disturbed. Many of the great mines are closed; for a time there was real danger of their being flooded and the horses underground starved; the Butte Reduction Works were temporarily short of ore; and at Anaconda, the Mill & Smelterman's Union having sternly resolved to handle no tainted ore, that great smelter may be forced to close. One might suppose that a life and death struggle were in prospect between the 'dread oppressor' and the 'wage slaves'. Apparently, however, the 'capitalistic classes' in this case have nothing to do with the matter—except to patiently act the part of innocent bystander while the air is full of flying brickbats. In other words, this is a fight over jurisdiction between two Unions, the Western Federation of Miners and the International Engineers. Trouble has been brewing for some time, and was finally focused over the discharge, at the demand of the Western Federation, of an oiler belonging to the International Engineers. The Federation, in the language of the Anaconda Mill & Smelterman's Union No. 117 does "not and can not recognize the pretended membership of the International Engineers Union No. 138 as a bona fide labor organization or entitled to any consideration as a labor organization within the jurisdiction of the Western Federation of Miners." The Federation men, considering the Engineers as out of the pale, refused to work with them, and hence the trouble. It happens that the International Engineers, while numerically weak at Butte, includes the high-class men who handle the big first-motion hoisting engines. Elsewhere the Union is strong, and it is quite competent to make a vigorous fight. At one time all the Boston & Montana mines, the Clark properties, the Red Metal, Parrot, Davis-Daly, and Alex Scott mines were closed, and on February 17 less than 1000 men were at work. The carpenters, blacksmiths, machinists, pumpmen, ropemen, and electricians employed about the mines, are affiliated with the International Engineers and are said to be ready to go out if necessary to support them. The companies affected have demanded that the Federation furnish engineers to take the place of the strikers. This the miners have undertaken to do and have in part accomplished. The Original and Stewart mines resumed work on Wednesday, and the High Ore was expected soon to follow. The Miners Union has the advantage over the Engineers in holding a two years' contract with the leading companies. Clearly, however, unless it

prove able to man the hoists the contracts will not amount to much. The Western Federation has not worked cordially with other unions, and in a long-drawn fight the sympathy of union as well as non-union men elsewhere is likely to go against it. Since the Homestake resumed work on a non-union basis Butte is the last great stronghold of the Western Federation. It has seemed clear for some time that it would need to change its policy materially or it would lose its hold altogether. At Butte there has been a growing irritation, and the last year has been marked especially by many small strikes and interruptions to work. The Miners Union, being locally dominant, inevitably suffers from this, whether responsible or not. The Federation wisely refused to interfere in the matter of the switchmen's strike, though in that case the operators called on it for aid necessary to the operation of the mines. As the leader among local unions, the public justly or unjustly blames it for all interruptions of industry. It would seem the better part of wisdom under such conditions to conciliate rather than antagonize other unions. It is an open secret that the mine managers are restive under the dictation of the Federation, and would welcome an opportunity to drive it out of the district. A lively fight between the two unions would not only afford an excellent excuse, but would necessitate the bringing in of troops to preserve order; and it has been abundantly proved that where non-union miners can be protected in their right to work, the Western Federation of Miners withers. Just how seriously the situation is regarded is indicated by the fact that Mr. B. B. Thayer of New York has gone to Butte, as has also the president of the International Engineers. While the situation seems just now to be improving, the extent to which the trouble will spread is still uncertain. The situation is undeniably serious.

Railroads and the Metals.

Revival of business in 1909 could hardly be better shown than by the receipts of the railroads. The common carriers draw revenue from all classes of industry, and therefore constitute one of the best gauges of prosperity. Hence it is peculiarly significant to find that the gross earnings show an increase of approximately $285,000,000 over those for 1908, the total gross receipts of the roads in the United States for the former period amounting to $2,696,786,500, on 238,073 miles of track. It is also noteworthy that this total railway income is the largest ever recorded in the history of the country, and that the rate of increase is also the largest ever reached, being 11.78 per cent. The gain, moreover, represents a steady growth, beginning relatively small in January, and progressing steadily month by month throughout the year. The chief source of these gains in revenue was the phenomenally great movement of iron ore and of the output of the iron and steel industry, followed closely by coal and coke. No increase of traffic due to agricultural products was observed, the amount of this freight remaining about the same as during the past three years, with a slight shrinkage in cotton shipments. The independence of agriculture as related to the general business of the country is a striking feature of recent economic history in the United States, some important bearings of which as a factor in determining prices, having been pointed out before in these columns.

Further examination of the returns from the railroads, however, shows that the West has added its share to the general prosperity. The Santa Fe, Denver & Rio Grande, and Union Pacific all reveal larger gross incomes than they had ever before enjoyed. The income of the Southern Pacific also came within five million dollars of the receipts during its banner year of 1907. This has been due in equal measure to contributions from the mines and the farms. The new issues of railroad stocks and bonds, therefore, represent a provision for future growth, not a 'capitalization of losses', to use a modern expression.

Development of the iron industry is always significant to the West, owing to the intimate correspondence existing between the production of that metal and the demand for copper and lead. The year 1909 witnessed the largest output of iron and steel yet attained, and the new business now being booked is evidence of continued prosperity, which promises to cause the output during 1910 to surpass that of the previous year. The Steel Corporation is averaging nearly 35,000 tons of new business per day, much of it coming from the railroads. Orders for 10,000 cars were placed in one week, with others pending for upward of 40,000. More steel than heretofore is also going into buildings all over the country, and large contracts for structural material are being made daily. Such a condition necessarily augments the consumption of copper, so that the excess of purchases of the red metal over the present capacity of the mines and smelters is not surprising. The recent depression in the market price of Steel common stock had nothing to do with production, either present or prospective. The great depression in Steel stock was caused by a single operator suddenly throwing 400,000 shares upon the market. The same operator, holding an additional 200,000 shares, placed these with a brokerage firm which found itself embarrassed with so large a proportion of such collateral as to necessitate further sales in order to liquidate. The resultant depression had no close connection with actual industrial conditions.

The Steel Corporation is supposed to possess an advantage over the independent steel-makers of not less than $2 per ton. A considerable part of this results from its ownership of two of the three Minnesota ore-roads, over which is shipped the bulk of the ore-supply for the independents. The charges are from 80 cents to $1 per ton, against an operating cost of not over 40 cents. The Steel Corporation is thus taking toll from its rivals equivalent to a profit of about 50 cents per ton on the independent output.

So great has been the revival of trade that the Corporation finds its own furnaces incapable of satisfying the demands of the finishing mills, and it has been obliged to resort to the outside market, purchasing from the Bessemer Pig Iron Association. In the face of such evidences of prosperity on the part of the railroads and of the steel manufacturers, no doubt of a steady growth in consumption of the other metals can remain, and a gradual increase in prices is inevitable.

Geological Distribution of the Precious Metals in Colorado.—III.

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

*Seven localities (14 to 18, also 56 and 57) are quoted as belonging to the Cripple Creek district; the lode formation presents interesting differences, due more to the structure than to the composition of the various eruptives. Cripple Creek, although an isolated area when regarded as a rich mining district, is yet an outlying portion of the much larger volcanic region lying to the southwest. Geologically, it is part of the Silver Cliff and Rosita districts and owes its origin to eruptive activities that were contemporaneous in occurrence and similar in character. The andesite breccia that predominates in the Cripple Creek district is late Eocene or early Miocene, but the dike-rocks penetrating the breccia are even younger, while the granite forming the basal formation of the district is older than the Cambrian. Rich gold veins occur equally in the oldest and in the youngest formations. The Cripple Creek district represents the ground-floor of a volcano, the superstructure of which has been removed by erosion.[1] There was more than one vent and there were many periods of eruptive activity, represented by fragmentary granite, andesite breccia, flows of andesite, then phonolite, nepheline syenite, and finally dikes of basalt. At the close of this vulcanism, thermal activity supervened. Evidence of the conduits through which the hot mineral waters ascended is to be seen today, particularly in the Deerhorn and Summit mines. But an economically more important proof of a long period of mineralization is given by the ore deposits formed by means of the action of solutions that ascended to the surface at the close of the successive volcanic periods. They healed the fractures with golden ore.

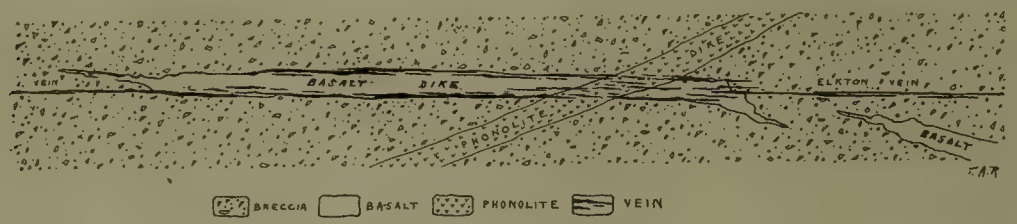


Fig. 1. Elkton Mine. Plan.

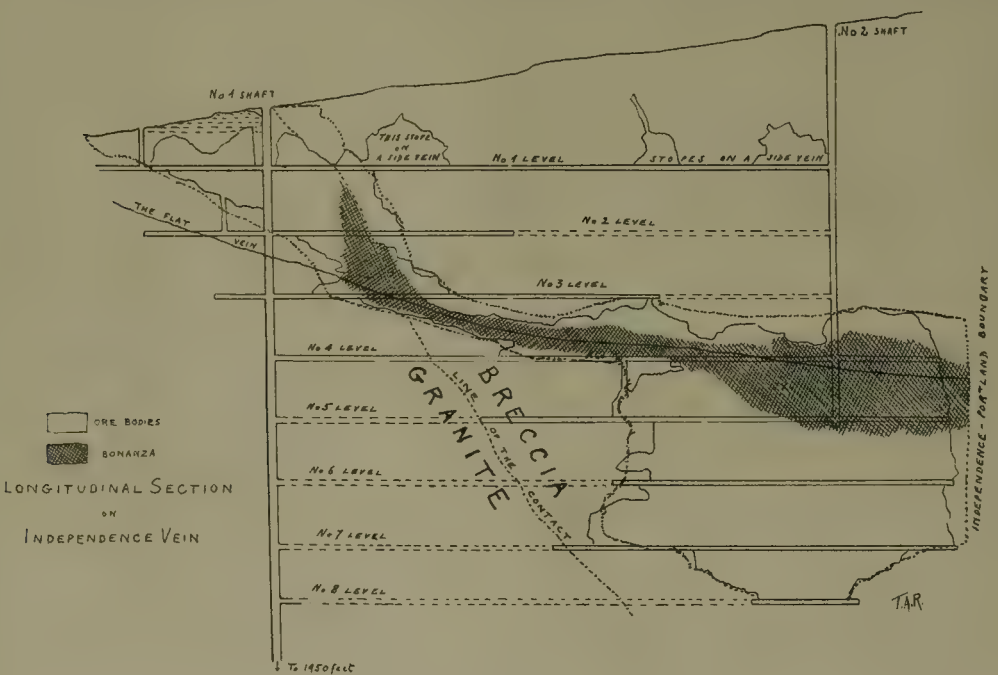


Fig. 2.

Everywhere in this district the distribution of the ore is modified by structural conditions, due mainly to dikes and other forms of intrusive rock. Thus, the Elkton represents the conditions characteristic of Raven hill. In this mine the rich ore follows one or both walls of a basalt dike about 4 ft. wide that penetrates the andesite breccia. The latter is itself brec-

*The numbers in the text refer to the table appearing in the first article of this series. MINING AND SCIENTIFIC PRESS, January 8.

[1] T. A. Rickard. 'The Cripple Creek Volcano'. Trans. A. I. M. E., Vol. XXX, p. 367.

cated, that is the fragmentary rock after becoming consolidated has been shattered by the rupture that made a way for the nephelite basalt. The ore is a replacement in both the breccia and the basalt, along the contact that granted a passage to the mineral solutions. A dike of phonolite crosses the basalt. The line of fracture that constitutes the Elkton vein extends beyond the basalt dike when the latter deviates in its course, showing how the vein fracture

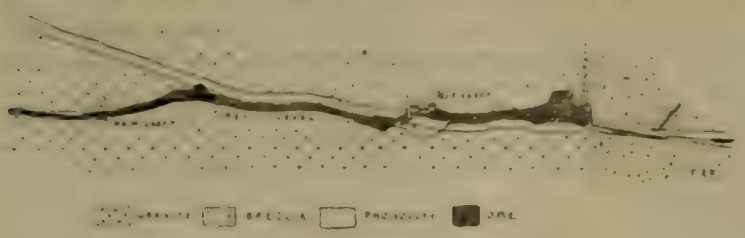


Fig. 3. Independence Vein and Dike.

was subsequent to the basalt and followed it where a line of least resistance was offered. But the richest ore occurs where the vein-fracture coincides with the basalt, for there the physical and chemical conditions were most favorable to the precipitation of the gold-bearing minerals, chiefly tellurides, such as sylvanite and calaverite.

Another example of the dependence of ore deposition upon structural conditions is shown by the Harrison vein in the Golden Cycle mine, on the southwestern slope of Bull hill. Here a large intrusive body of trachytic phonolite is traversed by dikes of phonolite that have shattered the older rock; along these bands of shattered rock the ore has been precipitated, the best of it occurring as a leader or persistent streak of very rich mineral flanked by mineralized and bleached country of a variable width. The greatest width of ore is found at places where subordinate veins join the main lode; this gives the orebodies a disconnected character, so that they seem like a series of linked enlargements. When the orebody dwindles, the line of the lode becomes indistinct, being then represented by a group of irregular fractures scarcely different from those to be seen in any cross-cut, and unrecognizable as 'veins' simply because they are unaccompanied by gold-bearing minerals.

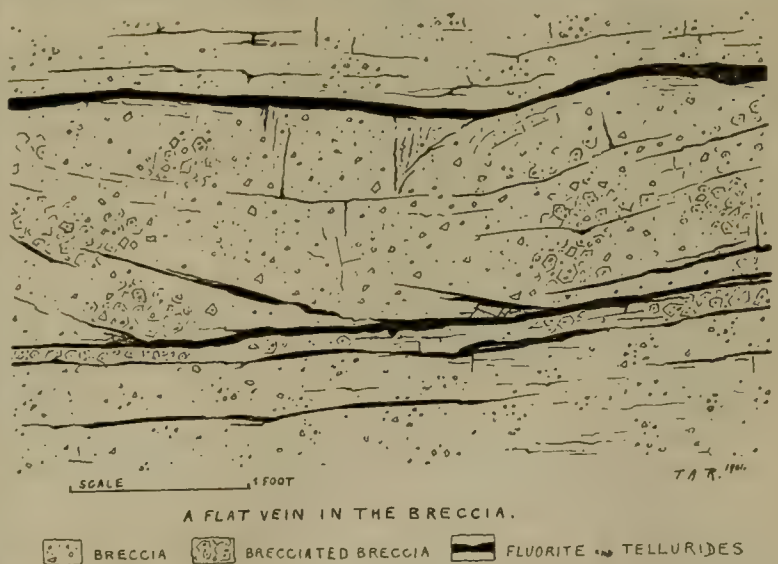


Fig. 4.

On the lower slips of Battle Mtn. are the Independence and Portland, the two most famous mines of Cripple Creek. In their geological conditions they typify the district, especially the disregard for the relative age of the formation, provided the structural conditions were otherwise favorable. In these mines rich ore is broken equally in granite and in phonolite, in the Algonkian and the Eocene rock. The Independence mine is on the rim of the basin that marks the eroded hollow of the volcanic crater—the crater that is now plugged with a complex of breccia and lava. The four or five veins that constitute the lode channel of the Independence mine have a strike that leads them out of the inner andesite breccia of Battle Mtn. into the outer granite of the surrounding country. And it is near the crossing of the vein from the one formation to the other that the bonanzas have been found. This is not surprising, for at the rim of the vent there were abundant facilities for the circulation of the mineralizing waters, the rock on both sides is shattered and penetrated by dikes belonging to successive periods of shifting and unrest, from the earliest andesite to the youngest basalt. However, the characteristic occurrence of ore in the Independence is that along a dike of phonolite, which is itself enriched by ore, but to a degree less intense than the rock it penetrates, namely, andesite breccia and granite. The ore consists of altered rock alongside the dike, and more rarely within the dike or even across it when the line of fracture of the vein has necessitated a deviation from the course of the dike. Where the phonolite, which is fine-grained and hard, is enriched it is usually along the seams produced by a sheeted fracturing parallel to the walls of the dike; in the breccia, which is coarsely granular and spotty, the rich ore occurs as an impregnation following fractures; in the granite, mica has been removed and in its stead is green chlorite, fluorite also is present, and secondary hydrous quartz fills the interstices of the original constituents; only the orthoclase survives the general disintegration of the rock. A thread of quartz sometimes marks the centre of the vein when in granite; at a distance the lode appears as a distinct broad (4 or 5 ft.) band of iron-stained granite, and it is only by close examination that the boundaries are seen to consist not of 'walls' or selvages but

of a definite transition from decomposed into undecomposed granite. The richest part of the mine coincides with a flat vein having a dip that produces a scissors-crossing with the contact between the granite and the overlying breccia, as shown in Fig. 2. This flat vein is shown in detail in Fig. 4. In places it was fabulously rich, consisting of two or three inches of almost solid sylvanite and calaverite.

On Squaw mountain and Beacon hill the veins are in the outer granite of the Cripple Creek district, but even there they are closely related to dikes of phonolite and basalt. In the Orizaba vein of the El Paso Consolidated mine, the rich ore is distributed with reference to sheets of phonolite that the vein-fracture crosses, so that the pitch of the ore-shoots coincides roughly with the dip of the intersection of the vein-fracture with the phonolite. At the crossing the vein faults the phonolite (which is 9 to 11 ft. thick), and in the jagged break there are found a number of cavities lined with long prismatic crystals of sylvanite, encrusted with quartz, of great beauty and richness. The tellurides also impregnate the rock encasing the fracture, both in the phonolite and the granite, but the most productive portions of the mine are in or near the phonolite. In this case, as elsewhere in the district, the distribution of ore seems to have been affected not by the relative age, nor even the composition, of the rock, but by the physical conditions produced by lines of fracture connected with eruptive activity. The impregnation of the rock by gold-bearing minerals has varied in character with the texture and composition of the various rocks, but the choice of a place for deposition appears to have depended mainly on structural conditions.

The youngest sedimentary formation in which gold and silver ore has been found is the conglomerate underlying the breccias and lavas of the San Juan region. This conglomerate is of early Eocene age and lies unconformably upon the Mesozoic rocks. Originally called the San Miguel formation, it is now known as the Telluride, from the mining district where it finds its greatest development. Varying in texture, it is coarse when a thin bed, and a fine-grained grit when it attains any thickness; this ranges from 200 ft. to a maximum of 1000 ft. In Canyon creek, above Ouray, in Bear Creek (20), near Telluride, and on Silver Mtn., at Ophir (21), this conglomerate is traversed by veins rich enough to have undergone exploitation by mining. The only mine that has been operated with notable success, and on any scale, is the Contention. Here gold is found in a fault-fissure having a throw of 58 ft. and accompanied by crushed country, that is, the ore is essentially rock in place, with a variable addition of secondary quartz, bounded by selvages. A good cross-section is exposed along the face of a steep mountain-side. The mine workings follow the vein from the conglomerate into the overlying andesite breccia; the best ore was in the conglomerate near its base, where it lies on a Jurassic sandstone. For a width of 30 inches the vein averaged $8 to $8.50 per ton. At a higher level the vein becomes poorer; in the breccia, it narrows and the valuable portions are more erratic. In descending, the Contention vein becomes unprofitable in the Jurassic sandstone and shale, and the evidence is such as to discourage exploration. The veins that penetrate the same conglomerate on Silver Mtn. (21) are similar to the Contention. The ore of the Golden Crown mine, for example, is "largely decomposed impregnated conglomerate, and little vein quartz is to be seen."[2] Here the conglomerate outcrops with a thickness of 300 to 400 ft. for a distance of several thousand feet, and is a grit held together by a porous cement. Thus it was easily impregnated by mineral solutions that followed fault-fractures coming through the underlying formation and reaching into the overlying breccias of the San Juan series. The geological interest of these veins in the conglomerate transcends their economic value, for mining operations have practically ceased, while the scientific importance of the occurrence is emphasized by the fact that the greatest goldfield ever developed by man is based upon the occurrence of gold-bearing quartz in conglomerate. I refer, of course, to the 'banket' of the Transvaal.

In Gunnison county there are several groups of mines that are geologically in the Cretaceous. At Irwin (22) this formation is represented by the sandstone, shale, and conglomerate of the Ruby formation, which is traversed by many veins, some of which yielded a large amount of rich silver ore nearly 25 years ago. The Ruby Chief vein is typical; it follows a fault-fissure, marked by two feet of broken rock and a band of quartz, streaked with arsenical pyrite. Ruby silver and stephanite occur in this quartz, which is from 6 inches to one foot wide. Between this leader of quartz and the nearly vertical hanging wall is brecciated country, containing stringers of quartz and speckled with arsenical pyrite. The best ore was obtained from this vein where it passes into a bed of conglomerate; so here again we have an example of precious-metal mining in conglomerate; but the Contention yielded gold, while the Ruby Chief is essentially a silver vein. It remains to add that porphyrite occurs in the vicinity, as an intrusive sheet following the bedding of the sedimentaries.

On Gold Hill, a few hundred feet below the workings of the American Nettie, already described (27), there are mines in another geological terrain, namely the McElmo formation of the Jurassic, just above the La Plata sandstone. In the Bright Diamond and the Ironclad (30) mines, the ore is found in a fine-grained dark-blue limestone, 10 to 15 ft. thick, overlain by green shale that has been altered by intrusions of monzonite-porphyry so that it has become an argillite heavily charged with epidote and other metamorphic minerals.[3] The orebodies lie flat, conforming to the stratification and in close contact with the shale roof. Cross-fractures fault the ore and the limestone as much as 10 ft. In the Bright Diamond there is a porphyry dike 10 to 30 ft. thick north of the ore-bearing tract. The metamorphic effects of the irruptive porphyry do not appear to have affected the limestone. The ore is an intimate mixture of granular magnetite and pyrite, with a little chalcopyrite,

[2] C. W. Purington. 'Telluride Quadrangle'. Page 845.

[3] J. D. Irving. 'Contributions to Economic Geology'. 1904. Page. 73.

together with epidote, actinolite, garnet, quartz, and calcite. The discovery of the ore-measures was due to prospecting on a large fault-fissure vein that crosses the limestone. The ore carries $10 to $14 in gold, but in the mill it is difficult to concentrate. In a neighboring sub-district, called Camp Paquin (30), a limestone of the same formation is exploited. In the Newsboy the limestone is 5 to 7 ft. thick and the ore occurs in flat masses that generally occupy the full thickness of the limestone for a distance of 5 to 30 ft. from vertical fissures. In the Pony Express the same limestone is 30 ft. thick and the orebodies are much

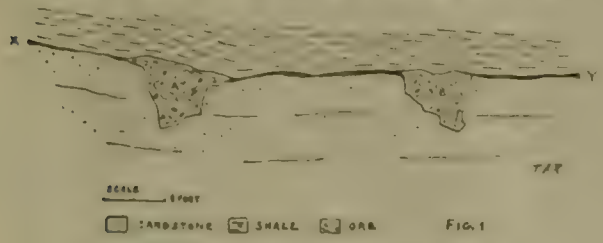


Fig. 5. Pockets of Ore in American-Nettie Mine.

thicker and more extensive. They reach into the hill for 1000 ft. along the strike of the vertical vein and spread out for 100 ft. The ore is sometimes the full 30 ft. of the limestone, but more usually from 8 to 10 ft. thick. It is richest immediately under the roof, which is shale. The ore is valuable chiefly for silver and is said to average about $30 per ton.

While most of the mines of the Silverton district exploit lodes in the San Juan breccia (11 and 12),

Fig. 6. Contention Lode.

which is Tertiary, there are gold veins in the same district that are mined in a hornblende-schist of pre-Cambrian or Algonkian age (58). In Cunningham gulch the lodes traverse both the schist and the breccia. The Highland Mary is typical; this vein is from 2 to 3 ft. wide, and appears as "a simple quartz-filled fissure" within well-marked walls, to which the quartz adheres or is 'frozen'. Galena and tetrahedrite characterizes the rich ore. When the vein passes upward into the breccia, it becomes much wider, but consists of barren quartz. In the neighboring Green Mountain mine, the schist underlies a rhyolitic flow-breccia. In the rhyolite the vein is about 3 ft. wide and is a simple fissure, containing small inclusions of the encasing country. The ore carries galena and sphalerite in quartz. In the schist the vein is a little wider and occupies a clear-cut fissure, the quartz being 'frozen' to the clean edges of the encasing rock. Pay-ore was broken from the vein where it traverses both formations, and the difference in the country

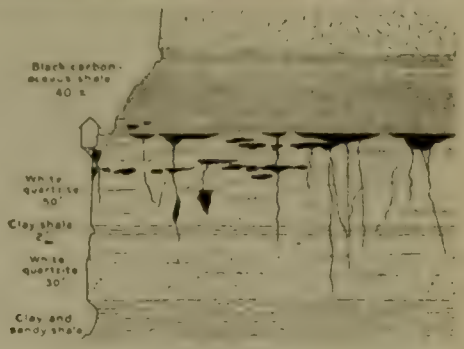


Fig. 7.

does not seem to have had any marked effect on the richness of the ore.[4]

In the Mt. Wilson district the veins penetrate both diorite (1) and the black shale of the Mancos formation (24) into which the diorite has thrust itself.

Fig. 8. Ruby Chief Vein.

Usually the veins are richer in the diorite than the shale, but in the San Bernardino, Badger, and American Frenchman mines, orebodies rich in silver occur in the veins when wholly within the shale.[5]

It has been noted that the Contention (20) vein passes from the Telluride conglomerate into Jurassic sandstone, only to die out. A few miles to the north, just above the town of Telluride, there are veins (28) that have been mined profitably in the same series of

[4]F. L. Ransome. 'The Silverton Quadrangle'. Pp. 167-169.
[5]C. W. Purington. 'The Telluride Quadrangle, Colorado', p. 815.

Jurassic sandstone and shale, constituting the McElmo formation.

The Dakota formation at Ouray (27) is called 'the upper quartzite'. it consists there of hard sandstone separated into two or three beds by thin bands of shale. It is about 150 ft. thick and forms bold cliffs. In this formation are found several curious ore deposits.

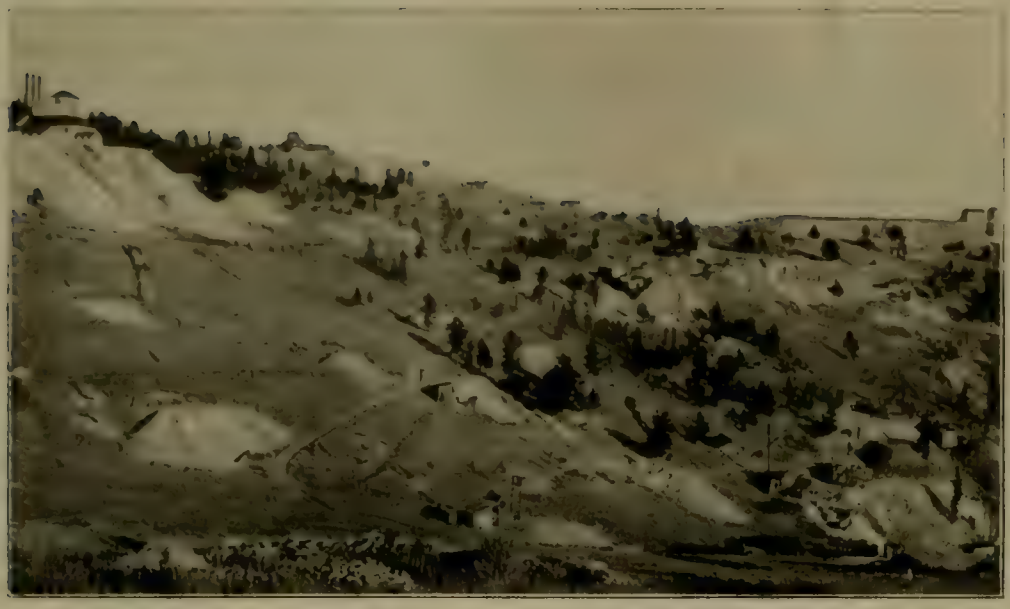
The gold deposits in the granite-gneiss of the Plomo district, in Costilla county, and on the western slope of the Sangre de Cristo range are in an Archean, or at least Algonkian, formation. The ore occurs in zones of crushed rock near lines of faulting.

The three terrains most productive of gold and silver in Colorado have proved to be the Tertiary volcanic rocks, the Carboniferous limestone, and the Archean granite-gneiss. The last of these was the first to be prospected because it constitutes a large part of the Front range of the Rocky mountains where they rise abruptly above the plains over which the pioneers came westward. The mines of Boulder, Gilpin, and Clear Creek counties are mainly in the granitoid gneiss, some of which may be Algonkian and represent metamorphosed sedimentary rocks. In this basal complex are found dikes and other less regular intrusions of andesite and felsite the age of which it is not possible to state with certainty because they do not traverse any of the later sedimentary strata; but by their resemblance to the eruptive rocks of neighboring districts it is presumed that they also were intruded during early Tertiary time. This much can be said: all the lodes containing gold and silver as yet discovered in Colorado are associated, directly or indirectly, with intrusive igneous rocks the age of which when ascertainable is found to be post-Cretaceous. This points to an era of intense thermal activity supervening upon the volcanic disturbances for which the early Tertiary period is remarkable in Colorado.

The study of the orographic features of Rocky Mountain geology has demonstrated several facts of great significance. For the ascertainment of these facts we are indebted in large measure to the investigations of R. C. Hills, a geologist long resident in Colorado as a specialist on the stratigraphy of the coal measures. In his address as president of the Colorado Scientific Society, in 1888, he established several points of prime importance. Thus, he showed that "the tilting and overturning of strata observed along the mountain border, both east and west of the continental divide, are due to a general movement affecting all the Eocene sediments, except the Uinta group" and that "the more salient features of the orography [of this region] were created in post-Cretaceous time." The great faults traversing the Rocky Mountain uplift involve Cretaceous beds, and are therefore of Tertiary age. The early Eocene was marked by a succession of stupendous eruptions, covering an enormous area with lava and breccia to a depth reaching in places to several thousand feet, especially in the counties of San Juan, Hinsdale, Ouray, San Miguel, and Rio Grande—forming the larger part of what is now called the San Juan region, after the name of the river into which its drainage is discharged. Subsequent regional movement of great intensity, and accompanied by extensive flexures, culminated in faulting that left dislocations measured by 5000 to 8000 ft. All of the districts now the scene of mining in Colorado were affected. The upper channels of the principal rivers were established during this period. Then followed another series of eruptions, extending into the Miocene, "amplifying the effects of simple orogenic movements." Mr. Hills also says: "In the Rocky Mountains of New Mexico, Colorado, and Wyoming, all the eruptive bodies belong to a time not earlier than the close of the Cretaceous, and the majority to a time subsequent to the close of the Eocene." He refers to possible exceptions, but concludes that "no important outbursts of eruptive material took place previous to the Tertiary." Some of these eruptions were contemporaneous with the great fault-movement, others followed. "The injection of sheets of lava into strata previously flexed" was a noteworthy structural feature of the region. Late in the Pliocene and again in the post-Pliocene period renewed movement caused faulting and folding, accompanied by eruptions of restricted character, especially southward into New Mexico. Thus the broad fact is emphasized that the Cenozoic was the mountain-building era in the south-central Rocky Mountains and that the Tertiary eruptions augmented and modified the previous orographic features.

To these grand geological events the formation of ore deposits is related as one of the minor consequences of wide-spread and intense thermal activity. At the close of the series of volcanic eruptions, the smothered plutonic energy found vent in the form of geysers and hot springs. Heated water circulated along the fractures and fissures, which were formed in the first place by excessive strains and subsequently by the cooling and shrinking of the extravasated igneous material. This heated water carried metals in solution, the source of such dissolved metals varying according to the origin of the water. Descending meteoric waters carried entrained oxygen below the surface, and magmatic waters representing the last phase of differentiation brought sulphides from the deep where slumbered the subterranean fires. In the approach to surface, and particularly at that horizon known as the water-zone, the precious metals were precipitated, forming the minerals for which the miner searches with labor unceasing and hope unabated.

The Bayhay Valley Oil Co. has recently been organized at Manila for the purpose of sinking wells on 11 claims in the Tayabas oil district on the Island of Luzon. The total area comprised in the claims amounts to about 200 acres. They are situated on the Bayhay river, three miles from Ragay gulf, and it is intended when the wells begin to flow to put in an 8-in. gravity pipe-line from this property to tidewater. A wagon-road is now nearing completion from the gulf to the Alabama claim in the group. There is a test well 120 ft. deep, with a 5-in. bore, now on the Alabama claim. The well can be pumped perfectly dry and the oil will seep in at the rate of from one to three barrels per day. Two wells are to be drilled at once.—*Philippine Resources.*



Bull Hill, Cripple Creek, in 1901.

Platey Jointing in Breccia at Cripple Creek.

Cyanidation of Silver Ores.

Written for the MINING AND SCIENTIFIC PRESS
By LLOYD B. KNIFFIN.

In striking contrast to the usual method of cyaniding Mexican silver ores is the treatment which we have been using at the Zambona mine in the Alamos district of Sonora, Mexico. The unusual feature is the extreme rapidity of solution of part of the silver in cyanide, and the peculiar advantage of concentrating before cyaniding. The ore consists principally of orthoclase feldspar, very much brecciated and filled with calcite. Distributed throughout the ore is the sulphide of silver, argentite, in all sizes down to minute particles. This mineral was formerly the chief object of mining in this camp, when transportation was expensive, and it sometimes occurred in pockets of considerable size. The silver sulphide is easily removed by concentration on Wilfley tables, and in this way an extraction of 50% of the total silver is obtained. For several years this method has been used, and the tailing stored. At present the mill is engaged in grinding and treating this ore with cyanide.

The process is as follows: Cyanide solution (0.075% free KCN) is mixed with the ore in the ratio of 6 to 1, and the sand separated and discharged to tube-mills by Dorr classifiers. The discharge from the tube-mills is returned to the classifiers, and the overflow from these goes to Dorr slime-thickeners. The underflow, at a ratio of 1½ to 1, is stored for delivering to the filter-presses as needed. Thus, concentration and grinding in solution, without agitation of any kind, is all the treatment required to reduce a 16-oz. ore to 1.3-oz. silver per ton.

The ore is also remarkable on account of its sensibility to low strengths of cyanide. The following table shows the results obtained with a free cyanide strength of 0.042%; the total cyanide was 0.066%, and the protective alkali, 0.046% CaO.

	Silver, oz.
Ore after concentration in water	8.30
After mixing with solution	4.48
Sand from above (tube-mill heads)	5.52
Tube-mill tailing, 52%, coarser than 200 mesh	5.28
Discharge from Dorr thickener	2.72
After standing six hours pulp was pumped to Pachuca tank without addition of cyanide	2.28
After 6 hr. agitation	2.18
After 9 hr. agitation	1.96
After 18 hr. agitation	1.82

The tailing consisted of 42% slime, assaying 1.44 oz. Ag; 45% sand finer than 200 mesh, with 2.06 oz. Ag; 13% sand coarser than 200 mesh, assaying 2.42 oz. Ag. It will be seen that both in time of treatment and in strength of cyanide necessary, this ore is similar to ores containing embolite and native silver as described by Theo. P. Holt, in the MINING AND SCIENTIFIC PRESS, July 31, 1909. In order to check this theory, as to the form of combination of the silver, the following test was made on the suggestion of E. M. Hamilton. To the working solution nitric acid was added in excess and the mixture boiled. The resulting precipitate (silver cyanide and chloride) was removed and treated with hot concentrated nitric acid. The precipitate which was then insoluble was easily dissolved in ammonia. This established the presence of chlorides in the solution, and probably therefore in the ore, although the water used for washing on the slime-filter press contained traces of chlorides. Whether the ore also contains native silver has not been proved.

For a short time the mill and cyanide plant were operated without concentrating, and in order to effect the same extraction as obtained with combined concentration and cyanide treatment it was necessary to use a 0.15% free cyanide solution and a 30-hour treatment in Pachuca tanks. In this case it was necessary to dissolve the argentite, which in general was separated as concentrate, as well as the chloride, which yields to shorter treatment.

It has proved here, as at Copala (MINING AND SCIENTIFIC PRESS, June 8, 1907, p. 719) that a high protective alkalinity is necessary with this ore in order to keep down the quantity of zinc in solution; and that even with the protective alkalinity constant at 0.1% CaO it is only safe to regulate the solutions by the free cyanide test, because the variations in zinc and copper present often cause the indicated total cyanide to vary from an amount less than the free cyanide present to three times the free-cyanide strength. Under this latter condition the recourse is to increase the protective alkalinity to 0.15% CaO, and then the zinc goes down to the normal quantity; but on account of using vacuum-filter presses, with a canvas filtering medium, it is not expedient to keep the slime permanently at this high strength.

Although it is usually stated that the zinc is precipitated from working solutions as cyanide of zinc, it seems probable here that basic zinc carbonate, at least under some conditions, is thrown down. The reaction ought to regenerate free cyanide, and this is usually observed to be the case, for the cyanide rises as the zinc decreases.

Topographic maps named below were issued by the United States Geological Survey during September, October, November, and December 1909: Alaska, Fairbanks (price 25c.); California, Carbondale, Clay, and Florin; Idaho, Garden Valley; Illinois, West Frankfort; Kentucky, Central City, Earlington, Madisonville, and Providence; Minnesota, Rockford; Montana, Sapphire; New Mexico, Gallina; New York, Watertown;* Ohio, Continental, Lancaster, Lisbon, Logan, and Newark; Oklahoma, Luther, McAlester,* Tuskahoma,* and Winding Stair;* Pennsylvania, Bellefonte; Tennessee, Franklin; Wisconsin, Sparta. Maps marked with an asterisk (*) are new editions of old maps. The price of these maps (except as noted) is 5c. each, or $3 per hundred if that many or more are ordered. Payments should be made by certified check or by postal or express money order, payable to the Director, U. S. Geological Survey, or in cash—the exact amount.

Alaska was bought from Russia in 1867 for $7,000,000. Its gold output since 1880, when placer mining began, amounts now to $161,000,000, and the exploitation of its resources of copper, coal, and other minerals has hardly begun.

Philippine Coal Mines.

The East Batan coal mine is located on the southeastern end of the Island of Batan, Province of Albay, Philippine Islands. The claims were originally located in 1903, but no effort was made toward developing the property until 1906. During the month of October of that year, active operations were commenced, in a small way, on a 3-ft. seam lying to the east of the village of Batan, and by the end of December, the same year, 200 ft. of entry had been driven and about 150 tons of coal taken out and stored. A light wharf was completed and a small portable track laid from the mine out to the end of the wharf where lighters could be loaded. The half-ton cars were moved by hand. Occasional sales of a few tons of coal were made from time to time to launches passing near the mines; but it was not until March 2, 1907, that the first steamer was coaled there. On that date the *San Juan*, an inter-island steamer, took on board 75 tons. The coal gave satisfactory results. Development work was steadily continued, and from time to time other steamers began to call at Batan for coal. During this period all work had been done by private capital. In September 1907 it was found that additional capital would be required to purchase the machinery and equipment necessary to continue the development work on a more extensive scale. This resulted in the organization of the East Batan Coal Company.

In November, work was commenced on the 5½-ft. bed, lying west of the village and worked on the 3-ft. seam stopped, it having proved more profitable to work the larger seam. Since July 1908 a more vigorous policy of development has been pursued through the aid of additional capital. Among the improvements made may be mentioned the building of more lighters to expedite the coaling of ships; a wharf 300 ft. long with sufficient water to accommodate the largest ship in the world; a railroad from the mine to the wharf with an equipment consisting of two locomotives and 50 two-ton cars, thus making it possible to deliver coal direct from the mine to the ship, avoiding the costly re-handling of the coal; a steam launch to aid in the harbor work and place the mines in communication with outside ports. New streets also were laid out in the Barrio, and it now represents a clean healthy little mining camp of 2000 souls. During all this period of outside improvement the work below ground had not been neglected, but a greater force had been employed, and with the additional equipment gratifying progress had been made in driving tunnels and galleries, until at present the work below ground aggregates several miles.

The coal removed during development has all been consumed by coasting steamers, and the funds derived from the sale have been applied to the work, until now nearly a half million tons is blocked. The coal-seam shows no rolls or faults.

The bulk of the mining and all outside work is done by Filipino labor, which has proved entirely satisfactory, and of which there is an abundant supply. Several experienced Japanese miners and timber men are also employed in timbering and special development work. There has been no labor trouble of any kind and no trouble has been experienced in procuring all the men needed. Experience at these mines during the past three years has shown that the Filipino takes readily to mining, and, under competent supervision, has proved as reliable and satisfactory as any labor found in the Orient. The entrance to the harbor at Batan is well marked with concrete beacons, built by the Insular Government; and range lights have been established for the convenience of ships desiring to enter or leave the harbor at night. There is an average of 54 ft. of water, with mud bottom, making excellent holding ground.

It is proposed to make Batan the quickest cargo-handling port in the Far East, which can readily be done by taking advantage of the mine and harbor's natural conditions. The pit-mouth is within 600 ft. of the sea and within 3000 ft. of the wharf, where the largest ships in the world can load at all times and seasons. Under the proposed new method, the coal will be touched by hand only once, and that is when it is shoveled into the trucks down in the mine, and it goes from there direct to the ship's hold or bunkers, being loaded into the ship mechanically.

It is proposed to install a complete electric plant at the mines, using electrical coal-cutting machines, electrical coal-gathering equipment, and electric pumps, and to light the mine throughout by electricity. This new system will be used to light the plant outside the mine, and will make it possible to despatch ships either night or day. It is proposed to extend the present wharf from 300 to 600 ft. and increase the present bunkers now in course of construction to a capacity of 6000 tons. Under this method ships can load with bunker coal in a few hours, while a cargo ship could be loaded with 6000 tons within 24 hours at a cost of a few cents per ton.

Coal to the amount of 494,209 tons, with a market value of about ₱5,000,000, was imported into the Philippine Islands during the past fiscal year. With the proposed new equipment the greater part of this coal can be supplied from the mines of the East Batan Coal Mining Co., and the millions of pesos paid for the same thus be kept in the Philippine Islands, instead of going out of the country, as at present. The commercial value of Batan coal is shown by the report of the Philippine Bureau of Science, recently published, giving the results of a practical test of Australian *versus* Batan coal as used on two Government coast guard vessels, sister ships, having the same equipment throughout. The test as given is by ordinary steaming for a distance of 5000 miles. The cost to the vessel using Australian coal was ₱0.66 per mile, and to the vessel using Batan coal ₱0.38 per mile, ₱1500 being saved by using Batan coal on a 5000-mile run.

In 1903 the United States Government commenced prospecting for coal on the west end of Batan island, some ten miles distant from the East Batan mines. The results were so satisfactory that, in 1906, the west half of Batan island was declared a military reservation. Diamond-drill work and mining have been steadily continued, and about ₱700,000 have been expended since operations were commenced in 1903.

Stability of Dams.

By J. F. Jackson.

*In the old-fashioned timber dams, hundreds of which have been built for logging and power purposes, on all sorts of foundations, it was customary to give the water-tight surface of dams a slope upstream generally two or more horizontal to one vertical, making a cross section something like Fig. 1 in the case of an overfall dam. For the purpose of a coffer-dam of moderate height on solid rock or impervious bottom, the same general idea is satisfactory, as shown in Fig. 2. In this diagram the planking is shown laid at slope of one to two. Note the position and direction of the resultant of water pressure. Little theoretical study, as far as I know, has been given to these forms of dams. It is obvious in each of the above cases that the weight of the water and the back filling have been a large or the entire factor in the stability of the dam, both against sliding and overturning. The beaver has always utilized the weight of water for stability, and some of his achievements have been truly remarkable. The lower part of beaver dam is always open for drainage. His work is more scientific than that of some of our modern builders.

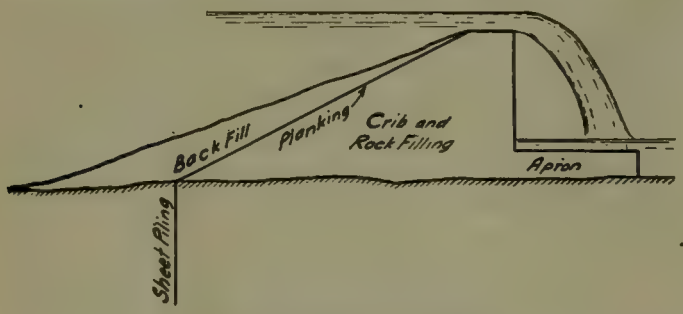


Fig. 1. Cross-Section of Timber Dam.

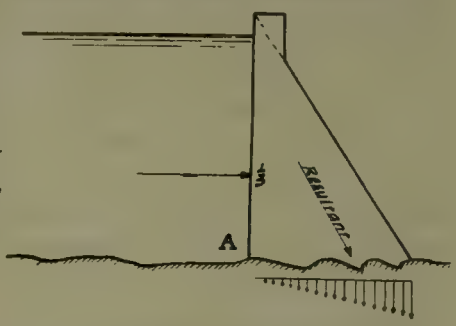


Fig. 3. Typical Cross-Section of Masonry Dam.

Fig. 2. Cross-Section of Coffer Dam for Shallow Water.

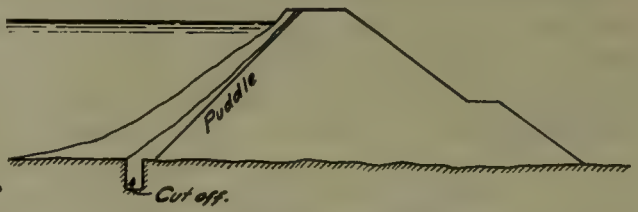


Fig. 4. Typical Cross-Section of Earth Dam.

The first masonry dams were probably built entirely by guess, but some of them stood. A precedent having been established, in course of time mathematicians came along and found that masonry structures having a factor of safety of two against overturning and of one against sliding on their bases were actually standing up. Therefore a coefficient of friction of 0.6 or 0.7 was assumed, and a sufficient weight of masonry provided to resist the horizontal hydrostatic pressure of the reservoir. Hence we have the standard triangular or trapezoidal section as shown in Fig. 3, in which the resultant pressure of water and masonry usually falls just inside or at the middle third of the base, so that pressure begins practically at zero at the inner heel and increases to a maximum at the outer toe, as illustrated below, provided the structure acts as a unit. The pressure of water and weight of masonry are such that the coefficient of friction is barely sufficient to resist sliding. In fact, if it were not for the dove-tailing into rock at the base of the dam and into the walls of the gorge between which the dams are built, there would be many more failures by sliding than there have been. However, so far as mathematics are concerned, we have the astonishing fact that in masonry structures of immense importance, and in perhaps no other cases, engineers are content to follow in the rut and build with a factor of safety of one. Further than this, as soon as you assume hydrostatic uplift, or that water enters under the edge *A* of your dam, your precious friction coefficient is partly destroyed, and the dam fails. It is only fair to say that most engineers now make some attempt to drain toward the downstream toe of the dam. The form of masonry dam is somewhat circumscribed by the fact that no tension is assumed on the upstream face. I nevertheless believe it quite possible to develop a form of masonry dam in which the weight of water and possible backfill is utilized to add stability. The ordinarily accepted coefficient of friction as indicated above and the factor of safety of two against overturning, should not be accepted as sufficient. In earth dams, I believe that the section should be something like that shown in Fig. 4.

The same idea applies to an earth dam, a rock fill dam or like structure with a cut-off planking, reinforced concrete, steel plate, or common puddle. In every case water-tightness should, if possible, be secured as near the water itself as possible, and the vertical components of the hydrostatic pressure should be equal to or exceed the horizontal ones. Western engineers have already followed this idea to some extent in earth and in rock fill dams with planking. Designers of concrete dams have usually followed the standard masonry profile or something like it. Happily, Bainbridge with his steel dam, and

*Abstract from *Jour.* West. Soc. Eng., Vol. 14, No. 5.

Ambursen with his concrete dam, and the idea of the reinforced concrete retaining wall came along, so that it is now in order to consider a dam having a water-tight face capable of taking tension. Bainbridge's dam consists of a series of inclined bents covered on the upstream side with water-tight concave plates. In this dam, water pressure is taken normal to the water-tight face. The column loads are taken directly to the rock bottom, and tension of face plates is taken up by anchor rods.

If it be not founded on rock, the design must be altered radically, as indicated further on. Although

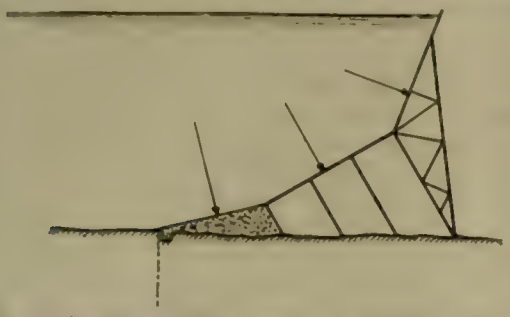


Fig. 5. Cross-Section of Suggested Concrete and Steel Dam.

the Ambursen dam utilizes the weight of water to some extent, in my opinion it does not, as ordinarily constructed, provide much greater stability against sliding than the standard profile, though it does thoroughly provide against hydrostatic uplift by the open construction of its base. The main idea of Ambursen's patent was apparently to so construct the water face of his dam with reference to the cross-walls that the direction of water pressure at any point should fall within the base. The calculation of stability of a steel dam on rock bottom, with given factors of safety, is much simpler and more certain

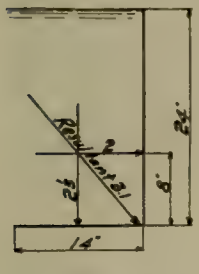


Fig. 6.

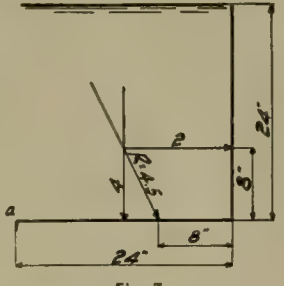


Fig. 7.

Cross-Sections Showing by Bent Plates the Principles Suggested.

than even the design of a steel railroad bridge, and I believe that the time is coming when the merits of this construction will be much more appreciated by engineers than at present.

In designing the cross-section of a steel dam about 100 ft. high, I accidentally hit on the idea of making the part near the top, where hydrostatic pressures are light, nearly vertical, and sloping the part near the bottom, where hydrostatic pressures are heavy, until it was nearly horizontal. This resulted in a saving in construction cost, and a greatly increased factor of safety against sliding and overturning. The idea is illustrated in Fig. 5, where the plating on the lower section is supported directly in concrete, cheap masonry, or other filling, while the upper part is of steel construction. The amount, position, and direction of resultant pressures depend upon the exact shape of the water-tight surface. The vertical water pressure may be made 1.5, 2, or even 3 times the horizontal pressure, depending on the width of base, and the resultant pressure of all weight of water and structure, may be brought as near the centre as desired. The limits of this idea are shown in Fig. 6. Suppose we have a dam built of a small bent plate, calling the height 24 in., the base 14 in., the horizontal water pressure would be 2, applied at 8 in. from the base, the vertical pressure would be 2.33, applied at 7 in. from the bend. The resultant would be 3.1, applied practically at the bend. The structure would be just a little more than stable against overturning, and a friction coefficient of 0.86 would be sufficient to prevent its sliding. In case the base were 24 in. and the height 24 in., as in Fig. 7, the horizontal water pressure would be 2 as before, and the vertical pressure would be 4, and

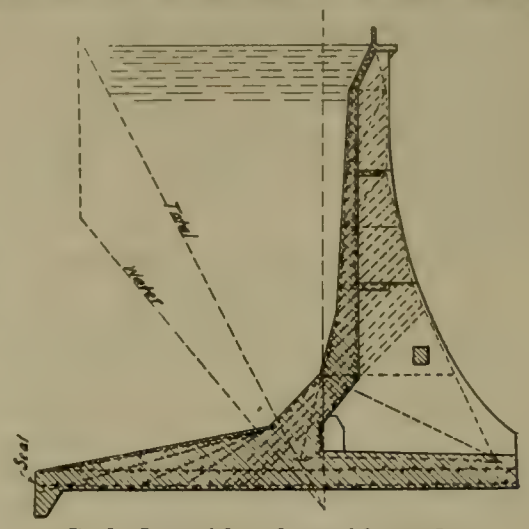


Fig. 8. Proposed Cross-Section of Concrete Dam.

the resultant 4.5, falling at a point one-third of the distance from the bend to the upstream edge of the horizontal plate. This resultant would stand two vertical to one horizontal, giving a coefficient of 0.50 to just prevent sliding. If leakage at *A* be prevented and the plate be stiff enough to preclude bending, there will result, due to water pressure alone, a small dam as safe against overturning and safer against sliding than the standard profile. It is evident, then, that in a dam having a base equal to its height, the sum of all horizontal pressures is exactly that due to the depth of the water, no matter what the shape of the water-tight surface, and it is possible to utilize the vertical pressures from a minimum of zero to a maximum of two times the sum of the horizontal forces, and to bring the resultant of both forces from a horizontal direction to an inclination of two vertical to one horizontal, as shown. Of course, in the practical structure of steel of the Bainbridge type or of concrete, wood, or other material, the tension face would be curved in some manner, and in making calculations the weight of the structure itself should be added.

In Fig. 8 is shown the proposed section of a reinforced concrete dam having a concave water-tight

face. Note the position and direction of the resultant of the water pressure and also note that the total resultant falls about half way between the centre and the ⅓ point. It is designed to be a heavy and substantial structure, but contains only about one-half the amount of concrete of that required in a dam of standard cross-section. In this particular case the water pressure resultant stands at an angle of five vertical to four horizontal, and the total resultant at eleven vertical to five horizontal, and the structure evidently has some stability against both overturning and sliding. A spillway section employing this principle also works out favorably in either steel or concrete. The Patent Office has recently recognized this principle of using hydrostatic pressure on a concave face to add stability to dams. So far as I know, this is the first recorded recognition of the hydrostatic principle involved. I do know, however, of a mining engineer out West who once built a small concrete dam wrong side to, and with good results. The modern inside buttressed reinforced concrete retaining wall employs a similar idea, but the earth pressures are not hydrostatic. In the earthen dam with masonry core-wall, the hydrostatic pressure against the core is greatly modified, though nobody knows how much, by the presence of the earth-fill on the water-side. Its design is eminently a matter of guess work.

STANDARDIZATION OF EXPLOSIVES.

By Charles E. Munroe.

*That some definite standard of composition is needed for explosives offered on the market may perhaps be made apparent by instancing dynamite. As invented by Nobel it consisted of an absorbent, called a dope, and nitroglycerin. The absorbent long used commercially was kieselguhr. It was made to absorb and hold various percentages of nitroglycerin up to 75% of the dynamite produced, and the product was styled by a name such as 75% dynamite, which indicated the quantity of nitroglycerin contained in it. Kieselguhr is incombustible, so it and substances like it that were used as absorbents were called inexplosive dopes. Nobel also found, however, that gunpowder or gunpowder-like mixtures, such as wood-pulp and nitrate of soda, would act as satisfactory absorbents for nitroglycerin, and hence a large number of dynamites have been made and used with these explosive dopes, but since there has been a dispute as to any useful explosive effect from the dope, these dynamites have been generally rated by their nitroglycerin content only. Later it was discovered that explosives such as the cellulose nitrates, which, like nitroglycerin, can be made to detonate, could form compositions with nitroglycerin, and such compositions, or others with nitro-substitution compounds mixed with a dope, have been offered in the market as 40 or 60 or other per cent dynamites, though they contain less than the designated percentage of nitroglycerin. It is claimed by the manufacturer that the new compositions are as strong as a straight dynamite containing the designated percentage of nitroglycerin. This may be true for a certain set of conditions; in fact, the new composition may be under certain circumstances not only as efficient as the straight dynamite, but even more efficient. Nevertheless the consumer is entitled to know definitely by some conventional means the nature and composition of an explosive which is publicly offered for sale, in order that he may decide for himself when and how he shall use it and what is a reasonable price to pay for it.

As another example may be cited black blasting powder, which, as invented in 1857 by La Motte Du-Pont, is a mixture of charcoal, nitrate of soda, and brimstone. This has been extensively used in mining in this country, particularly in coal mining, so that at the census of 1905 the production amounted to 205,436,180 lb.; yet today no standard exists as to the kind of wood from which the charcoal is to be made, the manner in which and the degree to which it is to be 'burned', the proportions in which the components of the powder are to be mixed, the conditions and extent of incorporation, or the quantity of moisture which may be left in the finished grains. Neither have any steps been taken until recently to insure uniformity in granulation, although this feature is of vital importance and its effect well known.

As a third example, the classification of detonators, known also as blasting caps, may be mentioned. These powerful and delicate initial sources of detonation have been graded by a variety of methods at the will of the manufacturer, whereas the vital information which the consumer should possess is a knowledge of the quantity of fulminating composition contained in each capsule. The system of grading should therefore be so conventionalized as to set this forth explicitly.

The mine inspectors in several States have taken up the inquiry and it has been experimentally examined by the Technologic Branch of the United States Geological Survey at the Pittsburg Testing Station. The Bureau of Explosives of the American Railway Association has also been making investigations into the composition of commercial explosives, particularly as it affects safety in transportation. But a still broader field for standardization exists.

*Abstract from *Proceedings* of the Amer. Soc. for Testing Materials.

The average consumption of fuel per brake-horse-power hour in gas-producer tests made by the United States Geological Survey was 1.36 lb. of bituminous coal, or 1.99 of lignitic coal, the minimum consumption being 0.84 and 1.48 lb., respectively. Comparative tests of 75 bituminous coals under a water-tube boiler and in the gas producer showed that the average fuel consumption per brake-horse-power in the steam-plant was 2.7 times that in the producer plant. Several low-grade coals and lignites that were of little value, or even worthless, under the steam-boiler gave excellent results in the producer.

Nevada has recently been re-studied in a reconnaissance of mining camps in Elko, Lander, and Eureka counties, by W. H. Emmons, of the United States Geological Survey, whose report is just printed as the Survey's Bulletin 408. The region covered, comprising 7000 square miles, has produced silver and gold worth about $50,000,000.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use its columns for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that useful criticism is entitled to a hearing. The acceptance or rejection of any contribution is determined by its probable interest to the readers of this journal.

Australian Gold Production.

The Editor:

Sir: In 'Ridpath's Universal History', Volume VIII, page 860, I find the following statement: "The industrial development of Australia may be further illustrated with a few additional facts gathered from the census of 1881-82. At that time the total aggregate of gold taken from the mines of Victoria had reached the enormous sum of a thousand and ten billions of dollars. The aggregate from New South Wales was a hundred and seventy-two billions, and that from Queensland fifty-six billions, which, together with the yield from Tasmania, made a grand total of a thousand two hundred and fifty-five billions of dollars." Is it true that the Australian census reports contain such absurd statements, or did Mr. Ridpath get his ideas as badly confused here as he did in many other places throughout his work?

J. W. BUSH.

Lower Lake, California, February 9.

[We do not have a copy of the census report at hand; perhaps some of our readers can answer the question. Probably the error was in the History rather than the Census.—EDITOR.]

Geology at Globe, Arizona.

The Editor:

Sir—"In 1903 was published the first report by the United States Geological Survey on one of the Southwestern copper districts, based on field work done in 1901 and 1902." The above is quoted from the first sentence of a contribution by F. L. Ransome under the same caption that heads this article, and the report referred to is of course Mr. Ransome's work on the Globe quadrangle. In this last article, which appeared in the MINING AND SCIENTIFIC PRESS on February 12, 1910, Mr. Ransome has for the first time to my knowledge corrected certain serious mistakes in the above-mentioned report. Mr. Ransome continues as follows: "At that time practically nothing was known of the geologic relations of the copper ores of Bisbee, Clifton, and Morenci, Ely, Bingham, and Yerington." Possibly some of us who had the pleasure of examining some of the Southwestern copper camps before the publication of the reports of the United States Geological Survey were not in quite such dense ignorance in regard to what we saw as Mr. Ransome would have us believe, and we were able to gain some notion as to the structural relations of the deposits. But few, however, will hesitate in giving the Survey credit for the way it has taken advantage of its opportunities for geological field-work, which until recently were not allowed to the consulting geologist, and the reports mentioned have, more than all other literature combined, contributed to the knowledge of copper deposition.

With the advantages of the United States Geological Survey organization behind him, the Government geologist is expected to do excellent work. The specialist, examining an individual deposit in a region mapped by the Survey, should be able to have confidence that the general work of the Survey forms a reliable basis for his more detailed investigations. In spite of certain excellent features in the work of Mr. Ransome at Globe (and I have had reason to appreciate this when examining certain outlying ore deposits of the Globe region), and realizing that the work was of a pioneer nature, it still seems hardly excusable that the errors, now admitted by Mr. Ransome, should have been permitted to stand as long as they have without correction. The error in placing the Schultze granite in the pre-Cambrian was a serious one, and was detrimental to certain of the early attempts to attract interest to the Miami-Inspiration ore-zone. Mr. Ransome states that evidence of the post-Carboniferous age of the Schultze granite is lacking, in the area mapped. Possibly so, but the intrusive contact of the Schultze granite with the 'meta' diabase should at least have suggested the alternative hypothesis of post-Carboniferous age. In any event, as brought out by Mr. Ransome, a reconnaissance to Troy and Ray would have proved the later age of the Schultze granite. In a report of the importance of the one under discussion, especially considering its nature as a pioneer investigation, search outside the exact limits of the area mapped, for evidence not fully presented within the limits of the sheet, would have been desirable.

Mr. Ransome's objection to my suggestion that the Schultze granite extends eastward under the Gila conglomerate and was responsible for the Globe Hill as well as the Miami-Inspiration deposits, is not sustained by the data presented by himself. He states that some of the granite near the Old Dominion mine, originally described by him as Gila conglomerate, is not Schultze granite but Madera diorite, and he goes on to describe 300 ft. of yellow granite porphyry as a dike in the Old Dominion mine, and further states that it resembles the porphyritic varieties of the Schultze granite, and was probably intruded at that time, all of which is definite evidence in favor of the conclusions advanced, evidence which I was not able to obtain, as I have not visited the Old Dominion underground workings in the last few years.

It would seem to be of value to the mining industry at large, and to its own prestige in particular, if the Survey, after once reporting on a district, would keep in touch with the same, and present the new data as they are available, and correct old mistakes promptly and frankly. For instance, the error in not grasping the importance of the dissemination in the Bingham monzonite, would be more easily forgiven, had the Survey been prompt to rectify its error of judgment by supplemental descriptions of the orebody as it was developed, and microscopical work showing the relation of the leached cap above and the dessemination below, etc. Certainly the time is ripe for a re-survey of the Globe region, a survey of the Ray district, and a study of the chalcocite disseminations which have as yet received almost no attention at the hands of the Survey.

One paragraph in Mr. Ransome's article needs cor-

rection, which reads as follows: "C. F. Tolman, Jr., deriving his conclusions mainly from unpublished work of J. E. Spurr at Ray, and W. H. Weed at Miami, has suggested that the Schultze granite is post-Paleozoic (Tertiary?)." From this statement, as well as an account of a change in the article made in editing the same, which gave the impression that I was presenting Mr. Weed's work when describing the Miami orebody, the inaccuracies of my sketch diagrams and of my rough reconnaissance work, may wrongly be attributed to Mr. Spurr and Mr. Weed. The only information received from Mr. Weed was a statement that in his opinion the Schultze granite was post-Paleozoic (Tertiary?), and belief in its post-Carboniferous age was reached independently by myself. The investigation at Ray, the results of which appeared in the article noted, were made before meeting Mr. Spurr, and discussing informally the Arizona copper deposits. As Mr. Spurr's investigations at Ray were confidential he did not of course give information as to the details of his results.

C. F. Tolman, Jr.

Tucson, Arizona, February 14.

Alfred James' Annual Cyanide Letter.

The Editor:

Sir—I would be glad of the opportunity to supplement the information conveyed to your readers on one point in Alfred James' annual letter. He says, on page 45, that he does not know of any instance where the Dehne press has been displaced by a vacuum filter. I may state that such a case occurred at the Creston Colorado mine, in Sonora, Mexico; also at the El Rayo mine, in Chihuahua, filter presses (not of the submerged leaf, but of the frame type) were displaced by a vacuum filter. In both instances the change was amply justified by results and has never been regretted.

It would also be interesting if Mr. James would inform us why, in speaking of the "fixed immersed vacuum filter" he unconditionally labels it 'non-wash'. If this is his unbiased judgment on the examples he has investigated he must have been singularly unfortunate in his choice of examples. I have had a sufficiently wide experience with this type of filter to state emphatically that the description 'non-wash' is misapplied. The filter allows of thorough washing when properly cared for and well manipulated, and I have often seen cases where no trace of soluble gold and silver could be detected by assay of the washed cake. If any users are working it as a non-wash filter they are not obtaining the service of which it is capable. I admit that the system is not perfect, but in spite of its drawbacks I believe it will hold its own against any other at present in use.

E. M. Hamilton.

Ventañas, Mexico, January 17.

The Editor:

Sir—I have read with interest 'James' Annual Cyanide Letter' in the Mining and Scientific Press of January 1, and considering that Mr. James is thought by some to be a leading light on the whole question of both the chemistry and dynamics of the cyanide treatment of ores, I find many points to criticise, which I think should be pointed out, otherwise many investors might be prejudiced in favor of some particularly patented article to an extent that it does not merit. Furthermore, I know that your paper always endeavors to handle subjects from a purely disinterested and technical point of view, and I was therefore surprised to note that Mr. James could be so small-minded as to omit the name of Butters when referring to 'fixed immersed type filters'. I am not at present interested in any of the filters, though, like most men who have dabbled with the subject, I believe I have an idea that beats the rest, so I think I can express my opinion without prejudice.

In the summary given on page 46 the 'fixed immersed type' is charged with 2d. for acid, while the others are not. This is distinctly unfair; the necessity for using an acid bath for dissolving the calcium carbonate with which the filter-cloth becomes choked, depends not on the filter but on the nature of the ore and the system of treatment. I have seen just as much trouble with the Moore filter from this source at the San Rafael mill, Pachuca, as with the Butters. The Ridgway is a filter that I admire very much, but it has its special field. I refer to the old type, as I am not familiar with the new. The valves are a serious source of trouble, and, while the results are excellent on sands from silicious ores, it fails utterly where there is a large amount of calcareous clay and what may be termed sticky 'slime'. I would classify filters in the following order of merit: (1) Dewatering filters, for dehydrating and treating sandy pulp, where a cake can be formed rapidly; Nichols, Hunt, Wilfley, and Parrish. These are not suitable for slime. (2) Continuous process filters, suitable for very fine pulp with some slime, for small units, area too small for pure slime; Grothe and Carters and Ridgway (old type). (3) The slime filters, all adapted to slime, not adapted to sand; Butters, Moore, and Ridgway (new type). Butters best where space is a consideration, Moore can be sampled better, Ridgway the most complex.

Filter presses are only suitable for rich solutions and for elastic and non-porous pulps, and for cleaning up and pressing precipitates from the zinc boxes. Filter presses cannot compare with vacuum-filters for economy of operation.

What we really need is a table of statistical data which will show the following facts when each filter in turn is put through the same series of tests on ores of widely different nature:

Total area in square feet of filter-surface per machine; capital cost per square foot area; gross weight per square foot of surface; interest on capital-cost; depreciation and repairs per square foot of surface; air required and vacuum-curve at all stages; filtering capacity in dry slime per 'hour square-foot surface'; current costs, that is, power for air; labor, filter-cloth, acid bath, etc.; percentage of moisture in pulp before filtering, and percentage after filtering.

An extraction percentage without comparing the above factors is misleading, because the extraction is more largely dependent on the chemical part of the process, the dynamics of fine grinding, and the

method and time of agitation, then on filtering. The filter is merely a remover of solution.

I also notice a feature referring to crushing on page 42. Mr. James states that on the Simmer Deep there was an increased efficiency in crushing when using less water, but the comparison was made after the addition of tube-mills, and it is not shown whether the increased efficiency were due to the step-reduction, or to the increased efficiency of both stamp-mills and tube-mills with less water. This is important. My own observation shows that the crushing capacity of stamps increases with an excess of water, and also with increase of screen-area by the use of multiple screens, but decreases in a tube-mill; therefore dewatering should be the rule between the stamp-mill and the tube-mill.

Data are lacking on the efficiency of multiple-discharge mortars. I am certain that they would be of great use in a silver mill using concentration and the cyanide process. I also wish to take this opportunity of drawing attention to certain remarks made by Mr. James, in regard to the Brown agitators (which are more generally known here in Mexico as Pachuca tanks), especially with regard to the suggested Grothe-Mennell continuous treatment which he disposes of in a few words. At the top of the first column on page 43 he refers to "a system of continuous decantations." Does he mean this in reference to the Grothe-Mennell process, or is it merely a case of ambiguity? If the latter, it is certainly serious, considering the authority that Mr. James' words carry, for his statement might be taken as final by some young metallurgical engineer about to design a mill. If, on the contrary, he refers to the former, then Mr. James should read up more thoroughly before seriously putting pen to paper for an annual letter. Grothe-Mennell never suggested a system of 'continuous decantation' (?) sic: I beg to draw attention to an article by Leslie Mennell on page 15 of the February issue of 1909 of the *Mexican Mining Journal*, in which this suggested process is thoroughly described and data regarding a series of experiments are given, from which I take the liberty of making the following precis: "In the system of continuous treatment a series of tanks is placed at the same level; the pulp, however, is maintained at a slightly lower level in each succeeding tank of the series, the drop from first to last being just sufficient to allow the pulp to flow through the series at the same rate that it is being charged into the first tank; * * * as the finished product discharges from the last tank at approximately the same level as the intake, it then proceeds by gravity to the filter plant."

It is clear that in this manner all of the time now virtually lost in filling and emptying tanks is saved, and all tanks are constantly and usefully employed in cyanide agitation. Will Mr. James kindly explain what he means by 'continuous decantation'. Judging by my own training in metallurgy, the term 'continuous dewatering' or 'dehydrating' would be admissible, but 'continuous decantation' would be impossible. The generally accepted procedure here in Mexico is to use the Pachuca tanks solely as an agitator, and to trust entirely to vacuum-filters to remove the solutions, even non-continuous decantation being only practised in the large-diameter, low-height vats used with mechanical agitators.

Referring to the test and experiments of Mennell, an exact miniature of the standard Pachuca tanks was used. The first test was by the standard intermittent process. The ore was of silver, the metal being present as a sulphide, the more refractory being associated with slimed galena and iron pyrite which had escaped concentration; this with iron oxides and a little zinc blende caused a considerable consumption of cyanide. I have taken the following from the *Mexican Mining Journal*:

The test on this ore by the ordinary system, agitated for 48 hours, gave the following results:

OLD INTERMITTENT PROCESS.

Amount of finely crushed ore used, kilos.....	Amount of solution, kilos.....	Time agitated, hr.	Strength cyanide solution, %.....	Consumption cyanide, kilos. per ton.....	Head value silver grams per ton.	Residue value silver grams per ton.....	Extraction, %.....
70	100	0	0.39	0	349	...	...
		12	0.26	1.86		118	66.0
		24	0.20	2.71		108	69.0
		36	0.13	3.76		98	71.2
		48	0.12	3.86		95	72.7

The second test was made using four of these same tanks connected in series as described. Pulp was fed at the rate of 70 kg. per day with 100 kg. of solution, this being the amount of the individual capacity of the tanks. The operation was continued for 8 days; after 5 days, when the process was running perfectly uniform, samples were taken from each tank and assayed. Samples were taken frequently up to the eighth day. The whole test is shown as follows:

NEW CONTINUOUS SYSTEM.

Amount of finely crushed ore fed daily, kilos.....	Amount solution fed daily, kilos.	Number of tanks.	Time of treatment, hours.....	Strength KCN solution, %.....	Consumption KCN kilos. per ton..	Head value silver per ton, gm.....	Residue value silver per ton, gm.	Extraction, %.....
70	100	..	0	0.39	0	325	...	...
		1	12	0.30	1.29		146	58.0
		2	24	0.26	1.86		122	68.0
		3	36	0.20	2.71		101	71.3
		4	48	0.18	3.00		80	77.3

Assay of entire discharged residue was 80 gm. silver per ton, with an extraction of 77.3%. For full data on the subject I refer to the article mentioned, but I have shown enough to indicate that the subject should not be dismissed with a wave of the hand by a cyanide expert whose knowledge, while extensive, is not absolute. I trust that the above notes will be of value to some of my co-workers.

JOHN M. NICOL.

Mexico City, January 20.

Timber to the amount of 4.5 cu. ft. per ton of ore is used at the Bodie mine, while at the Ontario 100 tons may be produced using only 6.25 cubic feet.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Pig iron production in the United States in 1909 amounted to 25,795,471 tons as compared with 15,936,018 in 1908 and 25,781,361 in 1907.

Performing assessment work upon a claim without 'discovery' will not prevent adverse re-location. Marking the boundaries, coupled with actual possession, and continual exploitation or continued prospecting of the ground in good faith for mineral, will hold a claim without discovery.

Humidity of air is the pounds of water carried by 1 lb. of air when saturated at a given temperature and pressure, and percentage humidity is the weight of water actually carried by a pound of air divided by the maximum that could be carried by the pound of air under the same conditions.

Under the last mining act of California a mine-owner who fails to make the annual expenditure upon his claim is disqualified from re-locating the ground embraced in the original location or mining claim, or any part thereof under the mining laws within three years after the date of his original location. Any attempt at re-location thereof by any of the original locators renders such location void.

Iodine in the nitrate deposits of Chile is attributed to decaying marine plant-life in the shallow sea once covering the region now constituting the saline deserts, according to R. A. F. Penrose, Jr. While it may have come from mineral springs, such an origin is unlikely and unproved. If a greater demand should be made for iodine great quantities could be produced from the waste liquors in the saltpetre factories. Iodine can be used advantageously as an 'oxidizer' in the cyanide process.

Timber cut when the flow of sap is least shows the greatest strength. There is also material gain from drying the timber before use. Water absorbed does not impair strength as does the fluid in the cells of the wood. It is the elimination of the latter moisture that is sought by drying. Timber uniformly wet throughout is relatively stronger than if one part be dryer than the other. Trunk-wood is greatly superior to limb or sapling wood, both for strength and durability. Sawed lagging is therefore better than pole-lagging.

Mine rescue apparatus of the compressed oxygen type permits a person wearing it to breathe naturally with little inconvenience for a continuous period of two or three hours, even while surrounded by deadly or irritating fumes, smoke, or other irrespirable gases. The principal features of such an apparatus are the tanks or cylinders containing the oxygen under high pressure, absorption cans for taking up the oxygen exhaled from the lungs, and a helmet or mouth attachment with breathing bags, which enable the person wearing the apparatus to breathe with ease. The foregoing features are accomplished in different degrees of efficiency by different types of apparatus.

Semi-monthly steamboat service has been inaugurated between Iquitos and Yurimaguas, Peru, a distance of nearly 900 miles. Iquitos, the capital of the Department of Loreto, is on the Amazon, while Yurimaguas is on a tributary, the Huallaga. The enterprise is undertaken by the Cia. Anónima de Alto Amazonas, which has connections with the down-river steamers at Iquitos. This will afford easier communication with a region in north-central Peru which contains some valleys rich in placer-gold.

Tungsten finds its most important use as an alloy for steel, to which it imparts the property of holding temper at a much higher temperature than high-carbon steels. When lathe tools are made of tungsten steel the lathe may be speeded up until the chips leaving the tool are so hot that they turn blue. It is said that about five times as much work can be done by a lathe built for such speeds and work and fitted with tungsten-steel tools as can be done by the same lathe with carbon-steel tools. From 16 to 20% of tungsten is ordinarily used in lathe tools.

Gypsum is being used extensively as wall plaster (hard plaster) and in cement, as well as for minor uses, such as in stucco and as a fertilizer. This has created a large demand for knowledge of gypsum deposits. In most States such knowledge is more easily obtained than in California, where the gypsum deposits are largely in long stretches of sparsely inhabited regions in the nearly arid territory along the east side of the Coast Range and in the Mohave and Colorado deserts. The area has been recently described by F. L. Hess, of the U. S. Geological Survey.

Platinum is constantly being reported from the placers and dredging areas of the California gold belt. It now seems questionable whether this so-called 'platinum' is not largely iridosmine. A recent shipment of metal from Oroville, supposed to be platinum, turned out to be wholly iridosmine. The amount was 31 oz., resulting as a by-product from the treatment of approximately one million cubic yards of gravel, and was paid for at the rate of $18 per ounce. The metal is obtained by washing the skimmings from the amalgam in a rocker, after previously removing the bulk of the iron with magnets.

Leaching of copper ores has never been conducted to a large extent. The most successful efforts, applicable to oxidized ores, consist in leaching with dilute sulphuric acid, subsequently precipitating the copper in vats on scrap-iron. Certain classes of friable copper-bearing iron-pyrite ores, such as those obtained at Rio Tinto, Spain, can be leached by natural rainfall, the ore being stacked in heaps several feet high, on yards with a tamped clay bottom. The gradual oxidation by such weathering forms the sulphate which is soluble and leaches out. In default of adequate rainfall, the heaps are wetted with water from pipes. Care has to be taken to prevent spontaneous ignition of the heaps from too rapid oxidation. The copper-liquor is drained off to boxes where it is precipitated on scrap-iron.

Special Correspondence.

TORONTO, CANADA.

Porcupine and Elk Lake Districts. — Cobalt Quiet. — Nickel Inquiry. — Newfoundland Iron-Ore Royalties. — Canadian Steel.

The principal interest in mining matters still centres in the Porcupine gold camp, where some important events have lately taken place. M. J. O'Brien, the Cobalt millionaire, who undertook diamond drilling operations on the Miller claim, one of the star prospects of the camp under a $300,000 option, threw up the contract on which he had paid $1000. It is understood that he asked for an extension of time so as to make further explorations, not being altogether satisfied with results, and as an alternative proposal offered $100,000 for the property, both of which offers were refused. Any discouraging effect which this transaction may have had on prospectors and speculators has been quickly dispelled by the consummation of a considerably more important deal a few days ago, the McCornick Brothers, of New York, having purchased the Wilson claims comprising 11 locations about two miles southwest of Porcupine lake for $1,500,000, after their representative, Mr Geddes, had spent about two weeks examining the properties. The Provincial Government is laying out a new townsite at the northeast end of Porcupine lake to serve the requirements of the district, and town lots will shortly be offered for sale. The new mining district of Porcupine has been established with Arthur E. B. Bruce, late of Haileybury, as recorder in the new town of Porcupine. The gold area is being extended, new discoveries having been made within 17 miles of Matheson, and 3½ miles east of Night Hawk lake. The Elk Lake district, which was expected to be a second Cobalt, has proved a disappointment, and few, if any, of the numerous companies floated a year or so ago are likely to return anything to the investors. Two of them, the Otisse-Carrie and the Gavin-Hamilton, are now in process of liquidation. Each of these concerns had a nominal capital of $1,500,000 and paid $1,000,000 for the respective properties. The Reeves-Dobie Gowganda district has made a second shipment of 32 tons of ore, bringing the total shipments from this district since January 1 up to 92 tons.

Cobalt stocks continue depressed, the outside public having apparently lost all interest in the market, as a result of the general slump in New York stocks. There is not likely to be much change for the better until the camp obtains cheap power. This was promised long ago, but has been deferred from time to time. Apart from this cause, the passing or reduction of dividends by leading companies, litigation, and the diversion of capital to newer fields are quite sufficient to account for the prevailing stagnation. Shipments for the first four weeks of 1910 amount to 1896 tons, of which La Rose furnished 350 tons and Nipissing, 336 tons. The La Rose is preparing to install a new power system, which is expected to reduce the cost of power to half the present figure. Some of the smaller La Rose properties are showing up better under development. Veins from adjacent properties have been traced to the Fisher-Eplett and the indications on the Princess and University are improving. At the Bailey mine the new power-plant, to operate six drills, has been installed. At the Hargrave stoping is now being done on the No. 3 vein entering from the Kerr Lake, the ore averaging 3000 oz. per ton. No. 1 vein has been opened up to the 75-ft. level where 6 in. of good ore has been found. The shaft will be sunk to the 150-ft. level. The financial statement of the Nipissing shows a cash surplus as of January 1, 1910, of $1,322,985, as against $920,510 on January 1, 1909. Dividends paid for 1909 were $1,500,000, as against $840,000 in 1908. The ore shipments last year amounted to 6510 tons of the net value of $2,210,364. The Cobalt Lake mine has shipped 66 tons valued at about $30,000 from the new veins at the south end of the lake, near the McKinley-Darragh line that show marked improvement. A winze has been sunk from the 190 to the 250-ft. level, and an adit will connect the other veins and the shaft. The McKinley-Darragh concentrator is being extended so as to give a capacity of 120 tons per day. The Beaver mine has been temporarily closed for the enlargement and timbering of the shaft. Several new buildings are being erected on the property. The Trinity mine has been sold under liquidation proceedings against the company, the purchaser being Henry E. Long Ling, of Buffalo, New York.

The Mines and Minerals Committee of the House of Commons, Ottawa, is conducting an enquiry into the nickel resources of Canada, there having lately been some agitation in favor of an export duty on nickel ore and matte so that the whole process of refining may be done in Canada. At present the nickel is exported in the form of matte to the refinery in New Jersey. It has been contended that the International Nickel Co., which controls most of the Sudbury output, is practically a trust and restricts the supply in order to maintain the price. A. P. Turner, president of the Canadian Copper Co., the Canadian branch of the International, was heard before the committee on January 2. He denied that any trust existed, pointing out that the Mond Nickel Co. and the French Nickel Co. were competitors. The refining of nickel was done to the extent of 82% in Canada, and the company had spent $250,000 in experiments in order that it might be enabled to complete the refining process in Canada. At present it could not profitably do this and was obliged to ship in the form of matte to New Jersey, owing to the necessity of using certain chemicals, including salt cake, in the proportion of more than ton for ton. This was a by-product of some of the New Jersey factories. To do any further refining in Canada would render it impossible for the company to compete with the New Caledonia ores. Other evidence was adduced to the effect that it was only recently that the investment in nickel manufacturing had proved remunerative, the present return being only 6%. The Government of Newfoundland has imposed a royalty of 7½c. per ton upon the output of the hematite ore mines of Bell Isle, which furnish a source of supply for the furnaces of the Dominion Iron & Steel Co., and the Nova Scotia Steel & Coal Co. The production amounts to about 1,000,000 tons per year. André Weill, of Paris, a representative of the Creuzot Steel Co. of France, has been for some time at Ottawa looking into the possibilities of the steel industry in Canada. It is understood that the French company, which is controlled by the Rothschilds, contemplates the establishment of an electric smelting plant at some point in Canada, and Mr. Weill has been inspecting a number of water-power sites in the Ottawa district, and has held several interviews with leading public men in connection with the project.

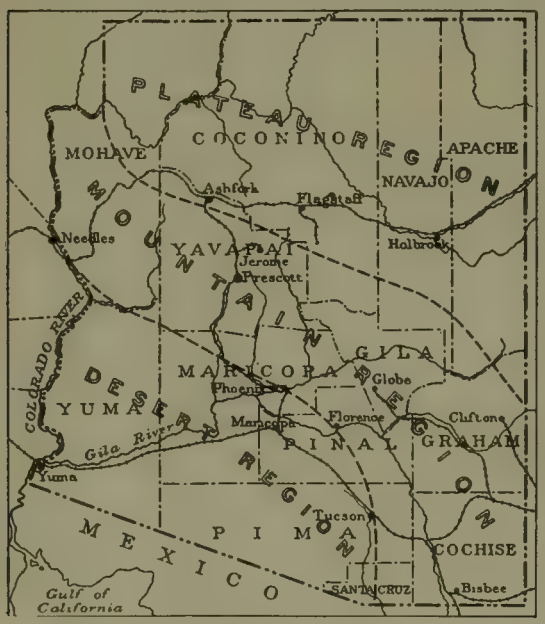
GLOBE, ARIZONA.

Miami Copper Co. — Inspiration. — Old Dominion. — Arizona Commercial. — Lost Gulch. — Lake Superior & Arizona.

The Miami Copper Co. has 40,000 ft. of driving and crosscutting on its property, six miles west from Globe, 29,000 ft. of which was driven in 1909, developing great bodies of chalcocite in a gangue of Pinal schist. This ore averages 2¾% copper, and is said to extend through a vertical depth of 400 ft., that is, between the 230 and 620-ft. levels. Operations are carried on through four vertical shafts: No. 1, or Redrock shaft, started in the apex of the orebody, has reached a depth of 720 ft.; No. 2, Red Springs, is 2500 ft. from No. 1, and at a depth of 460 ft.; No. 3, known as the Captain, 850 ft. west from No. 1, is 220 ft. deep; No. 4, to be the principal working shaft, is down 535 ft., and is to be continued to a depth of 700 ft. It is 12 by 16 ft., 4-compartment, timbered with creosoted 12 by 12-in. timbers. This shaft is sunk off the orebody, in conglomerate, and is connected with shaft No. 1 on the 420-ft. level. No. 1 and No. 2 are connected on the 470-ft. level. The ore is to be hoisted from shaft No. 4 in two 7½-ton skips by a hoist operated by compressed air from the power plant. The skips are to be loaded from two 1000-ton ore-pockets, one just below each of the two main working levels. Each pocket is being equipped with a measuring box, holding the exact load for the skip, the loader being manipulated by a compressed air operated gate. Electric haulage is being pro-

vided on the two main levels for delivering the ore to the loading pockets. It has been estimated by the company's engineers that 700,000 tons of ore can be mined in a year.

The concentrating mill is under construction and probably will be in operation before the close of this year. The mill-site is an advantageous one, on the east slope of the hills, in close proximity to No. 4 shaft. Next to the shaft are the bins which are to receive the ore from the skips. Adjacent to the bins is the coarse-crushing plant, consisting of two No. 7½ gyratory crushers, and two sets of rolls, each 54 by 24 in., whereby the ore is reduced to 2-in. cubes. Between the crushers and rolls are two 4 by 10-ft. manganese trommels for sizing. The ore, reduced to this size, will be delivered by a 300-ft. belt-conveyor to the sampling plant, thence by conveyor to six cylindrical steel bins of which there is one for each section of the mill. Each bin is 30 ft. diam., 30 ft. high, set 24 ft. above the ground upon a concrete foundation, and has the capacity of 1000 tons of ore. The bins are to be provided with automatic weighing and sampling devices, whereby the weights and samples of ore going to the different mill units may be checked against those of the sampling plant. The ore is to be drawn from



Globe in Relation to Physiographic Regions of Arizona.
(After Ransome, U. S. Geol. Survey.)

each cylindrical bin by a conveyor to the section of the mill opposite it, passing first to a set of rolls which reduces it to ⅛-in. size. It is then to be classified by 22-mesh screens, the oversize going to two Chilean mills having 30-mesh screens. The product of the Chilean mills unites with the undersize from the 22-mesh screens, passing thence to classifiers, the coarse product going to sand concentrating tables, and the finer material to slime tables. There are to be 20 sand tables and 30 slime tables to each of the six mill units, the aggregate capacity of these units to be 2000 tons per 24 hours. H. Kenyon Burch, the company's mechanical engineer, who designed and is directing the construction of the mill, states that the ore will concentrate in the ratio of about 18 tons into 1 ton. The entire foundation of the plant is of concrete, in which there are 15,000 cu. yd. of cement work, which was laid at the rate of 300 cu. yd. per day. The mill structure is of steel, there being no woodwork in the plant except that used in the system of launders.

The power plant, under construction, has a site at the base of the hill on the flat surface of the valley, close to the railroad. This plant is being housed in a concrete steel building, 264 by 70 ft. in size. The concrete stack, having a 12-ft. flue diameter, will be 200 ft. high. There will be installed four 600-hp. Edgemore water-tube boilers, which will generate steam at 200-lb. pressure. These will have Green fuel economizers and Foster superheaters to superheat steam at 100°C. Oil is to be used as fuel. The other equipment will consist of three 4-cylinder, tripple-expansion Nordberg engines, direct-connected to that number of 1000-kw. electric generators, each 3-phase, 25-cylinder, generating 6600 volts; also two 4000 cu. ft. air-compressors, 4-cylinder, tripple-expansion, Nordberg type; and two direct-acting counter-current, jet-condensing engines. Close to the power plant are towers for cooling the circulating water. The mill machinery is to be operated by electric motors advantageously distributed throughout the plant. Water for mill work and other purposes will be obtained from the Old Dominion mine at Globe, and this will require a pumping plant and a line of 4-in. pipe 25,000 ft. in length. O. D. Lawton is superintendent of the mine, and B. Britton Gotzberger general manager.

The Inspiration Copper Co., whose group of 444 acres lies contiguous to the Miami on the west, has a length of about 5000 ft. on the same mineralized zone as the latter. The width of the zone on the Inspiration is not fully determined. The mineralized area is in schist, having intrusions of granite-porphyry, and a dacite overflow. The ore is composed of chalcocite in a schist gangue, as is the case on the Miami. Explorations by churn-drills on the Joe Bush and Pinto claims, on the eastern part of the group, indicate a thickness of the orebody of 400 ft. One drill-hole is down 718 ft., another 600 ft. The average depth of the numerous holes is 450 ft. These tests show that below the chalcocite zone is an unaltered deposit of copper-iron sulphide, some of which might be mined. The Joe Bush shaft, down 400 ft., and the Scorpion, 300 ft. deep, are 1700 ft. apart, on opposite sides of a mountain ridge. Driving is in progress on the 400-ft. level of the former and also on the 275-ft. level of the latter. An adit level is being driven northerly from Keystone gulch. To facilitate this work a Sullivan air-compressor and drills have been installed there. This adit will be driven 2300 ft. through granite-porphyry before it strikes into the orebody. It is to become a working level for a large body of ore above it. The entrance to this adit is one mile from the railroad. T. R. Drummond, manager for the company, states that Inspiration ore does not differ materially from that of the Miami. It is observed that the chalcocite in all these ores occurs in coarse highly concentrated stringers and in finely disseminated particles. The New Keystone Copper Co., under the same management as that of the Miami, has been for some time developing from a shaft and exploring with two churn-drills its group of copper-bearing claims adjoining the Inspiration on the southeast. This work is in charge of E. B. Tinker. The Boston-Miami, next to the Light Hope and Keystone, is controlled by F. W. Hoar and associates, forming a close corporation. Their holdings comprise 42 claims in a body. Exploration is in progress with two Star drills, now on their sixth and seventh holes, the depth of the holes drilled being 550 to 600 ft. A force of 42 men is employed.

The Old Dominion Copper Mining & Smelting Co., now under the general superintendency of G. H. Dowell, is mining 600 tons of ore per day, 350 tons of which are concentrated in the ratio of three to one. The two furnaces of the smelting plant which are in operation are treating 400 tons per day of ore and concentrate, the total charges amounting to 650 tons. The smelting ore runs 8% copper, 35 to 37 iron, 13 sulphur, and 35 silica; the milling ore, running lower in iron and higher in silica, carries 3½ to 4% copper. In the smelting practice the converter slag is used as flux instead of lime, the composition of which is 33% silica, 50 iron, and 2½ copper. The blast-furnace slag contains, approximately, 38% silica, 44 iron, 10 alumina, and 3 lime. L. O. Howard, superintendent of the smelter, states that instead of using barren clay for converter lining they utilize the slime from the mill. A new Nordberg steam-pump has been installed at shaft A, this and other pumps in use now lifting 2½ million gallons of water every 24 hours. A new hoist has been ordered for this shaft, which has a depth of 1400 ft. George Kingdon is mine superintendent. The Old Dominion company employs about 1000 men at mine, mill, smelting plant, and shops.

The Copper Hill section of Globe district, 3½ miles northeast of the town, is in a country of diabase, limestone, and

quartzite in which well defined lodes of copper ore occur. The principal mine operators there are the Arizona Commercial Co. and the Superior & Boston Copper Co., whose properties are situated near each other. This part of the district is now served by the railroad of the Arizona Commercial Co., and that of the Arizona Eastern, whose line to Copper Hill is nearly finished, will soon be operating trains. The latter is a part of the Southern Pacific system. The Superior & Boston, for which Frank H. Probert is consulting engineer, and for which John D. Wanvig is superintendent, has 54 claims in a group, on which there are five veins having a strike nearly east and west. Three of these are said to have ore of commercial value developed. The two of most importance, apparently, are the Great Eastern and Old Dominion, which are 1000 ft. apart. The former has a diabase hanging wall, a quartzite foot wall, and a dip of 60°. The latter dips 88° south, is between diabase walls down to a depth of 400 ft., below which it has a diabase hanging wall and a limestone foot wall. The ore is much oxidized, but contains a good deal of chalcocite. It contains, as a general average, 25% iron, 45 silica, and 10 copper, with 8 oz. silver per ton. The McGaw, sunk to a depth of 580 ft. between these two veins, is the principal working shaft. It sinks in the foot wall of the Great Eastern; the first 450 ft. is in diabase, the remaining 130 ft. being in limestone. The shaft has two 4½ by 5 ft. hoisting compartments, and one 5 by 7 ft. compartment for air and water pipes. The timbers used in the shaft are 10 by 10 in.; there is a special collar-set, having a 3 ft. runway around the shaft to give rigidity and to facilitate the handling of heavy machinery. Levels are run to the Great Eastern vein from the fourth and sixth stations. The Old Dominion vein has been opened by a cross-cut from the shaft on the fourth level, and the plan is to develop this vein on the sixth level. Sinking below the sixth level is being resumed in the McGaw shaft. The surface equipment consists of a Nordberg double-drum geared hoist capable of operating to a depth of 1200 ft.; a 13-drill air-compressor, same make; two 250-hp. Sterling boilers, and two more of like capacity are being installed; a Prescott duplex triple-expansion pump, capacity 1000 gal. per minute, being installed at sixth level; also three Prescott sinking pumps now in use. The Black Oxide vein is being developed through the Gardner shaft. On the fourth level a drift is being run on the vein to strike a shoot of ore that was opened by an adit which was driven at a higher level. The ore here is similar to that found in the Great Eastern, excepting that it runs higher in iron. This company is shipping 50 tons of ore per day at present to the smelting plant of the Arizona Commercial Co. The latter company is mining and smelting 225 tons of ore per day from its Black Hawk vein, which is identical with the Great Eastern vein on the Superior & Boston. Added to this daily tonnage is 50 tons from the latter property and 50 of sulphide ore from the Copper Bell mine at Gleeson, in Cochise county. The Black Hawk vein is opened by the Eureka shaft, sinking 713 ft. in the hanging wall, the first 400 ft. of which is in diabase and the rest of the way in limestone. The shaft cuts the vein on its dip between the 600 and 700-ft. levels, the 700-ft. station being in the foot-wall. The vein on this property has a dip of 53° and a width ranging from 6 to 40 ft. The ore is mostly oxidized, carrying 30% iron and 4 to 10 copper; the iron consists of hematite and limonite. Chalcocite, occurring in irregular bodies from 6 in. to 3 and 4 ft. in width, is found in the carbonate body. It is said that most of the material between the walls is sent to the furnace. The smelting plant equipment consists of a 180 by 48-in. blast-furnace, a No. 9 Connersville blower, the latter operated by a tandem compound Nordberg engine; two Babcock & Wilcox boilers, 700-hp., using oil as fuel. The dust chamber is of the usual type, the steel stack is 8 ft. diam. and 125 ft. high. J. E. Penberthy, general superintendent, states that the furnace may be extended in length, thus doubling its capacity. When this is done a new stack will be built, and possibly a converter plant added. The smelter has been in operation since October 15, 1909, with E. L. Williams in charge. The 50% matte produced is sent to the converters of the Old Dominion plant. The furnace charge ranges from 350 to 400 tons per day. This company is closely allied to the Shannon Copper Co. operating at Clifton. J. W. Henry being general manager for both companies.

The Last Gulch United Mines Co., whose property is seven miles west from Globe, is completing a 10-stamp mill, having plates, tables, and vanners for milling its ore, which carries gold, silver, lead, and copper. The highest grade is sorted out and shipped direct to the smelting plants. J. T. Harrington is one of the principal interested parties. The property of the Lake Superior & Arizona Mining & Smelting Co., situated at Superior, half way between Globe and Florence, has been closed, except as to pumping operations, for several months pending the further financing of the company that will enable it to resume operations. According to data obtained from F. W. Hoar, the company's manager, the mine is opened to a depth of 1300 ft. on an incline, giving a vertical depth of 650 ft. The ore bearing lode, 40 to 50 ft. in width, has a limestone hanging wall and a quartzite foot wall, with diabase dikes intersecting the lode. The pay ore, which runs about 5% copper and $3 to $4 per ton in gold, occurs in lenses, some of which are said to be 1000 to 1500 ft. in length. The ore is oxidized to a depth of 1200 ft. on the dip of the vein, and at this level the sulphides come in. When work is resumed, the idea will be to sink 200 to 300 ft. deeper to obtain a supply of sulphide ore to mix with the oxides and carbonates already developed. On the results of this proposed work will depend the proposition to build a railroad to the mine and erect a smelting plant there. The mine shaft is close to Queen creek which, at times of freshets, would empty a part of its volume of water into the mine. To obviate this a cement flume, 800 ft. long, 34 ft. wide, 10 ft. deep, was built on the bed of the creek to carry the entire flow of the stream past the points where channels led into the shaft.

MELBOURNE, VICTORIA.

A Quietly Prosperous Year.—Output for 1909.—Cyanidation.—Electricity in Mining.—Bendigo and Ballarat.—New Coal Mines.

If the position of gold-mining may be accurately judged from recent actual yields, then it must be said plainly that in Victoria results are somewhat disheartening, though by no means desperate. It is no longer news that the enormous yields of the early days, say from 1862 to 1875, are affairs of memory and record only; in those golden years the output never fell below a million ounces, while in most of them it exceeded a million and a half, and once approached a million and three-quarters. But if the returns of the past fifteen years be compared with the ten years between 1885 and 1895, during which the year's output once fell as low as 576,399 gross ounces and never exceeded 735,218 gross ounces, things are not now so bad as they have been, though they appear to be on the down-grade again. These figures, it may be stated, are gathered from the Victorian Mines Department, which, for no particular reason, has set its teeth against recording yields in fine ounces. In 1906 the gold harvest amounted to 834,775 oz.; in 1907 it was 754,270 oz.; in 1908 it was 721,220 oz.; and for the first nine months of 1909 it was only 488,087 oz. This rate of production would give only 650,788 oz. for the whole year. The fact is that no new goldfields have been opened up, as has been done in some other States, in which the old ones are giving greatly reduced yields. Here and there, certainly, some good mines are being worked; wonderfully rich patches have been struck, which even promise a return of palmy days, but it is unsafe to predict a long continuance of their prosperity. The great bulk of Victorian gold has been obtained from quartz veins, and in many parts 'indicators' have been found which have proved extremely rich. One such was struck during the past year at Ballarat East, which will be referred to later on. In certain other portions of the State the deposits are alluvial, such as those at Creswick, on which the great Berry group of mines worked and are still working, and the deep-lead mines of Chiltern and Ruthergien, while a large quantity of the precious metal has been secured by dredging, notably in the Castlemaine and the Ovens Valley (Bright) districts. Indeed no branch of the gold-procuring industry in Victoria

has been so markedly successful of recent years, or has been so remunerative to the companies engaged in the pursuit, as the dredging of the banks and beds of certain of its rivers and creeks—water-courses which are quite unnavigable, and therefore useless for all other purposes except as supplying drinking water for live-stock and occasionally for irrigation purposes. During 1908 the dredges secured no less than 104,167 oz. gold, and in the previous year the recovery was 100,215 oz.; and after paying £305,060 in wages and other costs the companies paid £63,784 in dividends. A comparison of the figures for the years prior to 1900 and between that year and 1908 will show the enormous advance made in gold-gredging in the interval. Prior to 1900, 430 acres had been so dealt with for a return of 90,528 oz., whereas from 1900 to the end of 1908, 3738 acres had been covered, 109,031,108 cu. yd. of material being treated for a recovery of 549,143 oz. In 1908 the number of dredging plants in operation was 123, employing 2435 men, and they put through upward of 20½ cu. yd. of dirt for a return of 104,167 oz. gold, valued at £416,670, and averaging 2.4 gr. per cubic yard. One company alone, the Tewksbury Amalgamated G. D. Co., of Bright, obtained 8851 oz. last year, valued at £35,890, from 2,150,600 cu. yd., and paid £17,698 in dividends. The average value of the ground treated by the

whole of the dredges in the State in 1908 was only 2.43 gr. per cubic yard, but the Enterprise Dredging Co., also at Bright, paid £3000 in dividends on material which gave only 1.7 gr. per cubic yard, and a couple of other companies returned something to their shareholders on an even poorer recovery. Yet there is some danger that this highly lucrative industry may be seriously hampered at no distant date by the agitation of farmers and graziers who complain, and perhaps, justly, that the streams are polluted for their purposes. Of course it is impossible to dredge a river without stirring up the mud. In consequence of the onslaught of the agricultural and pastoral interests, P. N. Tewksbury, the most prominent and successful of the dredging promoters, recently turned his eyes to South Africa and probably in a short time he will have plants working there, where conditions are less antagonistic.

For the most part Victoria's auriferous material is free-milling, and, in consequence, the old stamp-battery or the hydraulic nozzle supplemented by cyanidation is still the customary means of dealing with it, and modern metallurgical methods have not been called for. Cyanidation and chlorination are, however, steadily increasing in favor for the treatment of concentrate and tailing; many old tailing heaps at workings long since abandoned are now being diligently exploited by the cyanider, with good results. A few years ago the Victorian Government purchased the patent rights of the cyanide process with respect to its own territory, and after all the royalty has been paid, the use of the process was made free to anyone in the community who cared to use it and provided himself with the necessary plant. In 1906 only 145 cyanide plants were operating; the following year there were 212, and in 1908 the number had increased to 289. The material treated was, for the most part, old tailing, the refuse of pre-cyanide days, and last year nearly a million and a quarter tons were made to give up 77,245 oz. of gold. If recent improvements in metallurgy have not been generally adopted by the Victorian gold-mining companies, some of the big companies have availed themselves of the numerous applications of electricity to mining purposes. To take only two or three in illustration: The Cassilis Gold mine, at Tongio West, Gippsland, possesses the most complete electrical mining plant in Victoria, erected at a cost of over £21,000. Previous to its erection the firewood bill alone amounted to £500 per month, and it was estimated that the savings that would be effected in this and other directions by the first section of the hydro-electric plant would pay off its initial cost in less than three years, while the second section was expected to return a considerable revenue by surplus power which would be available for sale to other mines. The fuel bill for the last half year was only £1167. The Long Tunnel Gold Mining Co., Walhalla, has a complete and efficient system of electrical pumps, some being employed in pumping water from the mine and others in bringing clean water a distance of nearly three miles from the Thomson river, for use in the boilers and the battery. The three pumps in the mines have each a capacity of over 6000 gal. per hour and a lift of 1000 ft.; the water-supply pumps are calculated to give at least 16,000 gal. per hour, and they are of the same type as those in the mine, consisting of a horizontal three-throw pump, driven through spur-gearing from a three-phase squirrel-cage motor mounted on a common bed-plate. The plant is driven by a non-condensing Allen engine and the fuel-cost of water lifted 500 ft. is less than 1½d. per 1000 gal., though interest and other charges bring the cost to approximate double that figure. The New Moon Gold Mining Co., at Bendigo, found about four or five years ago that a special effort was necessary if the mine were to be kept going. The management had large quantities of low-grade ore to deal with, averaging less than 6 dwt. per ton, and it was decided to introduce electricity for various purposes. The installation now includes plants for hauling, winding, pumping, crushing, and lighting. The ore, when brought from below, is fed directly into the crushers from which in due course it is transferred to the battery without handling, so that surface expenses are reduced to a minimum.

In spite of the facts that the Bendigo goldfield is the oldest in Victoria and that already more than 18,000,000 oz. of gold have been produced from it, it affords more promising opportunities for prospecting than any other district in the State. A great deal of attention has been given to deep mining, some of the workings being over 4252 ft. from the surface, and in their efforts to go downward many of the companies have left shallow ground unworked. Of recent years some of the most flourishing mines have been successfully operating the shallower ground, for example, the Hercules & Energetic, the Garden Gully, and the Horwood & Burrowes mines. At the present moment an effort is being made to open new ground along what are known as the 'side-lines of reef', lines running parallel to and intermediate between the main veins on which most of the work has hitherto been done. These have been left practically untried until now, but there is good reason for believing that they will be great gold-producers when properly and systematically worked. The Ballarat field also appears to be entering upon a period of renewed youthfulness and productivity, due also to the breaking of fresh ground. For some reason or other the quartz deposits to the north of the city have always been neglected, and it was only a few months ago that the Ballarat Citizens' Prospecting Co. was formed to attack this ground. After sinking to a depth of 360 ft. cross-cuts were put out, and on driving eastward a fine body of ore was cut from which a trial lot of 200 tons give close upon half an ounce per ton; since then the company's ground has been divided and a second company formed to work the southern portion. At Ballarat East, also, promising development has taken place where a small com-

pany was fortunate enough to strike a rich indicator abounding in nuggets ranging up to 500 oz. each and in the space of a few months the shareholders have been repaid considerably more than the capital invested. This vein has been found to extend into ground immediately taken up by other companies. Another promising feature of these mines is that the managers of several have succeeded in handling their low grade ore at a profit, and when other managers have learned the lesson and modernized their plants hundreds of thousands of tons of similar material standing in stopes will be turned to profitable account. The Pittfield Plains Berringa division of the Ballarat district also furnishes some good returns, though mainly below those of 1908, the Birthday mine was not working full time during 1909, and for the nine months produced only 491½ oz., as against 1928½ oz. in 1908, but the Birthday Tunnel mine, which in 1908 yielded 6934 oz., gave 5365 oz. up to the end of September, while the Kangaroo gave only 1117 oz., compared with 2570 oz. last year, and Williams' Fancy produced 2953½ oz., as against last year's output of 4389.

Gold mining is, of course, the main mining industry pursued in Victoria, though the known mineral deposits are numerous, the official list being as follows: agate, antimony, arsenic, barytes, bismuth, chromite, clay (pottery), coal (black and brown), copper, corundum, diamonds, diatomaceous earth, fluorspar, gypsum, iron, jasper, kaolin, lead, limestone, manganese, wolfram, and many others. The quantities of each of these so far produced is of no commercial importance, and in many instances is quite negligible. During December, however, a commencement was made with the opening up of enormous bodies of coal at the Powlett river in South Gippsland, the Government having resolved to work pits for the supply of its own railways, while private companies have been stirred to greater activity through the occurrence of a strike at the New South Wales mines, whence Victoria's supply has hitherto been mainly derived. At the Powlett river it is estimated that there are 25,000,000 tons of coal available and already five shafts have been opened and railway communication is being established.

NEW YORK.

Anaconda Charter Amendments.—Utah-Nevada Con. Aftermath.—Cobalt and Porcupine Lake.—Sonora.

It has been supposed that the new Anaconda Copper Co., which is to absorb the various Amalgamated properties at Butte, was to be an owning and operating company, doing away entirely with the corporate machinery of a holding concern. It appears, however, from the call, which has just been issued for the special meeting to be held on March 23, that the Anaconda is to become a full-fledged holding company. The call adds "that a committee has been appointed by the board of directors to confer with similar committees representing the respective companies interested, for the purpose of entering into negotiations for the purchase of the different properties involved, provided the necessary increase of stock is authorized, and that these committees and a non-interested board will endeavor to arrive by careful investigation at the fair value of all the properties which it proposed to purchase." Apex troubles seem to be much in the minds of the Anaconda officials, as a mine map of Butte is enclosed with the call, and this comment added: "The manner in which the mining claims of the different companies interested are interlaced, and the controversies which may arise in determining the ownership of underground orebodies apexing within the surface lines of the claims exhibited upon the map can be readily appreciated." The two individuals who 'appreciated' this situation most are no longer factors in Butte. Henry H. Rogers is dead, and F. Augustus Heinze, the original 'appreciator', is at present a rather discredited financier and no longer a thorn in the side of the Amalgamated Copper Co. B. B. Thayer, president of the Anaconda, has gone to Butte to arrange for the necessary examinations. The position of North Butte still remains very much a mystery. It is said on one hand that the property is to be left out of the Anaconda merger entirely, on account of the claim made against it by the Tuolumne. Contrariwise, it is said that the North Butte and Tuolumne will both be taken in and the matter in dispute between the two companies settled. As the ore which the Tuolumne claims is appraised by the Tuolumne at $8,000,000, it is apparent that some adjustment would have to be made before either concern could be absorbed. Many theories have been propounded as to why the larger copper merger was postponed after having been semi-officially announced as all but completed. Undoubtedly the main reason was the multitude of details and the bitter disagreements provoked in getting together the preliminary consolidations. Mr. Morgan has sailed away for Italy, evidently with the intention of forgetting the whole matter for a time. The turn taken by the argument arising over the Utah Copper-Nevada Consolidated deal could hardly have been encouraging to Mr. Morgan and his associates, who were to stand sponsor for the greater merger. The Nevada Con. interests claim to have defeated the Guggenheims in their campaign for control of the company, and for the present both have ceased hostilities. It is anticipated, however, that there will be some litigation brought by the Nevada Con. stockholders, who are demanding the return of the stock which they deposited, the claim being made now that they were not fully informed as to the terms and conditions of the proposed exchange. There is a rumor that J. H. Hammond is to resign from the Utah board on account of the efforts which have been made to force through the merger against the apparent wish of a large number of the Nevada Con. stockholders. Mr. Hammond is at present absent from New York, and it is impossible to secure a denial or a confirmation of the story. It is anticipated that the Utah Consolidated will pass its next dividend; this is expected to be only temporary. After April 1 Utah Con. ores will go to the International S. & R. Co., which is controlled by Utah Con. interests, and the company will probably enjoy a lower smelting charge.

At the Goldfield Consolidated meeting held in New York this week the regular 30c. dividend was declared with an extra 20. The report that copper was coming into the ore on the lower levels was not accompanied by any selling orders from the West. On the contrary, it is apparent here that there were orders from the West to pick up any shares the news might bring out. It is hoped that the board of directors will clear the air of all uncertainty by making some definite announcement at the meeting. The Timmins Brothers, who first worked the La Rose mine at Cobalt, have taken an option on the McMahon-Hollinger property at Porcupine, the new gold camp to the north of Cobalt. The claims are said to have a fabulously rich surface showing. The discovery hole has been sunk to a depth of 30 ft., at present the deepest in Porcupine. The whole camp is now deep under the snow, but there has been quite a little trading in the properties 'sight unseen'. Canada made good with its silver camp, but was not able to hold the interest of the people of the States. Perhaps she can arouse some excitement with a gold camp. Montreal men interested in La Rose are credited with having purchased all of the holdings of the New York men in the company. From the January shipments the Cobalt output appears to be falling off, tonnage for that month being 400 tons below that of January 1909. Enlargement of concentrating facilities is given as a reason for the decrease. Both smelter and freight charges are saved by concentrating, and the result is a smaller tonnage of higher-grade ore. Charles S. Herzig and W. Murdoch Wiley are directors of and are interested in a new company formed to develop two sections of mineral ground in the neighborhood of the Little Lake properties in Ontonagon county, Michigan. The ground lies about eight miles from that of the Indiana Copper Co., which is being developed to catch the extension of the amygdaloid bed now being worked by the Lake Copper Co. The new company has a capital of $2,500,000 in shares of par value of $25. Several thousand shares are to be sold at $8 per share for development purposes. The Mines Company of America, operating the Creston-Colorado properties, near Minas Prietas in Sonora, Mexico, states in its annual report that there is as much ore in sight now as there was a year ago.

General Mining News.

ALASKA.

(Special Correspondence).—The Mount Andrew mine, in the Ketchikan district, has another large shipment of ore in the bunkers at Kasaan bay.——The It and Goodroe properties are preparing to commence operations March 1 after having been closed down for the winter.——H. S. Martin, manager for the Springfield Mining Co., is developing a galena property on Dall island.——M. M. Churchill reports good showings on the Tongas mine.——M. D. Ickis and W. L. Polson are sinking a shaft on their property near McLeans Arm. At present they have 8 ft. of shipping ore in their drift at a depth of 20 ft.——J. T. Jones has purchased a stibnite property on Cleveland peninsula, some of the ore assays over 50% antimony.——Most of the ore from this district is shipped to the Tyee smelter.

Ketchikan, February 10.

ARIZONA.

COCHISE COUNTY.

(Special Correspondence).—D. T. Swatling and A. Y. Smith, who have had the Commonwealth mine and mill leased during the last six years, have purchased 75% of the stock, and are now operating the property under the name of the Commonwealth Mining & Milling Co. The mine is at Pearce, on the branch of the Southern Pacific railroad from Cochise to Gleeson. The vein strikes east and west cutting at right angles an andesite hill that rises abruptly from the smooth surface of White Sulphur Springs valley. The shoot is 60 ft. wide and 400 ft. long, and is opened by a 536-ft. incline shaft in the foot-wall, the incline corresponding to the dip of the vein. A new incline has been sunk on a smaller vein south of the principal lode. This dips in the opposite direction, and at a depth of 257 ft. it is found to join the main vein. The ore is four feet wide, and assays 12 oz. silver with $1 to $1.50 gold per ton. At the 150-ft. station drifts were run 60 ft. east and 36 ft. west in that grade of ore. In the last six years the lessees cyanided 400,000 tons of tailing that had accumulated as the result of previous operations of the 80-stamp pan-amalgamation mill. Part of this tailing was cyanided after dry-crushing. The mill is now being remodeled to provide for stamp-crushing in cyanide solution and all-slime treatment. The equipment, nearly all of which is installed, consists of 20 stamps, four sets of rolls, two Chalmers & Williams tube-mills, 20 ft. long by 4 ft. diam.; four Pachuca slime tanks, 12 by 36 ft.; two Burt revolving filters, each 30 ft. long, 5 ft. diam., which will treat 80 tons of slime per 24 hours. With this equipment it is proposed to handle 100 tons of ore per day from the mine, and 200 tons of tailing from a dump of 40,000 tons from the old mill. The two classes of pulp are to be united in the tube-mill. The tailing to be cyanided is moved in cars up an incline, dumped into bins, and drawn from the latter to a Jenisch ball-mill, wherein it is pulverized in cyanide solution. It goes then to cone classifiers, the slime passing to the Pachuca tanks and the sand to tube-mills. It is estimated that the crude ore thus treated will assay 8 oz. silver and $1.50 gold per ton, the cost of mining and milling same $2.50 per ton; that the tailing dump to be treated in this connection contains 4 oz. silver and $1 gold per ton, which can be treated at a cost of $1 to $1.25 per ton. It is proposed, ultimately, to re-treat the 400,000-ton dump which is supposed to contain 3 oz. silver and 50c. gold per ton. It is estimated that the cyanide consumption will be 1 lb. per ton of crude ore, and 0.75 lb. per ton of tailing treated. Steam-power is used, with oil as fuel at a cost at the plant of $1.94 per bbl. Edwin Burt, of El Oro, Mexico, patentee of the Burt filter, is expected here next month to inspect the work of these filters, as they are said to be the first installed in the United States.——L. R. Le Gier and associates, of Los Angeles, are opening a marble quarry in the Dragoon mountains, eight miles west from Pearce. There are 20 claims located and the marble found there is reported to be of excellent quality. A force of 15 to 20 men is employed there.——The Cochise Gold Mining & Milling Co., the control of which is held by P. W. Corcoran, J. E. McGee and Merrill Brothers, has a promising gold-bearing vein on a contact of porphyry and quartzite, three miles northwest from Cochise station. There is about 140 ft. of development work on the vein exposing gold ore, assays of which run from $4 to $25 per ton. The gangue is porphyritic and the gold is free. There are 12 claims in the group, covering the outcrop for over a mile. A gasoline hoist, probably, will be installed, and a deeper shaft sunk.

Cochise, February 19.

GILA COUNTY.

(Special Correspondence).—The directors of the Globe Mining Co., controlling the Mineral Farm property in the Copper Hill district, about four miles northeast of Globe, met in Chicago February 10 and voted to raise $100,000 to expend in development work. Meanwhile operations on the vertical shaft have been suspended.——The Williams shaft of the National Mining Exploration property, at its present depth of 568 ft., is in quartzite with considerable hematite stain. Occasional bunches of copper carbonate are also found.——For the present, the Superior & Boston Copper Co. will ship 50 tons per day of 9% copper ore to the Arizona-Commercial smelter. The sinking of the McGaw shaft which was resumed February 15, has advanced to a point 45 ft. below the sixth level. The shaft sump and the station-pump sump on the sixth level have been completed. By a method of stoping without the use of timbers, which the Superior & Boston Copper Co. has just adopted, it is expected that the cost of ore extraction will be lessened fully $1 per ton.——Three pumps are raising about 3,000,000 gallons of water per day from the Arizona-Commercial mine. The cross-cut northeast from the Eureka shaft on the seventh level has not yet cut the Black Hawk lode. The smelter is treating from 200 to 220 tons of ore per day.——The management of the Inspiration company is preparing to install a small testing plant to determine the ratio of concentration possible for the Inspiration ore.

Globe, February 19.

GRAHAM COUNTY.

(Special Correspondence).—The Cobre Grande group of 14 claims, 23 miles west of Fort Thomas, in the Santa Teresa mountains, has been sold by the locators to Albert F. S. Cooper, representing Wheeler & Shaw, brokers, of Boston. The purchase price is $100,000, to be distributed in semi-annual payments over a period of two years. This property is situated in the Aravaipa mining district. Operations to explore a 42-ft. vein of sulphide copper ore will be commenced at once and a development company will probably be organized within six months.——A sub-lease on the Comstock No. 1, 2, and 3 claims in the Clifton-Morenci district, has been granted to P. Weurschmidt who has interested El Paso capitalists in the property.——Work was recently resumed in the 1500-ft. adit at the Stevens group and a small vein of rich copper-silver ore has been opened.

Clifton, February 18.

MOHAVE COUNTY.

Up to the present time but little progress has been made in draining the Tennessee mine, which has been the centre of interest in the county since its purchase by the Needles Mining & Smelting Co. six weeks ago. Both a pump and a skip have been worked almost continuously since that time, but because of drainage waters getting into the old stopes, some of which had been worked nearly to the surface, and also considerable caving in the shaft, only about 100 ft. of the entire 600 ft. of shaft are clear. The Tennessee ores, sulphides of lead, zinc, and iron, are especially desirable as flux on account of the excess of iron, and will furnish the bulk of that metal for the company's enlarged smelter at Needles.——In the Midnight mine, which has been under bond to the White company, of Lima, Ohio, since December 1, four feet of low-grade sulphide ore containing copper, lead, zinc, and silver was cut on the east 200-ft. level. Daniel S. Richards is manager and Walter Fellows, superintendent.——M. A. Moore, superintendent of the Dixie Queen mine, in the Virginia district, returned from Indianapolis several days ago, where in a conference with the principal owners it was decided to erect a 5-stamp

mill. Mr. Moore left for Los Angeles to buy a mill and a 40 hp. hoist. While East he ordered a 3-ton automobile truck to be used for the 20 mile haul from Chloride. At the C. O. D. mine, at Cerbat, whose record as a shipper is exceeded in this county only by the Gold Road, preparations are in full swing for the resumption of mining and milling.

On the Silver Legend prospect near the C. O. D. mine, W. D. Grannis has opened two feet of lead silver ore, which assays 47% lead and 110 oz. silver per ton. The new Tom Reed mill, at Oatman, was started a few days ago. Only 10 stamps are in operation, but it is expected that another 10 will be ready in a few weeks. Both mine and mill are operated by electric power from the Kingman plant. At a depth of 100 ft. there was found in the main shaft of the Nil Desperandum No. 2 three feet of ore averaging $20 gold per ton. The mine adjoins the Pioneer property and is under management of H. E. Woods, of Los Angeles.

PIMA COUNTY.

At the old Pueblo mine, four miles west of Tucson, the shaft is now down over 300 ft. The property is being operated under a bond by an Eastern company, one of the conditions being that the shaft be sunk to the 500-ft. point. — The shaft at the Chesterfield property has cut a number of rich stringers of lead silver ore with small amounts of gold and copper at a depth of 390 ft.——A serious cave occurred in the shaft on the Villaescusa property in the Babaquivari mountains while it was being unwatered, and the work has been temporarily abandoned. An adit has been started lower down the hill that will eventually drain the shaft.

SANTA CRUZ COUNTY.

A rich discovery of zinc ore has been made at the old Flux mine near Patagonia. The property, which is owned by R. R. Richardson and associates, has been worked for the past twenty years for its lead-silver ore.

YAVAPAI COUNTY.

(Special Correspondence).—There are 50 men employed in Copper Creek district, 27 miles south of Mayer, where the Arizona Copper Queen and several other companies are developing. The former, in charge of W. B. Douglas, has a 200 ft. shaft and three or four others about 100 ft. deep. There is a series of radial veins in granite, the ore being a copper and silver-bearing quartz, mostly oxidized as far as opened.——The American Copper & Gold Co., owning the Iron King, close to Humboldt, may resume operations after the Humboldt smelter blows in. This is a gold and silver property, having lenses of ore in chloritic schist. The ore contains an excess of iron. S. R. Trengove, superintendent, states that the mine, when in operation, can supply 50 tons of ore per day.——There is considerable activity on the Cherry Creek district, 15 miles east of Cherry station. This camp is at the southern end of the Black Hills range, where there is a granite country, cut by porphyry dikes. The Arizona Copper Gold Mines Co. has locations covering what is known as the Leghorn vein, on which a 500-ft. shaft has been sunk. The vein is 2½ ft. wide, containing gold, silver, and lead, partly free-milling and the rest suitable for concentrating. A Lane slow-speed mill, 40 tons capacity, has been installed. J. S. Sessions, superintendent, states that he has operated the mill at a greater capacity and is well satisfied with the work. Besides amalgamating plates, he has installed a Woodbury table and a Frue vanner. The concentrate is to be shipped to one of the smelters in this district.——The Black Hawk group, in the same locality, is being considerably developed, and a steam-boiler, hoist, and Huntington mill are being installed. This belongs to the Federal Mining & Milling Co., in which C. C. Scoullar, of Chicago, and E. A. Bonham, of Cherry, are interested. J. H. Tribby has partly developed the Hillside property, in the same camp, and has put up a mill containing three Nissen stamps.

Cherry, February 18.

CALIFORNIA.

CALAVERAS COUNTY.

The Ball Mountain Mining Co. has purchased the Ball Mountain property, near Vallicita, and is installing a Dow pump and 12 by 12 in. compressor. The group is five miles from Angels Camp and adjoins the famous Bishop mine on the Vallicita channel. F. Saville-Smith is consulting engineer. — A 100-ton mill and steel head frame are to be erected at the Boston mine in the Mokelumne Hill district in the near future. The lumber has been ordered and the roads to the mine are being repaired. The adit at the Ariel Consolidated Mines property, which is under bond to J. L. Green and associates, of San Francisco, is in 400 ft. A drift has just been started on the vein and is opening some fair copper ore.

INYO COUNTY.

The Benton Mining Co. has sold $100,000 worth of bonds and has purchased a compressor and power drills. The company is operating a group of claims on Blind Spring hill, near Benton, and is to start an adit near the base of the hill that will tap the old Cornucopia and Commanche veins. C. E. Julihn is in charge of the work. — The Four Metals company is shipping, approximately, 10 tons of ore per day. The company's smelter has been closed temporarily and in the meantime the ore is being shipped to Utah. — A rich 8-in. stringer has been opened in the North Inyo mine, six miles east of Bishop, and the ore is being sacked for shipment.

LOS ANGELES COUNTY.

At the annual election of the Los Angeles Chamber of Mines, Calvert Wilson was elected president; S. E. Vermilyea, first vice-president; J. S. Mitchell, second vice-president, and J. R. Mathews, treasurer. The annual meeting of the Chamber was held February 18.

MARIPOSA COUNTY.

Several men have been laid off at the Mount Gaines mine, in the Mariposa district, while the shaft is being sunk another 100 ft.——There is a large force at work at the Ruth Pierce and some good ore is being opened.——Petitions have been filed for the sale of the Diltz property, and the group belonging to the Teats estate.

NEVADA COUNTY.

Operations are to be resumed at the Banner Ridge drift mine, near Nevada City. The shaft is down 120 ft., and it is believed that it will cut the gravel within the next 50 ft. C. A. Bailey is manager.——A contract has been let by A. L. Shinn, of Sacramento, and C. L. Wilson, of Lincoln, for the erection of a 25-stamp mill near the Sierra county line. The work will be started as soon as the roads are in good condition for hauling and the plant will treat the ores from the Black Bear and Metropolitan mines.

PLACER COUNTY.

A number of the smaller mines at Ophir are crushing their ores at the Malmberg mill which has been idle for several months.——The adit on the property of Charley Glover is now in 550 ft. The 5-stamp mill is crushing ore that assays from $15 to $20 per ton.——A telephone line is being strung from the Rawhide mine to Alta and a road to Towle will be constructed this spring. The main adit is in 1400 ft., and two others have been started.——At the Herman mine the shaft is down 80 ft. from the adit level and a station is to be cut at this point. The mill is running on good ore.——The Hibbe copper prospect has been sold to an Oakland company and the shaft unwatered.

SHASTA COUNTY.

(Special Correspondence).—At Iron Mountain the Mountain Copper Co., Ltd., is pushing work steadily on its 3-compartment shaft which will be continued to the 500-ft. point to tap the ore at depth. A good body of fluxing ore, assaying well in gold and silver, is being opened. Structural material is arriving regularly and it is understood that operations will be resumed at the Keswick plant some time this summer.——A call has been issued for a meeting of the stockholders of the Inca Treasure Co. and the Delta Con. Gold Mining Co. in order to adjust the difficulties involving the corporations.——Operations at the Heroult electric iron smelter continues satisfactory. H. H. Noble, the manager, states that the capacity of the plant will be increased if production continues satisfactory.——A bond has been taken on the Jim Loage group by Eastern interests.——Op-

erations have been resumed at the Milkmaid, after a brief shut-down compelled by the recent severe storms.——At the Gladstone work is being carried forward on the vein opened some time ago on the 800-ft. level. The mill is producing at the rate of $40,000 per month.——The Consolidated Dredger Co. is moving its dredge from Clear creek to Middle creek. ——The United States Dredging Co. is re-constructing its dredge on Middle creek. The old hull was demolished last summer.——Operations have been resumed at the Mad Ox. ——Canadian business men have taken a bond on the Mad Mule group. The 165-ft. adit will be driven 200 ft. farther to open the vein. A. Egerton is superintendent.

Redding, February 19.

SIERRA COUNTY.

(Special Correspondence).—A deposit of bonanza quartz has been found in the main adit of the Rainbow Extension mine. Developments have not progressed sufficiently to prove the extent of the vein. O. A. Harlan, of San Jose, is manager.——A raise for air has been completed at the Rainbow and the development of the property is progressing steadily. The mill is running day and night. W. M. Wilson is superintendent.——A body of rich gravel has been opened in the Omega at a point 1300 ft. from the portal of the adit. On account of the roads, which prevents the shipment of necessary supplies, but little work is being done and the mill is idle.——The Plumbago is producing steadily.——The Wild Joe, recently bonded by C. L. Crane and associates, will be actively worked this spring. The vein is 5 ft. wide, and occurs in a slate formation. Assays of $10 to $31 per ton in gold have been obtained. The ore is generally free-milling.——The new company controlling the Sixteen-to-One expects to resume activities within a few weeks. Arrangements have been made to start a large force of men.

Alleghany, February 19.

A new adit at the Slate-Castle Jaffa property in the Downieville district has been started 100 ft. below the upper workings. There are five men now working on the property but the force will be increased as soon as the weather modifies.——Jason Frye has purchased the interest of Thomas E. Winrod in their lease on the Standard mine in Sailor ravine. The Standard has produced some of the richest arsenical sulphide ore found in the district. ——A small vein of high-grade ore has been opened at the Morning Glory mine, in the Alleghany district.

TRINITY COUNTY.

(Special Correspondence).—The Forest Service, together with the county, is building a new trail along the Trinity river that will open a large amount of placer ground in the districts tributary to Weaverville. Lack of transportation has been a serious handicap to this portion of the country. ——At Cox bar, Tinsley & Trelom have opened a gravel bar formerly known as the Tom Price drift mine. The original owners of this property took out considerable gold by drifting and the mine was considered worked out. The present operators secured the ground for a nominal sum and fitted up a small hydraulic plant obtaining about a 70-ft. head. The two first clean-ups netted the operators $100 for each hour the water had been turned against the gravel. The extent of the rich ground has not been determined as it is thought that a portion of it had been enriched from a higher channel which was worked several miles down the river at the Highland mine. Down the river from Cox bar a number of small mines are operating on pay-gravel.——At Don Juan point F. Murphy is operating a giant on some good ground.——From Don Juan point to Hawkin's bar there are several large areas of gravel comparatively untouched while in the neighborhood of Hawkin's bar a number of hydraulic properties are doing well. From Hawkin's bar up the Trinity river for 40 miles there is a large amount of excellent gravel.——The Headlight mine, at Carrville, is to spend $150,000 this spring in the erection of a 40-stamp mill and 400-hp. hydro-electric plant.

Weaverville, February 21.

TUOLUMNE COUNTY.

(Special Correspondence).—The Erie Mining Co. last week paid off all indebtedness for labor, and it is reported that operations will be resumed soon. The water ditch, which is about two miles long, is being cleaned.——The mill at the Black Oak, after a thorough overhauling, started Thursday of last week on good ore. The property is at present giving employment to 30 men.——A 5-stamp mill is being erected at the Maddox mine, situated one mile east of Confidence and operated by the Phoenix Lake Mining Co. Underground work is carried on with a small crew of men. ——The hoisting machinery on the Springfield Tunnel & Development Co.'s property is being moved to the Hard Rock incline shaft, where a new building has been erected. ——The Draper mill has again been put in operation after a shut-down of several weeks, during which it was thoroughly overhauled.——A restraining dam is being constructed at the Red Gravel mine, at Yankee Hill.——The wagon-road leading to the Ethel mine is being regraded to lessen the difficulty of transporting supplies to the property. The mine is being actively worked and the mill is running steadily.——The Densmore Mining Co. has acquired, by deed, a claim adjoining the Densmore mine which was owned by A. J. Miller.——At the Laguira mine, near Groveland, recently bonded to Thomas Lane, of Angels Camp, preparatory work has been commenced.——Another rich find was made a few days ago in the Gold Spring mine, which is to be equipped in the near future with a 10-stamp mill.——According to information being given to miners applying at the Confidence for employment, underground work will be resumed about April 1. Fifteen stamps are being used to crush the ore from the dump, which is said to be giving satisfactory results.——A 2-stamp mill is being installed at the Donelli mine, which is being operated by George E. Brown and associates.——In addition to making other preparations for commencing actual mining operations at the Little Gap gravel property, a large concrete dam will be constructed. The property, which is situated above Groveland, was a short time ago bonded by George Hamilton to a company composed of Stockton people. Lumber, tools, and supplies are being taken to the property, and with a small crew of men the preliminary work is now well under way.

Tuolumne, February 21.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—The Kelly Adit property on Democrat mountain, in the Georgetown district, is to be taken under bond and lease by B. F. Kelly, representing a syndicate of Colorado and Eastern capitalists and work will be put under way by March 1. The Kelly adit has been driven for 2800 ft. and is just penetrating the richest portion of the hill. The property is equipped with compressor plant and 50-ton concentrating mill.——In a few days electric power will be turned on at the holdings of the Accord Mining & Milling Co., on Saxon mountain, and the adit driven ahead with power-drills.——The Argentine Central Railway Co. has started work in the opening of the ground of the Santiago vein which was recently secured under lease and operations are being carried on through the Wilcox adit. C. L. Tingle is in charge.——A force of 50 men is now at work in the Stanley mine, in the Idaho Springs district. The water has been lowered to the fourth level, while large development is being carried forward on levels 1, 2, and 3. Seven sets of lessees are at work with machine-drills and during the past week the 50-ton mill was started. J. E. Bowden is operating the mine under lease.——A lateral is being driven from the Central adit to intersect the Refugee vein which was recently secured under lease by Hunt & Deming, of Denver. This vein is the west extension of the Shafter, and has a large production record.——Barnes Brothers, operating a group of claims on Santa Fe mountain, sent out a carload shipment of ore last week to the Modern smelter. A return of $32 per ton gold and silver was realized.——Thomas Hennehan, of Silverton, has been appointed manager of the Chesapeake mine at Alice and is opening the workings preparatory to starting shipments.

Idaho Springs, February 19.

GILPIN COUNTY.

(Special Correspondence).—A streak of smelting ore 14 in. wide has just been uncovered on the Great Bonanza

property, near Central City, at the 360 ft. level of the shaft workings that assays $60 per ton in gold. Cecil Morgan is manager.——A gold retort weighing 88 oz. was sold this week by H. Lowe, manager of the Topeka property, for $1400.——Work has been resumed on the Grand Central property by McMasters Brothers. The machinery is being overhauled and the compressor plant will be started during the next few days.——Work has been resumed at the Hilltop mine in the Russell district. A streak of ore has been found that is 8 in. wide and assays 1.16 oz. gold with 80 oz. silver per ton. H. Ramstetter is manager.——The Bald Mountain Mining & Development Co., operating in the York district, has advanced its adit 325 ft. and it is expected that a vein will be intersected within a short distance.

Central City, February 19.

LAKE COUNTY.

From 25 to 30 tons of zinc ore is being shipped from the Yak tunnel at Leadville to the smelter at El Paso and it is understood that a number of Leadville producers are to ship their zinc ore to the El Paso plant this spring.——Regular shipments are being made from the La Plata mine, on Rock hill, after an idleness of several years. A large vein of 45% lead ore has been opened.——Otto Thurn and associates have driven a drift 600 ft. on the 400-ft. level of the Louise property, in South Evans gulch, and are making arrangements for more extensive development.——According to a lease recently entered into by the present lessees of the St. Louis tunnel the Big Four shaft on Breece hill is to be sunk over 250 ft. during the next two years. Work is to be started April 1 of the present year. Kendrick P. Crawford represents the lessees and a graduated scale of royalties is to govern the payment for all ore mined. The Big Four property adjoins the St. Louis tunnel holdings. The lessees of the latter property have met with almost unprecedented success during the past few months. In their operations they have discovered valuable gold-bearing ore and have made regular shipment from the vein. They have calculated that the same streak continues into the Big Four ground.

OURAY COUNTY.

Five feet of ore have been found in the Bright Diamond property in the Ouray district above the ore that the company has been mining in the past. A portion of the vein

Camp Bird Mill, Ouray County.

is free-milling and a portion will be shipped to the smelter. The company is planning on the erection of a mill and compressor-plant shortly.——The shaft at the Neodesha, under bond to John Keleher, cut a small vein of high-grade ore.——What is believed to be the Mendota vein has been cut in the Thistledown property. The machinery for the new mill is being put in place rapidly and work on the pipeline for the power-plant and tramway is going ahead as rapidly as the weather conditions will permit.

SAN MIGUEL COUNTY.

In the Favorite mine, at Ophir, a 3-ft. vein of lead-silver ore is being opened with good results. The ore broken in the development work is now being sacked for shipment to the smelter, netting the company approximately $1000 per carload. The mill has been thoroughly overhauled and an aerial tram is being built to connect the mine and mill. The ore readily concentrates from five to one, the product assaying 1.5 oz. gold, 14 oz. silver, and 25% lead. Besides this the ore plates about $3 gold per ton. Gus Carson is superintendent.

SUMMIT COUNTY.

The tunnel of the King Solomon Mining & Tunnel Co., at Frisco, is now in 3600 ft., and has cut 11 veins. Development work has been started on six of these and considerable good ore is now being opened.——Work has been resumed on the White Cloud property, in the Brekenridge district. A. A. Pike is superintendent.——A gasoline power-plant is being installed at the O'Reilly property, and in the future machine-drills will be used in driving the adit. A. C. Howard is manager.—— The road has been broken to the Arctic mill, and work is being rushed in the construction of the mill.

TELLER COUNTY.

An 80-ton shipment from the Modoc mine, between Bull hill and Battle mountain, in the Cripple Creek district, has been forwarded to the Eiler smelter at Pueblo. The ore was mined on the 900-ft. level and will average $40 per ton. F. H. Frankenberg, Sr., is manager.——Sampson & Truscott, who recently purchased the sub-lease on the Longfellow No. 2 of the Stratton estate, have opened a good shoot on the first level and are now shipping ore.——The drift on the 300-ft. level of the Pinnacle Gold Mining Co.'s property has opened a shoot of high-grade ore containing from $\frac{1}{4}$ to 1 in. sylvanite. The property is under lease to the Pinnacle Leasing Company.

MONTANA.

SILVERBOW COUNTY.

(Special Correspondence).—J. J. Harrington, secretary for the Tuolumne Copper Mining Co., is authority for the statement that during the month of January the company produced 728,000 lb. of copper containing silver valued at $5491. The Tuolumne company is well satisfied with the conditions at present prevailing, and it has no fear of any litigation arising from a question of dispute with the North Butte.——An application has been made for the appointment of a receiver for the Hypocka Mining Co., a Heinze concern organized a few years ago during the trouble with the Amalgamated. A judgment was secured against the company for $14,000, but the sheriff reports that he is unable to find any property to levy against. An application has also been made for a receiver for the Pittsburg & Montana Copper Co. in consequence of the failure of the company to pay a judgment for $18,000 and on the strength of the sheriff reporting that he was unable to find any property to satisfy the judgment. The Pittsburg company is capitalized at $30,000,000, while the Hypocka company is capitalized at $100,000. The attorneys who represent these companies have refused to accept service on the ground that they no longer represent them. As both companies are liable to the full amount of their capital stock the attorney who made both applications for the receivership declares that as soon as the receivers are appointed he will see that the full amount of the judgments with interest will be collected from the stockholders.

NEVADA.

ESMERALDA COUNTY.

(Special Correspondence).—The controversy recently precipitated as the result of assertions that the gold content of the ore was being replaced by copper as depth is attained in the Consolidated mines, at Goldfield, has been given an effective quietus by a statement issued by the general manager, J. R. Finlay. Copper in small quantity is found throughout the Goldfield district and occasionally small seams or pockets of rich copper ore have appeared, but in no greater frequency at depth than near the surface, and at only a few scattered points has the quantity been other

than negligible. In point of fact there is less copper known to exist in the mines of the Consolidated than in the Florence, C. O. D., or Daisy. Development in the Consolidated mines continues to add to the ore reserves, particularly in the new workings of the Clermont where the vein is being opened for great width at the 750 and 900-ft. levels. The 1000-ft. level is being driven in vein-matter and from the highly silicified character of the material, it is expected that the ore-shoot will be penetrated within a short distance from the present face. The tonnage treated by the mill has exceeded 850 tons per day, a large part of this product coming from the Clermont shaft which is now capable of producing over 600 tons per day. The recently burned machine and carpenter shops at the mill are being replaced by more complete buildings and equipment. Additional provision has been made for fire protection both at the mill and near the surface plants of the mines. There is little danger of fire at any time in the mine workings. ——Timber sets for the enlarged Florence shaft are now being prepared and the work of opening the third compartment from the 500-ft. level to the surface will soon be in progress. This shaft, of small size, was first sunk to the 350-ft. level, and last year was completed to the 500-ft. point by raising from a cross-cut driven at this depth from the Engineer's shaft. Little work has been done in ground adjacent to the main shaft below the 350-ft. level, but laterals have connected this shaft with many of the old lease workings. A drift to the north has reached the Reilly lease territory and in its course has exposed good milling ore for 500 ft. The attention of the management has been devoted, largely, to the ground to the south embraced by the Little-Florence and Rogers leases where ore is being broken and blocked out in readiness to supply the mill through the Little-Florence shaft and over the aerial tramway while the main shaft is being enlarged.——At both the 200 and 300-ft. levels of the Gold Bar workings recent development has been attended by most encouraging results, insuring a profitable product for the lessees, W. F. Gray and associates, who have secured a five-year lease on the claim and will erect a 50-ton mill. Sample shipments of the ore have been sent to Denver with which to conduct tests to determine the best process of treatment and ore is being prepared for shipment to the smelter. A 4-ft. vein of excellent milling ore is exposed in which there are seams of richer material showing free gold.——Development will soon be in progress from a station at the 800-ft. level of the Combination Fraction to which depth the shaft has been sunk lately from the 600.——In the Annex shaft on the Polverde, a station has been cut at the 800-ft. level, just below the point where the vein contained 4 ft. of ore averaging $50 per ton. The second drum of the hoist has been wound with cable, and guides are in place for the second cage in the double-compartment shaft, which will be continued to a depth of at least 1000 ft. in the expectation of cutting the Clermont vein. Driving will be begun at once on the vein. Ore-bins are being installed, a spur built to the dump from the railroad, and a compressor will be used to operate the machine-drills. Preparations are being made to begin shipping ore at once. This vein apparently trends directly toward the St. Ives and Velvet claims of the Goldfield Merger Mines Co. to the east and south.——Ore is now being broken at the 350-ft. level of the St. Ives by lessees. The Merger company's main shaft is 600 ft. deep and the prospects of finding the Annex vein from this shaft are said to be excellent. A new lease on the Booth includes the company shaft from which a cross-cut is being driven toward the Red Top vein at 260-ft. depth. From the Banner shaft on the Booth a cross-cut has been driven to the vein and small assays obtained.——Pay-ore has been opened by lessees within the past few days on both the Blue Bull and Commonwealth. The extent of the ore-shoots is still problematical.——The Grizzly Bear shaft, sinking at the rate of 5 ft. per day, is nearing the 1000-ft. level and will be continued to cut the hanging wall of the Mohawk vein, which it is expected to penetrate near that depth.

Goldfield, February 19.

LANDER COUNTY.

(Special Correspondence).—The Nevada-Omaha Mining & Milling Co. has arranged to sink a 200-ft. shaft on its properties at Bannock, and a steam-hoist has been ordered. The drift from the adit on block 2 has opened 28 ft. of $9 ore and the lessees on block 9 have intersected 3 ft. of ore assaying $40 to $60 per ton.——The Nebraska-Bannock has started work on a 50-ft. shaft to open a 2-ft. vein that assays $6 per ton on the surface.——The Philadelphia-Western, Hilltop, and Golden Rule properties have been acquired by M. C. Scully and associates of Illinois and Canada. A 20-stamp mill will be immediately installed. The owners have been shipping high-grade ore for several months.——The Horton company has practically completed its 20-stamp mill and will commence crushing ore soon. A large quantity of ore assaying $20 to $30 per ton is reported opened in the property.——The Golden Hub Leasing Co. is driving a 300-ft. adit to open the vein between the granite and quartzite on the north half of the Big Five claim. A 10-in. seam of oxidized quartz has been cut.——The Hanks lease on the Pioneer and Smuggler lodes of the Buzzard is developing a vein of copper-silver-gold ore.——It is expected that the first unit of the Austin-Manhattan 10-stamp mill will be in operation in June. The Frost shaft is down to the 900-ft. point and a cross-cut will be driven north from this point to open the Panamint and Independence veins.

Battle Mountain, February 17.

WHITE PINE COUNTY.

(Special Correspondence).—It is reported that Ely Centennial has penetrated 15 ft. of ore at a point 52 ft. below surface.——North and south drifts are being driven from the 400-ft. level of the Zack shaft on Ely Consolidated. The vein recently opened at this point has been cut for 20 ft., the ore assaying from 3 to 4% copper. The raise from the 400-ft. level of the Brilliant shaft workings is up 50 ft., exposing 18 in. of ore assaying 10% copper and $15 gold and silver.——The McDonald Ely has resumed operations.

Ely, February 19.

CANADA.

BRITISH COLUMBIA.

(Special Correspondence).—A dividend of 2%, the first for some years, has been paid by the North Star mine in East Kootenay. There is considerable ore in sight, the last car of which gave a smelter return of 70 oz. silver and 60% lead.——The Canadian Northern Railway Co. has acquired the Dunsmuir coal interests on the coast for $11,000,000. It is reported that J. P. Morgan & Co. are financing the enterprise and that five or six million dollars more is to be expended, a steel and iron works being planned.——At the annual meeting of the British Columbia Copper Co., held last week at Charleston, West Virginia, the figures for the year ended November 30 showed that the company had earned 10% on its capital stock, despite a forced period of idleness during the fiscal year reviewed. ——The Copeland Mining & Development Co. has arranged for a two-year extension of its bond on the Le Roi property. ——A 9-ft. galena vein has been struck on the Silver Cup property, near Hazleton, recently bonded by Rossland men to Prince Rupert, capitalists, for $40,000.

Rossland, February 19.

MEXICO.

CHIHUAHUA.

(Special Correspondence).—The Alfarena Mining Co. has been organized to take over the Alfarene mine in the Santa Barbara district, and is testing the ore to determine the best method of treatment. F. C. Morehouse is at the head of the new company.——On a gross production of $807,783 in 1909 the San Toy Mining Co., operating in the Santa Eulalia district, netted $326,483. A deficit of $164,582 was carried forward from 1908.——The Guggenheim interests are negotiating for the purchase of the properties of the Chihuahua Mining Co. and the Potosí Mining Co. in the Santa Eulalia district.——The Joquivo Development Co., controlled by Charles and J. S. Qualey, will build a 100-ton mill and cyanide plant at Joquivo in March or April. The company is opening a gold-silver property.

Santa Eulalia, February 18.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

W. S. Noyes has gone to Oregon.

J. V. N. Dorr is in San Francisco.

A. D. Foote was in San Francisco this week.

W. Spencer Hutchinson has been at Los Angeles recently.

J. Morgan Clements has gone to Los Angeles.

Fred T. Williams has been examining mines at Park City, Utah.

E. C. Vinson is manager for the United Rhodesia Gold Fields, Ltd.

H. J. Shrafe was down to San Francisco from El Dorado county this week.

C. E. Morris has left London for the Santa Francisca mine, Nicaragua.

E. H. De Vore, mining engineer, has opened an office at Douglas, Arizona.

W. O. North is now at Goeblit, Sarawak, Borneo, instead of New York as formerly.

E. A. H. Tays has returned to San Blas, Sinaloa, from the central plateau of Mexico.

Gerald M. Browne is in Venezuela on a visit to the property of the Rio del Oro, Ltd.

L. S. Austin has opened an office in the Dooly block, Salt Lake, Utah, for consulting work and mine examinations.

R. E. Miller married Miss Euretta Stevens at Denver recently and is at Hahn, Idaho, with the Lemhi Smelting Company.

George G. Vivian, formerly superintendent at the Tintic smelter, is now manager at the Golden, Colorado, plant of the North American Smelter & Mines Company.

Selwyn Goldstein, of Pearse, Kingston & Browne, has arrived at the Tominil mine (Mexico), which he is to manage. K. D. Armstrong will join him as mine accountant.

J. H. Wise has resigned from the Pacific Gas & Electric Co. to become a member of the firm of F. G. Baum & Co., hydro-electric and irrigation engineers, 1404-1408 Chronicle building, San Francisco.

Thomas Hoatson and Gordon R. Campbell, directors of the Calumet & Arizona Mining Co., with William Kemp, consulting engineer, have been visiting mines at Mammoth, Clifton, and Morenci, Arizona.

Lyman P. Hammond, recently sales manager for the Denver Engineering Works, and formerly with the Crocker-Wheeler Co., has taken the position of manager of the sales department of the Central Colorado Power Company.

P. G. Spilsbury, of New York, has associated himself with Spurr & Cox (Inc.), and will be identified with the metallurgical department of that firm of consulting engineers. His new address is Room 10, Chamber of Commerce building, El Paso, Texas, with Godfrey Doveton.

J. W. D. Moodie has opened an office in the Story building, Los Angeles, California, and will devote special attention to transportation projects. Until recently he has been chief engineer for the Guanajuato Development Co., and its allied interests, and was in charge of the building of the mining railroad for the Phelps, Dodge & Co., at Nacozari, Sonora.

The San Francisco Section of the Mining & Metallurgical Society of America met at the Palace Hotel, February 21. The following members and guests were present: A. B. Christie, Francis Drake, J. F. Newsom, F. W. Bradley, M. A. Folsom, Gelasio Caetani, Edgar A. Collins, George B. Starr, A. C. Lawson, Corey C. Brayton, J. Morgan Clements, E. B. Kirby, C. W. Merrill, H. F. Bain. Arrangements were made for an executive session March 21, and a general session April 21. At the latter 'Porphyry Coppers' will be discussed.

The Canadian Mining Institute will meet in annual session at Toronto, March 2 to 4 inclusive.

Market Reports.

LOCAL METAL PRICES

San Francisco, February 24

Antimony	12—12½c	Quicksilver (flask)	69—70
Electrolytic Copper	15¾—16⅛c	Spelter	7½—8⅛c
Pig Lead	4.95—5.00c	Tin	36—37⅛c

METAL PRICES

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead	Spelter	Silver per oz.
Feb. 17	13.31	4.55	5.43	52⅛
" 18	13.31	4.55	5.43	52
" 19	13.31	4.55	5.43	52⅛
" 20	Sunday.	No market.		
" 21	13.31	4.55	5.43	52
" 22	Holiday.	No market.		
" 23	13.31	4.55	5.43	52

ANGLO-AMERICAN SHARES.

Cabled from London.

	Feb. 17. £ s. d.	Feb. 24. £ s. d.
Camp Bird	1 8 6	1 8 0
El Oro	1 8 6	1 8 6
Esperanza	2 18 9	2 17 6
Dolores	1 8 9	1 8 9
Oroville Dredging	0 8 6	0 10 0
Mexico Mines	8 11 3	8 5 0
Tomboy	0 17 6	0 17 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing Prices. February 24.		Closing Prices. February 24.
Adventure	7¾	Mohawk	65
Allouez	56	North Butte	37¼
Atlantic	9¼	Old Dominion	44
Calumet & Arizona	72	Osceola	101¾
Calumet & Hecla	622	Parrot	20
Centennial	27	Santa Fe	2
Copper Range	76¾	Shannon	15
Daly West	8	Superior & Pittsburg	13⅛
Franklin	19¼	Tamarack	74
Granby	90	Trinity	8½
Greene-Cananea, ctf.	10⅛	Utah Con	32¼
Isle Royale	22½	Victoria	4
La Salle	17	Winona	9¼
Mass Copper	6⅝	Wolverine	141

(By courtesy of J. C. Wilson, Mills Building.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices. February 23.		Closing prices. February 23.
Amalgamated Copper	76	Miami Copper	23⅞
A. S. & R. Co.	83⅛	Mines Co. of America	½
Boston Copper	19	Montgomery-Shoshone	¾
B. C. Copper Co.	6⅞	Nevada Con.	22⅛
Butte Coalition	24⅜	Nevada Utah	1¼
Cumberland-Ely	7¾	Nipissing	10¼
Davis-Daly	3⅜	Ohio Copper	4¼
Dolores	6⅝	Ray Central	3¼
El Rayo	2½	Ray Con.	21⅝
Ely Central	1½	South Utah	2⅞
First National	4⅝	Superior & Pittsburg	13⅜
Giroux	9⅞	Tenn. Copper	33
Guanajuato Con	1⅞	Trinity	8½
Inspiration	8½	Tuolumne Copper	3¾
Kerr Lake	9⅜	United Copper	6¾
La Rose	4½	Utah Copper	49½
Mason Valley	1⅜	Yukon Gold	4⅜

SOUTHERN NEVADA STOCKS.

San Francisco, February 24.

Atlanta	$ 17	Mayflower	$ 3
Belmont	1.60	Midway	28
Booth	16	Montana Tonopah	94
Columbia Mtn	6	Nevada Hills	50
Combination Fraction	31	Pittsburg Silver Peak	70
Daisy	8	Rawhide Coalition	16
Fairview Eagle	11	Rawhide Queen	15
Florence	2.35	Round Mountain	53
Goldfield Con	7.75	Sandstorm	4
Gold Kewenas	6	Silver Pick	9
Great Bend	3	St. Ives	17
Jim Butler	11	Tonopah Extension	71
Jumbo Extension	35	Tonopah of Nevada	6.75
MacNamara	28	West End	32

(By courtesy of the San Francisco Stock & Exchange Board.)

Goldfield Consolidated Operations in January.

The following tables and information are given out by J. R. Finlay as the official preliminary report of operations of the Goldfield Consolidated for January:

	Tonnage produced		
	Wet tons.	Dry tons.	Assay oz.
Combination	6,303	6,193	0.89
Mohawk	8,325	7,928	0.74
Red Top	6,555	6,243	1.76
Clermont	4,089	3,716	4.21
Totals	25,272	24,080	1.58

	Approximate value produced.	Per dry ton.
Combination	$114,093	$18.41
Mohawk	121,088	15.27
Red Top	227,122	36.36
Clermont	323,195	87.00
Totals	785,498	32.62
Loss in tailing	55,898	
Estimated recovery	729,600	

The values indicated as recovered were not all precipitated and turned into bullion at the end of the month. Owing to the increased tonnage treated in the mill there was a larger amount of concentrate in process at the end of the month than at the beginning. Mr. Hutchinson estimates that 60 tons of concentrate, containing 1000 oz. gold, belonging to the January ore, had not been treated.

EXPENSES.

		Amount.	Per dry ton.
General expense		$28,200	$1.18
Mining: Pay-roll and salary	$53,256		
Power	4,416		
Supplies	35,400		
Departments	7,972		
		101,044	4.21
Railroad		2,000	0.08
Milling: Pay-roll and salary	14,838		
Power	7,848		
Supplies	32,500		
Departments	2,603		
		57,789	2.41
Marketing concentrate		23,000	0.96
Total cost		$212,033	
Less miscellaneous earnings		1,713	
Net cost		$210,320	$8.73
Loss in tailing			2.32
Total costs and losses			11.05
Profit per ton			21.57
Total value of ore			32.62
Total profit per month			$519,300

It will naturally be of interest to note the effect of an increased tonnage on operating costs. In my telegram of January 31 I estimated the total expense at $197,000. This appears to be an underestimate to the extent of $13,000. This arises from the fact that the estimate was made simply on the total number of men employed, calculating $9.75 per shift. It appears now that the increased tonnage calls for a larger consumption of supplies in proportion to labor. The total sum of $13,000 can be accounted for in two items. First, an increase in supplies and labor at the mine of about $6000, and second, some additional expenses at the mill, caused by finishing construction which last month was charged to construction, but this month to operating, and also some supplies lost by fire and an additional consumption of chemicals and supplies due to the freeze-up and shortage of water in the early part of January. However, after making these corrections, it is still found that the total cost has come down a little, principally in the item of general expense. The cost of mining and development is a few cents lower than for December, and the cost of milling a few cents higher. On the whole, it is safe to say that the reduction in costs, due to a production of 25,000 tons per month, as against 20,000, will be almost entirely in the over-head charges. It is too early to figure on much reduction in other directions, but when the difficulties at the mill are fully overcome there should be some reduction there. As to mining, it is difficult to see much opportunity for lower costs; possibly somewhat higher costs should be anticipated on account of the necessity of providing equipment for operating at greater depth than heretofore.

Heretofore this company has published its complete costs only in the annual reports, but it has made a practice of publishing at intervals its operating costs, namely, mining, transportation and milling. In this statement, however, the effort is made to show the total deductions that must be made from the gross value of the ore, calculating gold at $20.67 per ounce, to arrive at net profits applicable to dividends. Very few companies issue such statements. The items that are stated as costs now that were not so stated formerly are the general expenses, of which at least half are bullion taxes and the cost of realization of bullion. Further, the cost of smelting residue from the concentrate plant is now included as an operating expense under the head of milling. The sum total of costs and losses will vary according to the grade of the ore. The bullion tax and tailing losses vary directly with the grade, and the cost of marketing concentrate residue varies also, but not in direct proportion to the value contained. This explanation is intended to dispel the surprise caused by a statement showing the total costs and losses instead of the direct operating costs. The former are about $11 per ton and the latter somewhat less than $7. It is, perhaps, worth while to state that the sum total of costs and losses is apparently less than that of any other gold mining company in the world that produces an ore of similar grade.

The total advance made in development headings is the largest on record, being as follows:

	Feet.
Combination	840
Mohawk	1020
Red Top	1328
Jumbo	1375
Total	4563

Of this development a total of 858 ft., or somewhat less than 20%, was in ore. Most of this work, however, was simply following orebodies that were already presumed to exist, and cannot be said to add anything to ore in sight. In the Combination and Mohawk no new ore was developed during the month. In the Clermont, on the 750-ft. level, developments were made in three new places exposing ore of a total area on that level of 1254 sq. ft. Of this amount 780 sq. ft. is due to the extension of the sill-floor in the large stope No. 401. Since no equivalent developments were made on the levels above and below, this ore should only be considered to extend half the distance to the 600-ft. level upward, and half the distance to the 900-ft. level downward. In other words, a reasonable estimate of ore put in sight by these developments should not be calculated on a vertical extent of more than 120 ft., but this will allow an estimate of approximately 12,000 tons put in sight at the Clermont as against 3700 tons extracted. The average grade of this ore is about $70 per ton. In the Red Top, out of a total of 217 ft. in ore only 96 ft. belongs to drifts on main levels putting new ore in sight. The total amount may be roughly calculated at 4000 tons of an average value of $15. In round numbers the developments of the month have put in sight 16,000 tons, with a total value of $900,000, as against 24,000 tons mined with a total value of $785,000, showing a surplus of value put in sight for the month, but a shortage of tonnage. On the 1000-ft. level of the Clermont, the main crosscut reached the vein, but thus far no ore has been encountered. The silicified mass in which the ore is expected is found with its usual attitude and appearance. Drifting is now in progress on a seam which will undoubtedly soon lead to an ore-shoot.

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EDITORIAL.

THE CENSUS BUREAU and the Geological Survey will co-operate this year in the collection of mineral statistics. If this results in as notable reports as those based on the co-operative work of 1880, the volumes will be in large demand.

MINIMUM tariff rates will be applied to articles of commerce entering the United States from Mexico. The order for such privilege, as provided by the terms of the Payne-Aldrich tariff law, was recently signed by President Taft. No announcement of reciprocal concessions on the part of the Mexican Government has yet been made.

YERINGTON, the Nevada district discussed on another page by Mr. F. L. Ransome, is likely to see lively times this year. A railway has been built from Wabuska down to Mason Valley and is to be extended twenty miles to the south. Among other improvements planned for this season is a smelter to be built by the Nevada-Douglas and allied interests.

A DIVIDEND disbursement of $8 per share will be made by the Calumet & Hecla for the first quarter of 1910. This is at a considerably higher rate than for the same quarter of 1909. With this payment the total distribution to stockholders since the organization of the company will have been $112,150,000, placing the Calumet & Hecla above all rivals as the most successful mining company in the world, measured by the magnitude of its returns.

ILLINOIS is to have both mine rescue stations and miner's institutes. The recommendations to that effect made by the Mine Investigation Commission have been approved by the General Assembly and $75,000 appropriated for the first, with $25,000 for the second. This is an important move in the right direction. A recent court decision relative to methods of appropriating money in Illinois may delay these and other matters, but the ultimate outcome is no longer in doubt.

GRATIFYING news comes to hand of the declaration of a dividend by the Florence Goldfield Mining Company of ten cents per share, making an aggregate disbursement of $105,000. It is also pleasing to note the wisdom of the directors in declining to be swept by enthusiasm into the risky position of establishing a regular quarterly dividend of this amount. The policy of paying what profits warrant, and of creating an adequate reserve fund, leaves a mining company in a stronger position. The market price of the stock is no more likely to suffer extreme variations under such circumstances than when the payment of a fixed sum is pledged. To pass

a regular dividend is certain to produce alarm, though it may be done for the sake of preparing for an increase in earning power.

REVISION of the mining code of the Republic of Chile is in progress. This is being made in the first instance by a committee appointed by the Chilean National Society of Mines. After approval of the revised code by the directors of this Society it will be submitted to Congress. The latter body will probably enact the measure into law practically as it comes from the hands of this group of representative mining men, who are supposed to know best what legislation is needed to facilitate the mineral industry. The revision makes no changes in the fundamental law, but is directed toward the elimination of obscurities and defects recognized in the existing statute.

THE SENATE Committee on Mines and Mining, we are glad to know, is likely to amend the House bill for a Bureau of Mines, by raising the salary of the Commissioner to the sum originally proposed, $6000, and inserting a qualification clause to assure that a technical man be appointed. Another much needed amendment is one leaving the Commissioner free in the matter of payment of salaries. Let Congress determine each year the amount which can be spared for each branch of the work, but let the Commissioner pay out of such sums whatever is necessary to get the best man for each investigation. The West wants to get away from regulation and investigation by '$1200 a year' bureau clerks.

KANSAS has been supposed by many to be the peculiar home of cyclones and trouble. This is a prejudiced point of view. As a matter of fact the name of the prairie State is fast becoming a synonym for sane and substantial prosperity. Last week, just by way of emphasizing that the resources of the State are not wholly agricultural and literary, the University dedicated at Lawrence a group of buildings, one being devoted to engineering, the second being a mechanical laboratory and power plant, and the third serving for investigation and study of geology and mining. Mr. E. R. Buckley, in his new capacity as president of the American Mining Congress, delivered the dedication address at the mining building.

REPLYING to the criticisms of Mr. James Phillips, Jr., a letter has been issued by Mr. Charles M. MacNeill, president of the Utah Copper Company, in which the pot admonishes the kettle as to its color. The statement that the Utah company can count on more than 100,000,000 tons of proved ore reserves may be accepted, but past experience would suggest caution regarding the average copper content ascertained by drilling of so large a quantity. On a mass lying as steeply as does most of the Utah Copper Company's deposit, the difficulty of restricting steam-shovel mining to the 'commercial ore', keeping out portions of the overburden and of the underlying lower grade material, is also considerable. On the other hand, it is true, as Mr. MacNeill declares, that the Nevada Consolidated has been mining its best and most cheaply available ores, and that costs must necessarily increase as the extension of the workings on Copper Flat involves the removal of a greater thickness of overburden. Mr. MacNeill, however, while calling attention to the cotton-back on the cloth admits the lustrous silken side of the Nevada velvet.

METALLURGICAL methods at Pachuca, Mexico, forms an attractive article by Mr. John M. Nicol, in the February issue of *The Mining Magazine*. The best available metallurgical talent is concentrated upon the problem of silver extraction in Mexico, and every fresh contribution to the subject is eagerly read. Other notable articles in the same number are 'Mineral Resources of Manchuria', by Mr. Thomas T. Read, 'Copper Mining in South-Western Alaska', by Mr. W. M. Brewer, and a clear and helpful word of advice from Mr. W. Truran upon 'Sketching' for the engineer. The department of discussion contains unusually valuable criticism of a technical nature touching problems in gold dredging, the Malm dry-chlorine process, and a note by Mr. John S. MacArthur on the precipitation of gold and silver from solutions. These matters afford Mr. T. A. Rickard opportunity for some illuminating editorial comment. He also reviews in an interesting manner the career of the Guggenheim family, which is remarkable in many ways. There is a particularly well informed editorial on mining in Sonora, and a wise endorsement of the growing practice of including the consulting engineer in the directorate of mining companies. A note on the publicity required of mining companies in England, and the restrictions as well as safeguards of secrecy provided for so-called private companies, will prove suggestive of reforms needed in this country.

Snowslides in the Coeur d'Alene.

Appalling disaster from snowslides has overtaken the mining communities at the headwaters of the Coeur d'Alene river in the Bitterroot mountains of Idaho. The centre of damage was in the narrow gorge of Canyon creek, where the towns of Mace and Burke were destroyed, entailing the loss of more than thirty lives. Among those killed was Mr. R. H. Pascoe, superintendent of the Standard-Mammoth mine, one of the properties of the Federal Lead Company. The damage seems to have been confined to the dwellings of the miners. The mills of the Standard-Mammoth and Hecla mines have apparently escaped, but late dispatches report the destruction of the compressor and other buildings at the Aeolian mine. Avalanches in this precipitous region are of yearly occurrence, and nearly every winter claims its toll of death, but no catastrophe in the past has reached such proportions as that which occurred this week. The most serious accident of the kind was twenty years ago, when the camp at the Custer mine in Nine Mile canyon was swept, extinguishing the lives of seven men. Fifteen years ago a snowslide in Canyon creek, at the Black Bear mine, a few miles below Mace, also killed a number of persons.

Considering the nature of the country such disasters are not surprising. The bottom of the canyon

is so narrow as to barely afford room for the two railroads, the Northern Pacific and the Oregon Railway & Navigation, and a wagon road. This narrow gorge is flanked by lofty hills of quartzite, which disintegrates and forms a loose soil opposing but little resistance to the sliding of accumulated snow. From Mace to Burke exists a steep unbroken face towering 2500 feet above the canyon, and it was here that the avalanche hurled destruction upon the helpless community huddled in the narrow defile below. Recklessness cannot be imputed to those living exposed to such dangers. It is part of the price men have to pay for persistence in industry under difficult conditions. It has led to a sorrowful result, to a regrettable accident in the doing of part of the world's work. Universal sympathy, and such aid as can be rendered, go out to the sufferers.

Geological Survey Methods.

Geology at Globe, Arizona, has been under discussion recently, and we have had the pleasure of presenting, first in articles by Mr. C. F. Tolman, and later in a re-statement by Mr. F. L. Ransome, the latest conclusions regarding that district. There have been slight differences of opinion, and Mr. Ransome has found occasion to correct some earlier conclusions; which as a thorough scientist he was glad to do. For our part we must regret that an error in our editing misled Mr. Ransome in discussing Mr. Tolman's conclusions. However, the point of major interest is not the age of the Schultze granite, but some questions Mr. Tolman raises as to the methods and work of the Geological Survey. Toward the latter the miners and engineers of the West have a strong feeling of loyalty. The relation of the Survey to their work is so close that they have somewhat of a feeling of proprietary interest and have never hesitated to suggest and criticise, feeling that it was 'all in the family'. This is a healthy situation, and we believe the Director and the men of the Survey would not have matters otherwise.

In the West the energies of the Survey have been directed so exclusively to the detailed study of individual districts as to have left relatively untouched many broad fields of investigation which it, alone, can occupy. A magnificent series of monographs and professional papers discussing in great detail individual mining districts has been published. These have been of the greatest service and have been fully appreciated. But where are the corresponding general studies, the accurate comparisons of district with district, the patient following of the vagaries of ore-shoots for example through numerous areas so as to permit valuable comparisons and generalizations? The men of the Survey are excellently prepared to make such studies, but the methods adopted have precluded much being accomplished. There has been an emphasis, if not overemphasis, on detail and on areal work. Even in the latter the policy of microscopic study of small areas has been pursued to such an extent that nearly thirty years after its establishment the Geological Survey still represents on its maps, great areas of the West as wholly unsurveyed. They are left as blank as central Africa before Stanley's time. It is true some general reconnoissance work has been done, such as Mr J. E. Spurr's study of southern Nevada, followed by Mr. S. H. Ball's report on southwestern Nevada and southern California. Many white places none the less remain on the map, and there are large regions within which one has no help from the Geological Survey. When a general study of ore-shoots, vein-walls, metasomatism in veins, classification of ore deposits, or similar subject is desired, it is necessary to go to the writings of non-survey men or to the unofficial publications of members of the Survey. Subjects which we must hold are of importance at least equal to any taken up by the Survey, are neglected or treated as incidental. The bad effects of this are shown in the case of the Globe work in that reconnoissance of neighboring areas being hurried, conclusions regarding the area itself proved in need of revision. This has happened before and will happen again. It is too much to expect or to ask that Survey men should always be right, but it is fair to ask that all proper precautions be taken to avoid mistakes, and one such precaution is the placing of greater emphasis on reconnoissance and on comparisons. It is easy to criticise and hard to administer. The Survey has always been cramped for funds. Like a prosperous university the best measure of its success is that demands upon it outrun its resources. The funds, however, will only be enlarged as a result of insistent demand, and the great expansion of resources and of activities of the Survey in recent years has not carried with it the corresponding increase in work on Western metalliferous deposits that we would like to see. It should be remembered this is the particular class of ores that it was designed to study. We would not have it do less in other directions, but we do urge the need of more broad general studies of Western regions and ore deposits.

Alaska Coal Land Values.

The Alaska coal land situation continues to be thoroughly muddled. Even so well informed a paper as the *Chicago Tribune* says editorially that if the Beveridge bill be passed the Cunningham and similar claims would be extinguished. We have already pointed out that the Cunningham claimants rest on rights believed to have been acquired under existing law. If their rights prove valid they cannot be extinguished except by condemnation and purchase. It may be proper to reserve the Alaskan coal; we believe it is, but this cannot interfere with rights already acquired under the law, and as yet there has been no determination as to whether or not the Cunningham claims are valid.

Mr. J. E. Ballaine has contributed to the gaiety of nations, if not to the solution of the matters in question, by his much advertised offer of '50 cents per ton royalty'. As often happens this single phase of his proposal has caught public attention while other, and more essential elements, are neglected. We would respectfully indicate that there is a string tied to Mr. Ballaine's offer; a string so big as to constitute a veritable steel-wire cable. Among the conditions are that the Government shall guarantee in-

terest on a thousand miles of railroad. It is provided, it is true, that interest shall be paid from the proceeds of the royalties—if the latter are sufficient. If the income from this source prove too small, the general revenue of the Government would be liable. It is further provided that no leases at a less royalty shall be granted, and that the Government shall either buy half its coal from the lessee or establish mines of its own which would necessarily ship over the lessee's railway. Nothing is said as to railway rates. Under these conditions amount of royalty to be paid is of minor importance. A wise man remarked many years ago that he cared not who wrote the nation's laws if he might write its songs. An equally wise coal operator might well profess indifference as to the royalty to be paid, so long as he held the privilege of fixing railway rates. The proposal is not to be taken seriously, and we can only suspect that it was not intended to be so taken. It will be remembered that Mr. Ballaine was concerned in the promotion of the railway north from Seward, and that when only fifty miles was finished he got into difficulties and finally lost his equity in the property. With a Government guarantee of the interest on bonds he might naturally expect to be more successful in a second venture.

Another curiously exaggerated estimate of the value of the Alaskan coalfields has been given prominence of late, and this time from a source most unlikely to make such a mistake. Our Washington corrospondent this week tells the story of the voluntary appearance before a Senate Committee of Mr. Stephen Birch and Mr. J. N. Steele, representing the Morgan-Guggenheim syndicate. We are glad they took this step. It was a courageous and proper means of meeting criticism. A frank avowal of their position, plans, and purposes was made. It was shown that the syndicate includes J. P. Morgan & Company, Daniel Guggenheim, Murray Guggenheim, and S. R. Guggenheim. It controls The Northwestern Commercial Company, The Alaska Steamship Company, The Northwest Fisheries, The Kennecoot Mine Company, The Copper River & Northwestern railway, and the Katalla company. Interest centres mainly in the last two because of the relation of the railway and the Katalla harbor works of the Bering coalfield.

The famous contract with the Cunningham claimants was submitted, and Mr. Birch estimated the net profit in sight to be $200,000,000. This is based upon a value for the coal in the ground of $1.80 per ton and a cost of mining of $1.40. Since the contract provides for the sale of coal to the proposed railway at $1.75 per ton, we think that $1.80 is really the value in the car and not in the ground. We also doubt greatly whether coal can be mined in the Bering river field at an average price of $1.40 per ton. Certainly it costs more than that in Washington and British Columbia where conditions are more favorable. A working profit of 40 cents per ton at the mine does not seem likely, even under the most favorable conditions as to output. As a matter of fact, conditions are not now favorable for a large output of Alaskan coal. Puget Sound coals can certainly be mined and delivered to tidewater as cheaply if not cheaper than can those farther north. There is as yet no adequate evidence that these fields are incapable of supplying the market, and the companies now in the business already have what coal-trade there is on the Coast. By the time local coal is all mined the effect of competition of Eastern coal brought in through the Panama Canal will have to be taken into account. That does not now seem likely to be important, but it is one element in an uncertain situation.

For the present, fuel costs in the Pacific States are fixed by oil production and not by coal. Existing contracts call for delivery in Alaska at 85 cents per barrel; equivalent to coal at $3 per ton. Petroleum is delivered to California coast points at 70 cents per barrel, the charge being made up of 50 cents for the oil and a 20-cent pipe-line charge. From coast-delivery points it can be sent to almost any point of consumption at a further charge of 25 cents per barrel, and at these prices every one concerned is making money rapidly. While the tendency is toward higher prices, there is no question that at even lower rates the industry would be profitable. Oil now is in fact so cheap that only about half the power used around San Francisco Bay comes from the hydro-electric companies, though they sell to the distributing companies at a rate of approximately a half cent per horse-power hour. So long as oil is available in quantity, there will be no big demand on the Pacific Coast for coal.

A most important question is how long the oilfields will continue to respond to the demand. Careful estimates covering this point have been made by a number of well informed oil producers. Neglecting possible discoveries of new oil regions, concerning which many are rightly pessimistic, and taking into account only the districts now producing, with others likely to be found in the same general region, the estimates give a minimum of 30 to 50 years before serious exhaustion need be feared. At present all such estimates are necessarily uncertain, and those given are merely the best available. Remembering that money at 5% compound interest doubles in fifteen years, it will be seen that the present value of Alaskan coal which can probably only be mined and sold advantageously thirty to fifty years in the future, is not large. The conservation of the Alaskan coal itself is one of the matters which need trouble us little. It is the conservation of future public rights in the coal which is important. There is plenty of time to study the situation and reach a satisfactory conclusion. Coal to the amount needed for present development may well be leased on nominal terms, or, if need be, given away—provided the reserves for the future be left free. On the other hand, the problem of the development of Alaska is a present one. Large capital is necessary to carry through railway and other enterprises. Adequate return on this must be assured or the money will not be forthcoming. Public opinion will sanction a liberal policy designed to meet the present wants of the Territory in the line of development. The real popular objection to 'syndicate control' is not to giving adequate returns on present investments, but to mortgaging the future by heavy discounting of profits.

Rock Drill Bits.

Written for the Mining and Scientific Press
By T. H. Proski.

The success of almost every drilling operation depends on the selection and treatment of the bits. Too much attention cannot be given this important part of the work. If the bits have been properly formed, sharpened, and tempered for the work, and if they are changed just as soon as their edges and gauges are worn, the result will be found to be most economical. The power-drill sharpener has removed many of the shortcomings attendant upon the hand-sharpening process, with the result that where these machines are used it is possible to accomplish from 25 to 100% more drilling than under the old methods. The reasons for this are that the power sharpener turns out a much better bit. The saving in the blacksmith's wages should be a secondary consideration. The superior quality of the bits made in a machine will increase the capacity of the drilling machines sufficient to pay handsome dividends on the cost of the power sharpener.

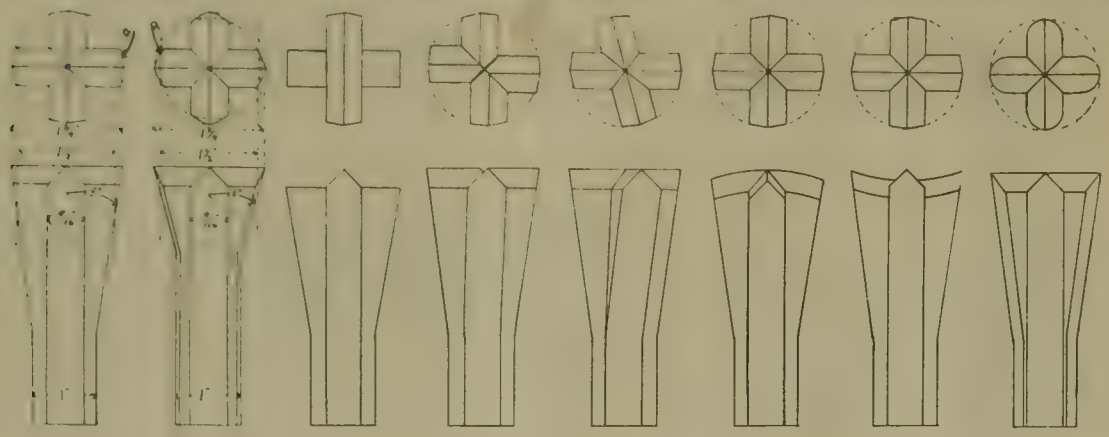


Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7. Fig. 8.

For the guidance of those unfamiliar with the forms of drill-bits used in the different sections, I have prepared a few drawings of those in use. Fig. 1 represents the square cross-bit adopted as the standard for American mining practice. It is made from either round, octagon, or cruciform steel. In the copper mines of Michigan, it is usually made of a round steel. In the iron mines of Michigan and Minnesota and wherever this form of bit is used east of the Rocky Mountains, octagon steel is preferred, but in the Rocky Mountain and Pacific States cruciform steel is used. The reason for the adoption of this form of bit as a standard will be appreciated when the three requirements of a rock-drill bit are recalled. These are, 'to chisel out a hole in the rock', 'to keep this hole round and free from rifles', and 'to mud freely'. There is really a fourth requirement, which is 'to do as much drilling as possible before being re-sharpened'.

The different kinds of rock to be drilled affect the wear of the bit. Very hard rock will blunt the chisel and reaming edges. The softer rocks do not blunt these edges, but wear the outer sides so that it loses its gauge and size, still appearing to be quite sharp. For this reason a bit that is made with a square edge and a clearance angle of 8° will drill about four times as long in soft rock as a bit with round edges and a clearance angle of 16°, before being reduced to the size of the next bit that is to follow. Referring to Fig. 1 and Fig. 2, the latter being a round-edge bit with a clearance angle of 16°, it will be seen that in Fig. 1 the corners of the bit at the base of the bevel describe a circle that is equal to the circle that the chisel edges describe. This is as it should be, as it is impossible for the chisel edge to cut out all of the rock. The reaming edge, which is that part of the bit extending from the chisel edge to the base of the bevel, marked 'A' in both Fig. 1 and Fig. 2, must ream the outer edge of the hole and keep it round and free from rifles. In Fig. 2 it will be noted that the circle described by the corners of the bit at the base of the bevel is much smaller than the circle described by the chisel edges. This causes an excess of wear on the corners of the chisel edges, the bit rapidly loses its gauge, as well as its efficiency, and it is almost impossible to keep the hole round. Rifles form, and these cause the rotation parts of the drilling machine to break, often resulting in the loss of the hole.

The angle of the bevel of the face of the bit has to do with its life as well as with the property of 'mudding' freely. It is generally accepted that if this angle be 90° it gives strength and permits the bit to 'mud' or throw back the cuttings from the face of the bit when the drill is pointed downward. Bits made like Fig. 19 and Fig. 20 will not 'mud' freely. Another reason why bits such as is shown in Fig. 1 are preferable to those illustrated by Fig. 2, is that having a long wing they are stronger and will not break so readily as does a short bit.

The Simmons bit, used at the Champion mine at Beacon, Michigan, is shown in Fig. 3. In it two of the wings are devoted entirely to reaming and keeping the hole round and free from rifles. Some tests made several years ago in jasper, the hardest rock found in the Champion mine, using a 2¾-in. Rand drill with 60-lb. air pressure at the compressor, showed an average speed per minute of 0.28 in. for the ordinary cross-bit, and 0.659 in. for the Simmons bit. Both forms were hand-sharpened.

The Brunton bit, the invention of the well known mining engineer, D. W. Brunton, is extensively used in Idaho and Montana. It is shown in Fig. 4. The object of this bit is to obtain the advantages of the X-bit without the attendant difficulties of re-sharpening. With this bit, as in the case of the X-bit, the piston must revolve a half turn before the cutting edges will strike in the same place a second time. It is as easily re-sharpened as the regular square cross-bit. The X-bit itself is shown in Fig. 5. Since the invention of power-drill sharpening machines, this bit is fast disappearing. The reason will be understood when a comparison is made with the regular square cross-bit, as made with the power-sharpener, and the cross-bits as they are re-sharpened by hand, shown in Fig. 18, Fig. 19, and Fig. 20. The X-bit is designed to prevent rifles. This the hand-sharpened cross-bit would not do, but the machine-sharpened cross-bit effectually accomplishes. Fig. 6 shows what is commonly termed the high-centre bit. This was for many years accepted as the proper form. It is still used in the mines of Cornwall and where Cornish customs prevail. Since the introduction of hammer-drills this bit is again finding favor. It is of especial advantage in starting a hole, the high centre immediately making an impression on the rock, whereas the square-faced bit requires a flat face for ready starting. For a starting bit in hammer machines it has no equal. Here, however, its advantages over the square bit end. Used as a bit to follow the starter, it is liable to follow slips and seams in the rock, causing crooked holes, which are sometimes lost before being finished. This the square bit will not do. Fig. 7 shows a bit where the corners are in advance of the centre. This is a fast cutting bit. The corners break up the rock in advance of the centre and leave little for the centre to do; this causes the corners to wear fast, but still not to excess when it is considered that they do most of the work. This drill will not follow slips and seams, will drill a round hole, and is easy on the drilling machine. The weak point of this form is that the leverage is so great on the corners that they are liable to break off if tempered too hard. Fig. 8 shows the round-edge bit, which is a favorite with some. In soft rock this is good, but in hard rock it permits rifles to form in the hole because there are no reaming edges.

The Y-bit, shown in Fig. 9 gives the advantage of plenty of room for the cuttings to escape. It is, however, quite difficult to make and re-sharpen by hand. With the power-sharpener it can be made as easily as any other form. Fig. 10 shows the 'bull' bit in use in the lead and zinc mines of the Joplin, Missouri, district, before the introduction of the power-sharpener. The extreme hardness of the limestone and flint in the sheet-ground of that district, caused the ordinary cross-bit as made by hand to wear too fast. This dull bull-bit therefore had to be adopted. Drilling here was not a matter of cutting the rock, but of shattering it by impact. The power-sharpener has changed all this, and the American standard cross-bit as made in these machines is now used. As a result the capacity of the drills has been materially increased. In mines where hand-sharpening is still done the bull-bit is yet in use. Fig. 11 shows the Z-bit used in hand-sharpening in the southeast Missouri lead district. This bit is also used quite extensively in Germany. In both places, however, the advantage of the standard square cross-bit as made with the power-sharpener is fast causing it to be displaced. Fig. 12 shows the 'six-wing rosette' bit as made in the power-sharpener in use at the Penarroya mines of Spain. It is used in hammer drills only. Of all the rosette forms of bit this has been found to be the most satisfactory. Fig. 13 shows the square cross-bits when made up for hammer drills where a hole for the introduction of air or water to remove the cuttings apexes at a point back from the bevel of the bit in one of the recesses between the wings. Fig. 14 shows the same form where the hole ends in the centre of the cross of the cutting edges. This form of bit is extensively used. Its faults are that a core is formed by this hole; this core fills the hole, and causes a stoppage of air or water. These cores have been known to become as much as 8 in. long, and are quite difficult to remove. To clear them away the core must be burned out by heating the steel the full length of the core in a slow fire; a sometimes slow and tedious process. This difficulty is entirely overcome by the use of the bit shown in Fig. 13. The Z-bit, Fig. 15, is extensively used in Germany. In hammer drilling machines, the steel is formed in bars having a Z shape. While I show this bar straight, it is usually twisted to form a spiral.

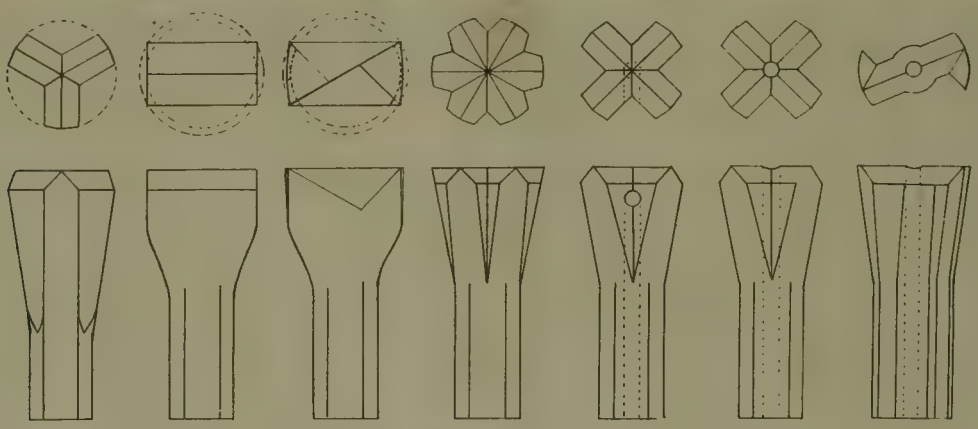


Fig. 9. Fig. 10. Fig. 11. Fig. 12. Fig. 13. Fig. 14. Fig. 15.

It is an easy matter to form a Z-bit on the end of such a bar. The results obtained are excellent. Holes to a depth of 16 ft. horizontal have been drilled with this form of steel. The spiral draws out the cuttings much the same as an auger. Fig. 16 to Fig. 20 are given to show the evolution of the cross-bit where hand sharpening is employed. There are two systems of hand-sharpening. One is known as the set-hammer system. In it the steel is hammered by placing a set-hammer on the bevels and driving the steel back. The results of this method are illustrated in Fig. 16 to Fig. 19. Fig. 16 shows a bit made by cutting the bevels with a chisel and is as it should be in form. Fig. 17 shows this bit after about the third sharpening. Fig. 18 is the same bit after about the sixth sharpening, and Fig. 19 is the same bit at about the time that the original cross that was formed on the bar of octagon steel has become exhausted. The other system of hand-sharpening is known as the fuller and dollie system. By this system the stock is first drawn sharp at the corners as shown in Fig. 20 with the fuller, after which it should be set back in the centre with the dollie. Unfortunately the man swinging the sledge hammer gets tired before the bit is set back enough, the result is that the bit, partly finished, is left as shown in Fig. 20. It is because the power-sharpener has the staying power, and because it readily finishes a bit perfectly, that inferior bits like these are not to be found where machine sharpening is employed.

Fig. 16. Fig. 17. Fig. 18. Fig. 19. Fig. 20.

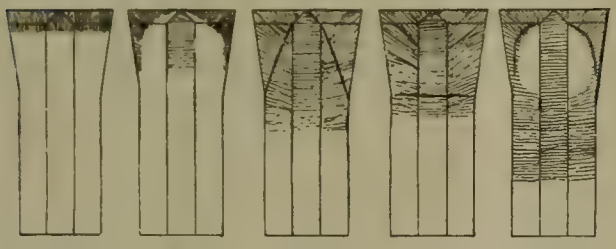


Fig. 21. Fig. 22. Fig. 23. Fig. 24. Fig. 25.

After a bit has been forged, it should be properly tempered as in Fig. 21. Fig. 22 shows the result of the common method of tempering. The centre of the bit is soft, while the corners are hard. When the bit is immersed in the water about an inch the large mass of metal in the centre cools more slowly than the corners since the corners have three sides exposed to the water. Perhaps the centre had not chilled at all when the bit is withdrawn for annealing, and the final result is a soft-centre bit, which will flatten and retard the work of drilling. Fig. 23 and Fig. 24 show the result of trying to temper the bit with the forging heat, by plunging the whole bit into the water as soon as it is sharpened. The line of tension induced by cooling is indicated. At this place the drill will break. Fig. 25 shows the checking caused by first chilling the steel back of the bit and then plunging with the forging heat.

For the purpose of tempering a bit as shown in Fig. 21 a tank should be provided, such as shown in section in Fig. 26. This should be about 12 in. deep by 12 wide, and of sufficient length to accommodate whatever number of drills are to be sharpened in a day with the machine. The water inlet should be at the bottom, and the outlet should be placed about $^3/_4$ in. above a grate which itself should be about 8 in. above the bottom. This permits the bit to be immersed to a depth of about $^3/_4$ in. With a temperating tank of this construction the bit can be hardened to any desired degree. This depends on the temperature of the bit when placed on the grate. It is essential that the drill stand in a vertical position. To lean either way would cause it to harden to a greater depth on one side than on the other, causing a tension that might lead to breaking of the wings. It is best to provide a rail around the tank about the distance above required to hold the shortest drill, and to drive pins about 3 in. apart in this rail. By placing the drills between these pegs they can be kept in a vertical position. When using this tank a small flow sufficient to displace the water heated by the cooling of the bits should be turned on to keep the supply always cool.

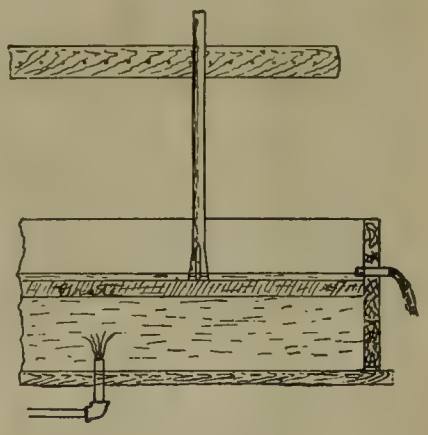


Fig. 26.

Tests are being made at the Pittsburg station of the U. S. Geological Survey of all types of lamps used for lighting purposes within mines with respect to their safety in the presence of explosive mixtures of coal gas and air. The candle-power of all safety lamps is determined for different kinds of oil used in mines, and electric portable lamps are also being tested in like manner as to their candle-power and their safety in explosive mixtures of gar and air. The tests are made in currents of air running at different velocities and charged with explosive gas.

The Cebu coalfields have been known for some time, but have remained undeveloped. The prospect for development of the deposits of Danao are brighter now than at any previous time. The necessary capital has been pledged to make the enterprise a success. The coal is of good quality and has been used successfully by inter-island steamers.

Piz-Piz District, Nicaragua.

Written for the MINING AND SCIENTIFIC PRESS
By W. A. CONNELLY.

The Piz-Piz gold mining district is in northern Nicaragua, about seventy-five miles in a direct line from the Atlantic coast, lat. 14°N., long. 84°30′W. The district is reached from the United States by steamers of the Bluefields S. S. Co., which runs a boat twice each month to Cape Gracias á Dios, a port at the mouth of the Coco or Wanks river, and four or more boats to Bluefields, a port farther south. From Bluefields it is necessary to take a coasting schooner to Principulca at the mouth of a river of the same name, thence by batteau up the Principulca and Banbana rivers to Tunkey, a small town near the head of navigation on the Banbana. This town is 20 miles distant from the mines, and the trip must be made on mule-back.

The Cape Gracias route is the one most generally used, as there is a commodious river steamer

Map of Nicaragua.

plying weekly from the port to the mouth of the Waspuc river, a distance by windings of the river of about 200 miles. From the mouth of the Waspuc to the mines, by the Waspuc and Piz-Piz rivers, freight is carried in batteaux, poled or paddled by Mosquito or Sumu Indians. These boats carry from 5000 to 8000 lb. of freight and the crew. Power-boats are not feasible above Ya-hook falls, in the Waspuc river, as there are numerous rapids and three or four portages.

The trip from New Orleans to the mines usually requires from 12 to 15 days, divided as follows: New Orleans to Cape Gracias five days; at the Cape one day; two days on river steamer to Waspuc; and four to five days from Waspuc to the mines. The expense of the trip is about $100, and to one fond of water travel it is extremely pleasant. This section of the country needs a railroad badly. There are two possible short routes, both in conjunction with river transportation. From the Waspuc, the head of steam navigation on the Wanks, about 60 miles of road would suffice to reach the mines. The country through which this road would pass is fertile and could be made to produce great quantities of bananas and tropical fruits, besides being a fine natural grazing country. The road would enter the gold belt within 15 miles above the mouth of the Waspuc.

The other route from Walpatara rapids on the Banbana river would have a length of about 30 miles, would enter the gold belt at once, and would serve the mines below Tunkey, as well as the Piz-Piz district. A narrow-gauge road could be built and equipped, in a modest way, for about $5000 per mile. A future for a road could be had by extending it through Jinotega and Matagalpa to Corinto on the Pacific coast. The climate of this part of Nicaragua is tropical, the temperature in the daytime being about 80°F. and at night about 75. There are two seasons, wet and dry. The wet season begins usually about June 15, with heavy rains till about September 15, lighter rains till December, then continuing heavy again till January or February. There is never a shortage of water for milling. The whole country is densely covered with tropical vegetation, including a good supply of hard-wood for mining and building purposes. Tropical fruits and vegetables grow in great abundance the year round, some of the most useful being banana, plantain, casava or yuca, sweet potatoes, yams, limes, citronella, oranges, papaya, and pineapples. Mexican beans and corn are raised by native farmers; many of the common northern vegetables are being successfully cultivated at the mines.

The mines are situated on the southeasterly slope of a prominent range of hills which forms one of the main water-sheds of the Republic. This range of hills, beginning not far from Cape Gracias, extends in a general southwesterly direction several hundred miles into the interior of the Republic, traversing its widest part, then westward to the Pacific coast. The water of the northeastern slope flows to the Wanks, and thence to the Carribean sea; the opposite slope is drained by a number of large short rivers to the Lake of Nicaragua and the Carribean sea. The general elevation of the district is about 1000 ft., with hills as high as 1800 to 2000 ft. above sea-level.

No work has been done by the Government in geological investigation, and little is actually known of the geology. Vegetation covers the whole country, and the excessive rainfall has caused great weathering and erosion, so the hills are invariably rounded, and the surface is a red clay. The country rock of the Piz-Piz district is a flow or succession of flows of andesite, much fractured and highly altered near the surface. The alteration, as shown at the mines, extends to a depth of 150 to 200 ft., making early development easy.

The vein systems have a strike about N.52°E., and a dip of about 70°N.W. Most of the smaller veins follow closely the strike and dip of the so-called 'mother lode'. This mother lode has been traced, and considerably developed, along a distance of 20 miles, and is thought to extend much farther. It is a true fissured zone, 25 to 75 ft. thick, having a quartz-iron filling, much weathered to a depth of 100 ft. or so. The surface has been eroded, and the finer particles washed away, leaving a *manta* of concentrated ore wider than the vein and somewhat richer.

The gangue has weathered more slowly than the enclosing country rock, thus leaving the vein exposed in a plainly visible outcrop along its length. This vein has large bodies of ore with an average assay value above $6 per ton, which are being quarried or worked by 'glory holes'. Near by, on either side of the great vein, are smaller ones, from 3 to 20 ft. thick, being either branched or parallel veins, with the same filling, but with more iron. The ore in these smaller veins is much higher in grade and the gold is of greater fineness. There are many large well defined veins in the surrounding country of which little more than their existence is known.

Gold was discovered about 20 years ago in the creeks of this district, and soon after the veins furnishing the gold were discovered and denounced. The working mines today, with their equipment, are as follows: Bonanza, Joe Lapierre owner, eight 3½-ft. Huntington mills, sand leaching plant, and decantation slime-plant, hydro-electric power plant; Lone Star, Norman McInness and William Bluett, owners, thirty 750-lb. stamps, sand leaching plant, water-power; Mars, S. B. Sherrick and Charles Lobner, owners, two 3½-ft. Huntington mills, hydro-electric power plant; Siempre Viva, Bluefields and New Orleans company, owners, twenty 650-lb. stamps, sand leaching plant, hydro-electric power plant, generating 300 kw.; Constancia, New York company, owners, ten 850-lb. stamps, water and electric power, buying power from Siempre Viva; Concordia, Paul Rener, owner, ten 750-lb. stamps and log-washer, electric power from Siempre Viva; Trinidad, Richard Lehmann, owner, five 750-lb. stamps working the extension of the Siempre Viva vein east, using electric power from the Siempre Viva.

The Bonanza is working a deposit or *manta* averaging about $6.40 per ton, and owing to the ease with which it can be mined, the working cost is low. The Lone Star and Mars are milling ore from the 'mother lode', mining it by open pit or mill-hole. Concordia and Siempre Viva are using ore from a large vein paralleling the main lode, and mining through adits, no pumping nor hoisting being done. Constancia is taking ore from two smaller side veins and from the main lode, the latter by open pit and the former through a shaft by a small electric hoist.

Besides the above named mines several new properties are doing well, with only 3 stamps and other prospecting mills. The output of the district is about $550,000 per year.

Up to the present time only ore from a comparatively shallow depth has been used, and with the existing milling plants there is enough ore of the same character to last for many years. Just what the ore will be like in depth is not known, but in the deepest levels run on some of the mines, sulphides in small quantities have been found. These sulphides are iron pyrite, chalcopyrite, zinc blende, and galena with some pyromorphite and anglesite. When the completely oxidized ores have been exhausted it will likely require a different treatment than is now applied.

This district is supposed to be inside the boundaries of the mining concession, held by a few Pittsburg men, under the name of the U. S. & Nicaragua Co. This company has played the dog in-manger for eight years. Their boundary lines have never been drawn, nor have they done any exploration worth mentioning, nor built one milling plant. This means that a magnificent mining territory 25 miles wide, reaching nearly across the Republic, has been withdrawn from entry, and that there is absolutely no use being made of it. It is hoped that this concession will be cancelled and that the Piz-Piz district will be allowed to resume the rapid growth checked so suddenly eight years ago by this useless monopoly.

The power possibilities are splendid. The upper Piz-Piz falls, owned by the Siempre Viva mine, are thought to be able to generate 2500 hp. The lower falls, owned jointly by the Mars mine and the Concession, will generate twice that amount. The Bonanza mine has a 100-kw. plant now, with a possibility of increasing it greatly. The Lone Star has water-power sufficient for 500 hp., provided a hydro-electric plant were installed at its falls. The United States & Nicaragua Co. hold all the lower falls on the Piz-Piz except 200 hp. owned by the Mars mine, and it lays claim to all others not now in use.

Labor, consisting of Spanish, Mosquito and Sumu Indians, and Grand Cayman Creoles, is plentiful and cheap. Miners receive 2.5 *soles*, muckers 1.5, car-men 2, timber-men 3 to 4. Creole amalgamators get 4 to 5 *soles* and mine foremen the same. The shift in the mine and all other work except in the mill is 9 hr., and the men are paid in silver, the *sol* being the unit. The value of the *sol* fluctuates with the price of silver. It has been worth 40c. gold for almost a year past. All men are fed by the mine owners. The rations are about as follows: wheat-flour bread once or twice per day; plantain, boiled, when bread is not given; beef is bought twice each week; beans, rice, and coffee with sugar.

Owing to a high tariff all foreign foodstuff is expensive. Beef is killed under a concession; sugar is made by a monopoly; salt pays tribute to a concession; also dynamite, caps, and fuse. The mines now drag or carry their freight from a landing on the Piz-Piz river, a solid mortar weighing 5000 lb. being the limit of weight, which can be handled by this method. Mining machinery is admitted free of duty. There is an export duty on gold of 50c. per fine ounce, with a penalty of 50% if said duty be not paid in certain bonds issued by the Government. As these bonds were promptly subscribed for by parties in Managua, tipped off by the Government, the mines pay the penalty. The total expense per ounce is about $1, in fact one large business company charges $1.08 per bar-ounce, all charges included except those made by the Mint in New Orleans. The gold as shipped from the mines is worth from $12.50 to $16 per ounce, the higher value being for gold from the smaller veins. The pertenencia is the unit for denouncement, and is 5 hectares or 12.36 acres, and the locator has the right to the minerals within the vertical side-lines. *Planteles* or wood and water-right are granted owners of mineral rights. Taxes are 5 *soles* per hectare on mining claims and 2.5 *soles* per hectare on *planteles*, payable between January 1 and 31 of each year, and if not paid within such time, double the amount will be collected.

Pony Dredges in Alaska.

Written for the MINING AND SCIENTIFIC PRESS
By WILLIAM H. WASHBURN.

Although the field of profitable placer mining has been much enlarged by the modern dredge and the hydraulic elevator, there is still a large area of placer ground not adapted to their use, or to the primitive method of shoveling into sluice-boxes. The bedrock may be too hard, the boulders too large, or the ground too shallow, to warrant the construction of a dredge, of standard size at least. A lack of cheap water with sufficient head, or the difficulty of ground so shallow as to cause a too frequent moving of the plant, limits the field of the hydraulic elevator. The mechanical elevator obviates the first difficulty, although not the last. In Nome and Council districts, Alaska, this is the case as to much of the placer ground there yet unworked, outside of that adapted to dredging. The high cost of labor in that region seems to make it a promising field for the introduction of labor-saving machinery to work ground such as that above mentioned. Much of it contains enough gold to barely pay expenses when worked by shoveling into sluice-boxes. The small floating dredge, of the ladder type, with a capacity of 500 to 1000 cu. yd. per 24 hr., generally called a pony-dredge, is probably best adapted to this class of work, where the conditions will permit of its use; and it is indeed coming into favor in that country in ground adapted to its successful operation. Several pony-dredges, originally built on wheels, have been there changed to the floating type with improved results. Still much of this ground is not suitable for even the floating pony-dredge on account of the hard bedrock, large boulders, and shallow ground. Sometimes the bedrock is blocky and full of crevices, into which the gold finds its way, and from which it can only be removed by much work. This calls for an exposed bedrock, so that it can be cleaned up. Sometimes the gravel contains boulders so large as to seriously interfere with the work of a pony-dredge, and to cause danger of breakage. If the operator can see these boulders he can dig around them until they can be moved out of the way of the buckets. When driven to work with a so-called 'dry bedrock' (though it is never really dry, unless perhaps on a bench), the problem becomes much more complicated, and necessarily more expensive than when a floating dredge can be used. The pit is usually unwatered by a drain ditch, or pump. The first may have to be 1000 or 1500 ft. long, in order to gain the creek-level, which makes it expensive, and besides there is always danger of floods choking, or perhaps totally destroying it. The pump may have the advantage of lower first cost, but the expense of power and attendance is generally a large item.

Pony Dredge on Wheels, Ophir Creek.

Even then it becomes troublesome to keep the tailing water out of the pit as the work advances. This is really one of the greatest obstacles to the use of mechanical excavation for this class of work.

Another troublesome problem is to arrange a washing plant, having the capacity, and at the same time adaptability, for washing the gravel, and for keeping within reach of the excavator as it advances with the work. If the sluice-boxes are set up permanently, they are soon too far from the fall of the cut, and the tailing piles up at the tailing sluice, compelling their removal.

A brief review of the different plans tried for adapting machinery to this work will here be attempted. The steam-shovel has been tried from one end of Alaska to the other, and yet it has generally not run over two seasons in any one place. Its efficiency as an excavator is well known and acknowledged. The difficulty seems to be that in some cases it will not elevate the gravel high enough to allow sufficient dump for the tailing, and in nearly every case it will dig more gravel than the washing

plant can take care of and keep within reach of it without frequent stops. If some genius can devise a way to wash the gravel as fast as the steam-shovel can dig it and do it cheap enough and keep the pit dry at the same time, the problem would evidently be solved.

The nearest approach to this that I know of is on Shovel creek in the Solomon River district. This steam-shovel is of the new turn-table type, mounted on wheels, on a track of heavy rails, the washing plant following behind it on the same track. This plant consists of a shaking screen over the head-box of a string of ordinary sluice-boxes, on trestles, mounted on trucks, on the steam-shovel track. The oversize from the screen is carried out at right angles to the sluice by a short elevator, and dumped into the pit, which is kept free from water by a drain-ditch. The tailing is kept out of it by a retaining wall of boulders, which is advanced from time to time as the work progresses. The bedrock is generally a hard blocky limestone, full of crevices, and yet I am informed that by careful manipulation the shovel will dig it up enough so that it does not pay to clean the bedrock by hand. It has been operating during the past two seasons with profit. Steam-scrapers have been tried, and found wanting. The power consumed, the wear and tear of plant, and the limitations of height to which it will deliver the gravel, seem to be the principal objections to its use. Some small plants are still in use in placer-work, but they do not seem completely to meet the conditions as to cost of operating and capacity required. In neither of these lines do they equal the steam-shovel. A derrick-hoist on Ophir creek has handled a large amount of gravel during the past two seasons, and seems to have a place in the field where the gravel must be lifted high, and a more expensive plant is not warranted by the gravel in sight.

The derrick mast is slightly inclined toward the sluice-box, so that, as the loaded bucket is hoisted, it and the boom swing toward the sluice where it is dumped into the head box by a man stationed there for that purpose. The boom is then pulled back by another man, stationed on the bank of the pit, with a pull-rope, and the bucket lowered upon one of a number of small trucks running on tracks radiating toward the face of the pit, where the buckets are filled by hand. When a new pit is to be started a duplicate line of sluice-boxes is set up, before finishing the work in the pit, leaving only the derrick and hoisting engine, cars, buckets, and tracks to be moved to begin the new pit. The cars are not, however, necessary at the start. The tailing from this pit is dumped into the one just finished, and a wall of gravel left in place between them to keep the tailing-water out. When the pit is nearly done, this wall is removed; the tailing-pile which has in the meantime accumulated, answering for a dam in its place. This device allows the ground to be worked neatly, and hoists the gravel to almost any height desired, with economy and despatch; but the buckets being filled by hand-work makes that part of the system expensive, and is only to be recommended where the special conditions seem adapted to it, such as a limited amount of gravel, and where the sluices must be at a considerable height above the bedrock. It really does not cheapen the work much, as regards the digging, which is the part which most of all requires to be lessened in cost.

Derrick and Sluices on Ophir Creek.

On the same creek, a pony-dredge of the turn-table type, on wheels on a track has been operated with apparent success during the past season. This machine is a ladder-dredge, having buckets of 2 cu. ft. capacity, which drop 24 times per minute; which, by the way, is faster than would be practical under the same conditions if it were afloat. The face of the cut being in sight, the boulders are avoided. This permits a faster speed for the buckets. The dredge is driven by a 35-hp. Western gasoline engine. The gravel is dropped on a screen, from which the over-

size is carried by a belt-stacker, extending behind the dredge, and from it is dropped into the pit. The undersize is passed through four lines of sluice-boxes, each 18 in. wide by 24 ft. long, lined with angle-iron riffles, and set on a grade of 1¼ in. to the foot. This is equivalent to one sluice 72 in. wide by 24 ft. long. These sluices are on the dredge, the plant being self contained. The tailing and water from the sluices are taken up by a 5-in. centrifugal pump, and forced through a 6-in. pipe, 60 ft. long at right angles to the dredge, where it is dropped outside the pit, and about 15 ft. above the pump, the tailing water being conducted away from the pit to the creek bottom.

The pit is drained of seepage water by a ditch extending along one side, the ditch having been excavated by the dredge. The bucket-ladder has a swing of 48 ft., and the dredge is advanced about 4½ ft. at a time. The track is laid with 60-lb. rails. Water is supplied from a ditch through a pipe-line ending in a flexible hose to allow for the swing of the dredge. The average depth of the ground is about 12 ft. There are a few boulders in it, too large for the buckets to handle, but these being visible, the gravel is dug from around them, and they are then moved out of the way of the buckets. This allows a faster bucket-speed without increasing the danger of breakage, and there is also a saving of power in avoiding useless bucking up against the boulders, as would be sometimes unavoidable if under water. The bedrock is taken up by the dredge deep enough to make cleaning by hand unnecessary. The capacity of the dredge is about 500 cu. yd. per 24 hr. It is run by two men on the dredge (one of whom is a capable machinist), and two men in the pit attending to track and other details. The machinist is the only skilled man required in the crew.

This machine being self contained, and delivering the tailing outside the pit, seems to have considerable merit. In this case, however, the bedrock being soft enough to be taken up by the dredge, the only reason for mounting it on wheels appears to be the few boulders in the gravel that are too large for the buckets to handle. I venture the opinion, however, that the advantages of the floating type of dredge would, in this particular case, more than make up for the drawbacks which the boulders entail. If the bedrock had to be cleaned by hand the case would be different, and the dredge on wheels would be more suitable for the work.

In conclusion, taking into account the concensus of opinion of those who have used the different types of machines above described, I believe that while the steam-shovel is a good digger, the separate washing plant it requires, causing additional expense and delays in moving it, makes it difficult to adapt it to this class of work. The steam-scraper consumes too much power per cubic yard, and unless the ground is shallow it does not allow sufficient head to take care of the tailing.

The floating dredge, of a capacity governed by the amount of ground available, seems to be the machine which will excavate and wash the gravel cheaper than any of the other appliances described, but the bedrock and boulders must be taken into account before its installation.

Yerington Copper District.

By F. L. Ransome.

*The town of Yerington is in Lyon county, in that part of western Nevada which lies between Tahoe and Walker lakes. (See Fig. 1.) The nearest railway station is Wabuska, 12 miles to the north, on the Hazen-Mina branch of the Southern Pacific. The town lies in the middle of Mason valley, through which Walker river flows. The principal mines are in the mountain ridge west of town, of which the Indian name is said to be Singatse,[1] but which J. E. Spurr[2] has called the Smith Valley range.

The geology of the region adjacent to Yerington received little attention from the earlier explorers. The only publication according it more than incidental reference is the paper by D. T. Smith, already mentioned, which is accompanied by a geologic map based on the topography of parts of the Wabuska and Wellington atlas sheets of the United States Geological Survey. The rocks in the Yerington district are readily divisible into two groups markedly different in age and structure. The older group consists of schist and limestone with intrusive masses of granodiorite, or quartz monzonite, and related porphyries. This assemblage of rocks was called by Smith the 'bedrock complex', a name which it is not desirable to perpetuate, and which will doubtless be replaced when detailed geologic work is undertaken. The granodioritic or monzonitic rocks were by him designated 'granite', 'granite porphyry', and 'porphyrite', although his own petrographic descriptions appear hardly to suggest these names. The younger group, called by Smith the 'superjacent series', is of volcanic origin and rests with obvious unconformity upon the older complex. It may in turn be divided into two parts, namely, (1) a series of rhyolitic flows and tuffs, bedded volcanic grits, andesitic tuff, and andesitic breccia, and (2) an unconformably overlying flow of basalt.

The schist, which is the prevailing rock in the canyon heading near the McConnell mine, is cut by many irregular dikes of granodiorite or granodiorite porphyry and is in places stained by salts of copper. On both slopes of Singatse ridge masses of limestone are intricately enfolded with the schist. Some of the limestone is a pure gray crystalline variety which is not noticeably metamorphosed and in which the bedding is distinct. Other parts of the formation, however, are intensely metamorphosed. The relation between the limestone and the andesitic schist is so intimate as to leave little doubt that a series consisting originally of andesitic rocks, limestones, and perhaps some tuffs and shaly sediments has been folded, squeezed, and mineralogically changed at the same period and by the same set of metamorphic processes. The cause of the metamorphism was the

*Abstract from 'Contributions to Economic Geology, 1908'. U. S. Geol. Surv., Bull. 380.

[1]Smith, D. T. 'Geology of the Upper Region of the Main Walker River, Nevada'. Bull. Dept. Geol. Univ. Cal., 4, 1904, pp. 1-32. The name is printed Sing-ats-e in this paper.

[2]'Geology of Nevada South of the Fortieth Parallel'. Bull. U. S. Geol. Surv. 208, 1903, p. 117.

intrusion of the granodiorite and closely related porphyries.

From Mickey Pass (see Fig. 1) southward to the latitude of the Western Nevada mine the granodiorite occupies in general that part of the ridge which lies between the summit and the eastern belt of limestone. South of the Western Nevada mine the granodiorite appears to make up a larger part of the ridge, and at the south edge of the area included on the map this rock extends practically to the river. The granodiorite of Singatse ridge is a rock of general granitic appearance and for the most part of evenly granular texture. The low hills north of Mason Pass and along the road from the pass to Yerington are composed mainly of granodiorite porphyry, which is generally more or less altered. This rock is stained with copper salts in many places, particularly about

capped by olivine basalt. These remnants occur at various elevations, ranging from 4500 to 6500 ft. They rest generally on the granodiorite, schist, or limestone, and this fact suggests that the older Tertiary rocks were deformed and much eroded before the basaltic eruptions began. Although the basalt has probably been faulted, and in places may have been gently tilted, it nowhere shows dips as high as those of the rhyolitic and andesitic rocks.

The general distribution of the important mines and prospects near Yerington may be seen from Fig. 1. One group, the members of which are similiar in the character and geologic relations of their ore-bodies, lies on the east slope of Singatse ridge southwest of Yerington, about halfway from valley to crest. Together they constitute a chain two miles in length, the mines from north to south being the Blue-

Fig. 1. Map of Yerington District. A-A' Line of Cross-Section.

1½ miles west of the town, where an attempt was made some years ago to mine and smelt the copper-stained porphyry. The prevailing rock of the hills which contain the Blue Jay, Yerington, and other mines southeast of Yerington, is granodiorite, or quartz monzonite, similar in texture to that of Singatse ridge, but generally fresher and darker. That not all of the granodiorite and granodiorite porphyry was intruded simultaneously is clearly shown in the hills southeast of Yerington, where the main mass of granodiorite is cut by porphyry dikes of similar chemical and mineralogical character.

The Tertiary lavas and associated sediments are younger than the ores. Their general relations to the older rocks and to the structure of the ridge is illustrated in Fig. 2, which is partly diagrammatic and makes no pretense to refined accuracy. Rhyolite makes up a large part of Singatse ridge north of Mickey Pass. South of the McConnell mine several of the spurs and summits of Singatse ridge are

stone, Mason Valley, Malachite, McConnell, and Western Nevada. Most of these mines have shipped some oxidized copper ore, but operations at present are confined to development in the sulphide zone or, at the Mason Valley mine, in a zone of mixed oxidized and sulphide ore. These mines are from four to eight miles from Yerington by wagon-road. The history of all goes back thirty years or more, but none has produced abundantly or continuously. At the western foot of Singatse ridge are the Nevada-Douglas and Ludwig mines, now under one ownership, the Nevada-Douglas Co. having bought the Ludwig in 1907 for about $500,000. By the direct but steep road over the ridge past the Bluestone mine the distance from Yerington to these mines is about seven miles. The Mason Pass road from town to the Ludwig mine is about twice as long, but is much used because of its better gradient. Both the Nevada-Douglas and Ludwig are old mines and have intermittently produced considerable ore; how much is

not known. The Ludwig ore has of late been hauled by a traction engine to Wabuska. About a mile north of Mason Pass (see Fig. 1) and nine miles northwest of Yerington by road, are the upper and lower workings of the Intervalley mine. These are shallow prospects which were never productive and are now idle. Buckskin, about 4½ miles west-northwest of the Ludwig mine, is a prospecting camp, in the vicinity of which some shallow exploration is in progress. Another group of prospects lies in the low hills from four to five miles southeast of Yerington. Among these the Blue Jay, with a 450-ft. shaft, and the Yerington, 412 ft. deep, are the most important. The latter only was in operation in 1908. A mile east of the Blue Jay is the Bradley, about 100 ft. deep, and a mile south of this mine is the Black Rock, with still less development. No work was in progress at either place at the time of visit.

The copper deposits near Yerington are of three kinds—(1) irregular bodies formed by metasomatic replacement of limestone and genetically associated with metamorphism of a kind usually attributed to the contact action of intrusive rock, (2) metasomatic vein deposits in altered limestone, and (3) metasomatic vein deposits in granodiorite.

The deposits of the first class are exemplified by those of the Bluestone, Mason Valley, Malachite, McConnell, Western Nevada, and Nevada-Douglas mines. The original sulphides of these ores are pyrite and chalcopyrite in various proportions. The gangue minerals are pyroxene, amphibole, epidote, garnet, and calcite. The proportions of these also vary widely in different deposits. The tenor of these primary ores is generally low; probably no masses of large size average over 3% in copper. The largest and richest body of such ore that has been at all satisfactorily blocked out is that of the Bluestone mine, which is about 300 ft. long and of approximately the same width and depth. The oxidation of these orebodies has not been extensive and appears to have penetrated deepest in the Mason Valley mine. There has been no important enrichment through the deposition of chalcocite or other secondary sulphides, though some of the oxidized ore is of high grade. Although these deposits are of a character usually associated with contact metamorphism they are not closely related to igneous contacts. Those nearest the granodiorite owe their present proximity to that rock to faulting. Consequently they cannot be regarded as typical contact-metamorphic deposits, although they are believed to belong in that general class and to be genetically connected with the granodioritic intrusion.

The only important deposit of the second class is the Ludwig orebody, in which the vein is composed mainly of coarsely crystalline calcite carrying some garnet with pyrite and chalcopyrite. Oxidation in this deposit has extended to a depth of about 500 ft. and has produced ore of shipping grade. At the base of the oxidized zone there has been some chalcocitic enrichment. The occurrence of garnet in the vein material links this deposit with those of the first group, but the fissuring and veining probably took place after the limestone had been considerably metamorphosed.

The deposits of the third class include those of the Intervalley, Blue Jay, Yerington, Bradley, and Black Rock mines or prospects. They are characterized by the development of pyrite with subordinate chalcopyrite in granodiorite or monzonite along zones of fissuring. In two of them, the Intervalley and Black Rock, there has been some filling of open spaces, but in the others the sulphides have developed within the rock alongside the narrow fissures that served as channels for the depositing solutions. No thorough study of the action of these solutions on the wall-rock has been made. The deposits, however, are believed to represent a stage of mineralization later than those in which the deposits of the first and second classes were formed. The economic importance of the deposits of the third class is as yet unproved.

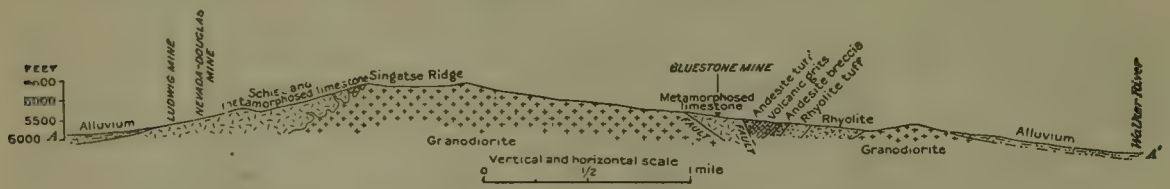


Fig. 2. Generalized Geologic Section Across Singatse Ridge Along Line A-A'.

The total quantity of oxidized ore exposed in the district is small and there is no indication of any extensive sulphide enrichment. The quantity of gold or silver in the ores is practically negligible. The future of the mines depends on the working of low-grade primary deposits. The conditions are in some respects favorable for cheap mining and concentrating; a railroad could be constructed from Wabuska along Walker river with little difficulty, water is more plentiful than in most other parts of Nevada, and many agricultural products can be grown in Mason valley. On the other hand, water, tailing, and smelting fumes are subjects concerning which miners and farmers usually find agreement difficult.

Gas-producer plants, according to R. H. Fernald, as a whole are giving remarkable satisfaction in view of the brief period of development. The most serious difficulty seems to arise from the lack of competent operators to run the plants, though there are many more competent operators today than three years ago. The situation regarding misrepresentations and misunderstandings resulting from incompetent salesmen has with the stronger companies greatly improved, and there is less trouble due to manufacturers neglecting plants that have been installed and paid for. The situation has changed decidedly for the better within the last few years.

Grinding Tests at Pachuca.

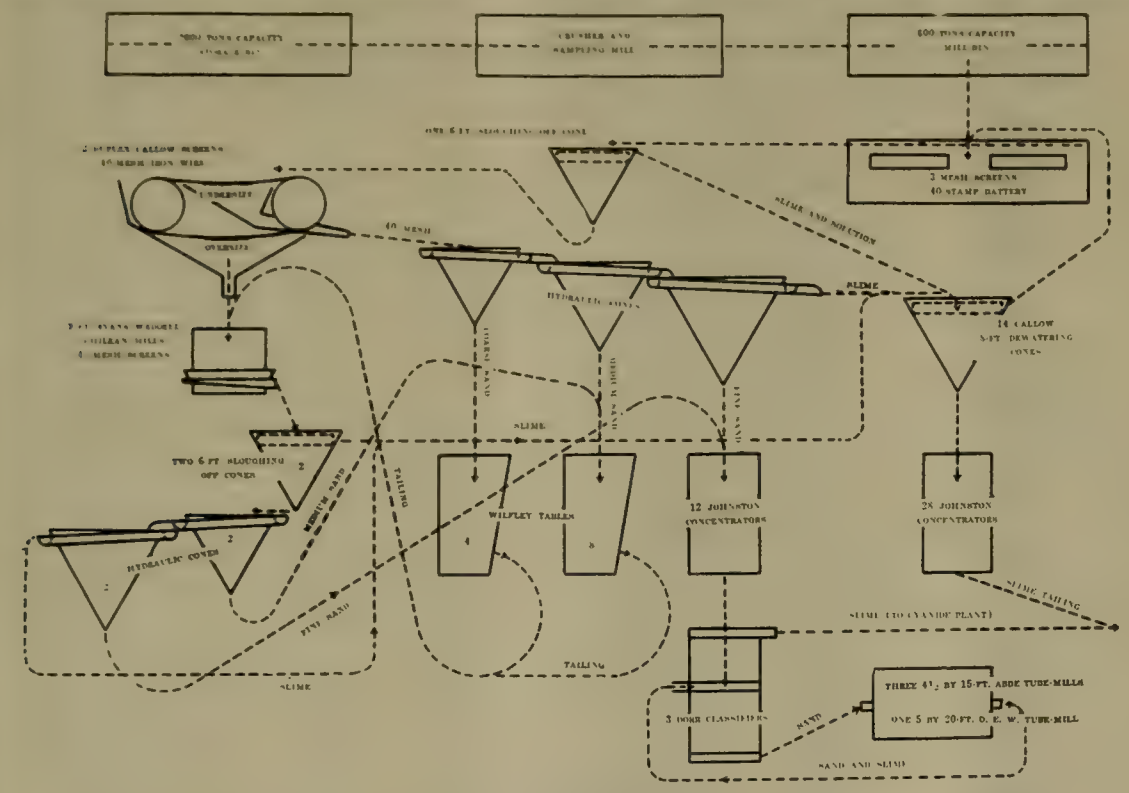
By V. B. Stuardo

*In the past year a great deal of investigation has been done at the Guerrero mill, Pachuca, particularly in the direction of pulp classification and in ascertaining the efficiency of tube-mill work under varying conditions, and I have prepared the following notes in the hope that they will serve to illustrate some of the features of importance disclosed in these investigations.

The flow-sheet illustrates clearly the sequence of the various operations and is self-explanatory.

three Wilfley tables, which really receive as feed a product that has once been concentrated by the Callow screens and once by the hydraulic cones following these.

Another feature of interest to concentrator men, is the analysis of the product of the Chilean mills, 4% of which remains on a 40-mesh screen and 32.4% of which passes a 200-mesh screen, notwithstanding that a 30-mesh 'ton cap' screen is used in the mills. The discharge through these screens is kept up to the maximum, a heavy splash being used, but all material coarser than 60-mesh is, so far as possible, cut out in the first hydraulic classifiers following these mills and sent back to the Wilfley tables, where it



Flow Sheet at Guerrero Mill.

The screen analysis of samples (table No. 2), shows the average screen, or grading-analyses of several sets of samples taken during the month of July, 1909, at the Guerrero mill, the various products at each step being carefully sampled. A study of the figures will show some interesting features. Special attention might be called to the work of the Callow screens which at 100-ft. belt travel per minute (a high speed), when equipped with 30-mesh No. 33 steel wire (the purpose being to separate as undersize all material that can be made to pass a 40-mesh laboratory screen), gives an oversize 92% of which remains on a 40-mesh screen and 96.5% remains on a 60-mesh screen. At the same time an undersize is sent to the hydraulic cones, 91½% of which passes a 40-mesh, said product containing practically all of the liberated mineral. The effect of this system is seen in the enormously wide streak of mineral on the first joins the oversize from the Callow screens and returns again to the Chilean mills.

Another feature of the grinding at the Guerrero mill is the fineness of the tube-mill feed, only 7% of which remains on a 60-mesh screen. This is, of course, absolutely against high tube-mill tonnage, but is justified by the necessity for the most careful possible concentration, which means, on these ores, pretty fine grinding, in stages, and careful elimination of mineral after each step and before the tube-mills get a chance to slime the mineral. The apparently low efficiency of the tube-mills receiving such feed, in comparison with the Loreto mill of the same company, for instance, in which a much simpler flow-sheet is in use, is principally due to the fact that all of the easily slimed portion of the ore has been made to pass a 200-mesh screen during its repeated passage through the Waddell mills, leaving for the tube-mills nothing but the most refractory portion to grind.

*Abstract from El Instituto Mexicano de Minas y Metalurgia.

SCREEN ANALYSIS OF SAMPLES TAKEN AT GUERRERO MILL.

		% Solids.	PERCENTAGE ON SCREENS:									
			+10	+20	+40	+60	+80	+100	+120	+150	+200	-200
BATTERY DISCHARGE.		20.74	36.0	20.0	16.4	6.8	2.6	3.6	.5	2.0	1.8	10.3
Elevator No 1 Sloughing-off-cone	Overflow	3.59	..	. ..	...	...	....	.5	.1	2.5	4.9	92.0
	Spigot	30.85	35.8	20.1	17.0	7.5	3.0	3.9	.8	2.5	2.0	7.4
Callow-Screens	Oversize	35.50	43.0	27.0	22.0	4.5	1.5	.5	....	.3	.1	1.1
	Undersize	11.92	....	....	8.8	23.7	12.0	14.7	2.0	7.0	6.0	25.8
Wilfleys, pulp from Callows	Feed	18.00	...	....	8.7	28.0	14.8	16.3	2.9	7.8	5.5	16.0
	Discharge	9.33	...	....	8.6	28.1	15.0	16.2	2.8	7.5	5.9	15.9
Wilfleys, Chilean Return	Feed	20.35	...	...	11.5	44.0	16.3	12.3	2.5	4.2	2.5	6.7
	Discharge	11.37	....	....	12.0	44.0	16.0	12.0	2.5	4.1	2.6	6.8
Wilfley Tables General	Feed	18.94	....	...	11.6	37.0	15.0	14.7	1.6	5.1	3.9	11.0
	Discharge	11.87	..	....	11.7	36.9	15.2	14.8	1.5	5.0	4.0	10.9
Waddell Mills	Feed	22.46	19.5	11.4	16.0	24.5	9.6	8.2	1.0	4.0	2.2	3.6
	Discharge	22.60	....	....	4.0	23.8	12.7	14.5	1.2	6.8	4.6	32.4
Elevator No 3 Sloughing-off-cone	Overflow	4.41	...	..	....	.2	.4	.5	.1	.8	1.5	96.5
	Spigot	25.93	...	....	6.4	28.5	13.2	14.5	2.0	8.2	4.5	22.7
Elevator No 4 Slough ng-off-cone	Overflow	4.49	. ..	. ..	....	.3	.5	.4	.1	1.5	3,7	93.5
	Spigot	27.58	. .	....	7.5	29.6	13.0	15.9	2.5	8.8	3.5	19.2
60 inch No 1 Classifier	Overflow	5.59	..	...	..	.8	.9	1.0	.5	2.6	3.3	90.9
	Spigot	17.90	....	. ..	.6	12.0	10.5	18.7	4.8	10.0	8.0	35.4
60 inch No 2 Classifier	Overflow	6.09	....	.....	....	.9	1.0	1.1	.5	2.5	4.0	90.0
	Spigot	24.02	. ..	....	.5	14.3	12.9	21.4	2.7	12.9	9.8	25.5
Johnstone Slime Tables	Feed	13.52	....	. .	...	.1	.2	.4	.1	2.5	3.2	93.5
	Discharge	9.53	....	...	....	.1	.3	.3	.1	2.6	3.2	93.4
Johnstone Fine Sand Tables	Feed	18.75	....	....	5	13.2	11.5	20.4	3.0	12.2	10.5	28.7
	Discharge	14.21	....	....	.4	13.1	11.3	20.3	3.1	12.1	10.7	29.0
Dorr Classifiers	Feed	32.94	....	....	.5	6.9	8.3	22.5	3.7	18.8	13.1	26.2
	Slime Overflow	12.15	. ..	. ..	....	. ..	.1	2.5	1.0	9.5	11.0	75.9
	Sand Discharge	60.47	.. .	....	.5	7.7	.2	26.0	5.0	23.8	13.5	14.3
Tubemill No 1 4'6,, by 15' Abbe	Feed	59.76	....	....	.5	7.3	11.0	25.0	4.5	23.5	13.1	15.0
	Discharge	60.90	....	...	.. .	3.3	6.5	21.7	4.7	22.6	13.5	27.7
Tubemill No 2 4'6,, by 15' Abbe	Feed	60.00	.. -	...	.4	7.7	10.7	27.8	5.0	20.8	12.8	14.8
	Discharge	61.32	....	...	....	2.3	5.5	20.6	4.7	20.0	15.0	31.9
Tubemill No 3 4'6,, by 15' Abbe	Feed	58.64	....	....	.5	7.5	11.9	26.5	4.4	22.0	12.5	14.7
	Discharge	59.34	....	..	....	3.7	6.7	23.2	3.1	21 2	14.2	27.9
Tubemill No 4 5' by,, 20' D. E. W. C.	Feed	59.84	. ..	....	.5	8.5	10.0	26.0	4.5	24.1	12.8	13.6
	Discharge	60.87	....	...	....	3.1	7.2	22.7	4.7	23.0	12.5	26.8
General	Slime to Tanks	10.60	...	....	....	...	...	2.0	.2	6.6	8.1	83.1

The tables herewith are made from sampling done at Loreto mill on various dates and do not furnish absolute comparison with the performance of the Waddell mills above mentioned, on account of the difference in the grinding system employed and also because the ores fed to these mills are much more friable than those ground in the Guerrero mill. The object of the test was to determine the most efficient feed for the tube-mills and to furnish comparisons between the tube-mills differing from each other in make and leading dimensions, especially in diameter.

The samples from which the analyses were obtained were taken in sets. For obvious reasons, such as daily variations in the character of the ore, too close comparisons should not be made between analyses of samples of different sets. Some sets of samples must also be eliminated from any comparisons whatever, because conditions changed so frequently during the two or three hours consumed by the tests that determination of kilos per minute of solids fed to mill, percentage of solids, and the like, are not accurate. Such tests are indicated by marginal notes. Despite these disabilities, however, it was possible to collect many valuable data.

The determination of the most favorable feed for horse-power efficiency was naturally the first consideration, with special reference to the percentage of solids in the feed and the kilos of dry feed per minute for each different mill. A little study of the tables leaves no doubt as to these points, except in the case of No. 4 mill (D. E. W. Co., 5 by 20 ft.), wherein the value of the tests was practically destroyed by the variations of feed above referred to. Therefore, the tests on this mill are given for what they are worth, demonstrating as they do that the horse-power efficiency of the mill does not increase with the quantity of dry feed up to an undetermined point. Briefly the conclusions which may be safely drawn from the series of tests are as follows: (1) That the grinding efficiency increases with the percentage of solids in the feed up to about 55 or 60%. (2) That the grinding efficiency increases with the quantity of ore fed per minute to a point which varies with the dimensions of the mill, and that beyond this point capacity is not gained and within reasonable limits there is no loss except that due to the return to the mill of an excess of oversize. The limit of profitable feed varies with the character of the pulp, and it is only possible to determine this limit for any mill by special experiment with the ores for which the mill is intended.

At the Loreto mill the profitable feed for the 4 by 18-ft. mill was apparently 80 kilos of solids per minute, or at the rate of 115 metrical tons per 24 hours, although heavier feed did not reduce the efficiency of the mill. The limit for the two 4 ft. 6 in. by 15-ft. mills was not proved, but is apparently somewhat lower than the correct feed for No. 1, and is probably due to the fact that they are 3 ft. shorter, which reduces the capacity somewhat, and they have a greater diamater, which tends toward a reduction of their horse-power efficiency.

This statement as to horse-power efficiency is not absolutely proved by the above tests, but in every case the efficiency has been lower in mills of greater diameter except one in which the small mill did not

TUBE MILL OPERATIONS. SCREEN ANALYSES OF FEED AND DISCHARGE.

MILL MATERIAL		1908	% SOLIDS	Kg per Min. SOLIDS	Kg per Min. SOLUTION	SCREEN ANALYSES 40	60	80	100	120	150	200	200	Kg PER MIN THROUGH 200 SCREEN	H P	KILOS PER H P PER MIN THROUGH 200	
1-Krupp	Feed	3/	55.0			0.2	5.0	7.7	14.2	2.3	20.0	19.8	31.5	..	...		
4'×18'-31 R. P. M.	Discharge	21	35.1			..	0.2	0.6	8.5	2.0	11.7	15.1	63.1	.....	...		
2-Abbe'	Feed		60.3			0.3	5.2	6.6	14.0	2.9	20.7	19.1	30.3	...			
5'×15'-29 R. P. M.	Discharge		10.8			....	0.7	2.4	9.7	2.1	16.7	17.3	49.9	.....			
3-Abbe'	Feed	..	60.0		.....	0.3	5.3	6.4	13.3	2.8	20.5	19.0	32.6	....	.	.....	
4'×18'-31 R. P. M.	Discharge		60.8	.	.	....	0.6	2.1	8.3	2.0	16.0	16.6	52.5	.....	...	.....	
4 D. E. W. Co.	Feed	..	58.9	...	...	0.3	5.2	6.2	14.4	2.5	18.5	20.0	32.5	...	...		
5'×20'-29½ R. P. M.	Discharge		62.7	....		....	0.2	0.9	5.6	2.2	10.9	14.3	64.6	.....	....		
1	F	1/	56.7	65.9	50.4	0.2	5.0	7.5	19.0	4.0	20.8	19.8	23.5	.....	.....		
El Oro Liner	D	27	56.9		.....	....	0.2	2.0	10.5	3.0	16.0	15.2	52.2	18.8	32.8	0.58	
2	F	..	61.8	100.0	54.4	0.2	5.5	7.5	18.8	5.0	20.0	18.0	25.0	.....	.....	.....	
Silex Liner	D		65.9	.....			1.0	4.2	15.5	3.0	18.0	17.8	39.5	14.5	27.0	0.54	
3	F	..	64.9	70.3	37.0	0.2	4.4	7.4	18.2	4.5	21.6	16.8	26.6	..	.	.	...
Silex Liner	D		65.0	..	.....	....	1.0	3.2	14.0	4.0	18.0	14.5	44.5	12.6	27.0	0.47	FED AT LESS THAN CAPACITY TO DETERMINE THE EFFICIENCY OF MILL.
4	F	..	64.9	64.9	35.1	0.3	4.5	7.0	17.8	4.0	21.5	17.0	27.6	.....			
El Oro Liner	D		66.7	.....	..		0.2	1.6	9.0	3.0	15.6	15.7	54.0	17.1	31.0	0.34	AS ABOVE.
1	F	4/	56.7	102.9	77.7	0.4	5.0	9.8	21.0	4.5	20.0	18.7	20.5	.....	.....	.....	
	D	13	58.9	...	.....	.	0.8	4.0	14.0	4.3	18.5	15.5	42.7	22.8		0.70	
2	F	..	62.8	115.5	68.3	0.4	4.8	10.0	21.2	4.2	21.3	19.0	19.0	...	....	.....	
	D		63.4	...	.....	....	1.8	5.5	17.0	4.4	21.0	18.5	31.7	14.7	...	0.55	AS ABOVE.
3	F	..	62.7	113.6	67.6	0.3	4.9	9.9	21.0	4.5	20.5	19.0	19.1	.....	.	.....	
	D		63.0	.....	.....	....	1.5	4.5	16.5	4.4	20.0	18.0	34.0	16.9	.	0.62	
4	F	..	62.4	103.8	62.6	0.4	5.0	9.9	21.1	4.4	20.5	18.9	19.7	.....	.....	....	
	D		63.4	.....	.....		0.7	3.8	13.5	4.2	18.4	15.2	44.0	26.2	....	0.50	
	F	5	52.1	46.0	42.0	1.2	12.0	11.0	18.5	3.5	16.8	12.8	23.0	.....	.....	.....	

have more than about 60% of its most economical feed.

The 5 by 20-ft. mill (which is mechanically the best built one), has shown in every comparative test a lower grinding efficiency than the smaller mills, but it would not be fair to look upon this deduction as final, owing to reasonable doubt as to the accuracy of determination of quantities.

MINERAL RELATIONS FROM THE LABORATORY VIEWPOINT.

By Arthur L. Day.

*The remarkable contributions which have been made to our knowledge of aqueous solutions since the formulation of the science of physical chemistry leave little doubt that its generalizations can be applied with equal success to the study of rock formation; but the effort to make the application has brought us face to face with the fact that the problem of rock formation is of much broader scope, and its phenomena far more intricate, than ever was imagined in the years when the first plans for laboratory work in the service of geology were made. This has had one conspicuous consequence. Most of the work done in the earlier years of laboratory experiment cannot now be used to aid in the application of the new theories to mineral solutions. The first effect of this conclusion is to emphasize the necessity for widening our viewpoint to meet the increased scope which physical chemistry has imposed upon the study of mineral and rock formation from the magma, and the second, to compel us to revise our experimental methods so that the number of unknown factors will not outweigh the known and so prevent their intelligent interpretation and eventual application to geology. It is also necessary to recognize more explicitly the physical conditions affecting the problem upon its quantitative side. For example, we cannot profitably continue to determine melting and solidifying points of natural minerals, and still less of complicated rocks, knowing that the addition of a small quantity of impurity almost always lowers a mineral melting point considerably, and knowing also that no mineral type occurring in nature is free from such impurities. We cannot continue to observe melting temperatures by watching for the moment when the mineral begins to sag and run, knowing that in many most important minerals deformation does not occur until long after melting is over. We cannot continue to ascribe individuality and characteristic properties to mineral glasses knowing that they represent an unstable and undefined condition which may persist for months or years, or even for geologic time, without reaching equilibrium. At best, physical chemistry encounters this difficulty in considering both the natural minerals and the natural rocks; individual minerals do not occur in nature in uniform types, but are somewhat variable solid solutions with many minor ingredients; so too with the rocks we often find that equilibrium is not reached during the entire process of natural formation.

*Abstract of paper presented at the Boston meeting of the Geological Society of America.

Santa Clara River Placers.

Written for the Mining and Scientific Press
By Claude E. Jamison.

The Santa Clara river placers are situated about 40 miles northwest of Los Angeles, on the north side of the little Santa Clara river, in Los Angeles and Ventura counties, California, in the Santa Barbara National Forest. The district is of particular interest on account of having been the scene of the first gold discovery in California. Although it is the general belief that the first discovery of gold was made near Sutter's Fort, that honor belongs to southern California, as is shown in the following extract taken from Hittel's 'History of California': "It was in Alvarado's time, and about March, 1842, that gold was first discovered in Alta California. * * * * In 1841, Andrés Castillero, the same person who afterwards discovered the New Almaden quicksilver mine in Santa Clara county, while traveling from Los Angeles to Monterey, found near the Santa Clara river a number of water-worn pebbles, which he gathered up and carried with him to Santa Barbara. He there exhibited them, said they were a peculiar species of iron pyrite, and declared that, according to Mexican miners wherever they were found, there was a likelihood of gold being also found. A ranchero, named Francisco Lopez, who was living on Piru creek, a branch of the Santa Clara river, but happened at the time to be at Santa Barbara, heard Castillero's statement and examined his specimens. Some months afterwards, having returned home, he went out on a search for strayed cattle. At noon, when he dismounted from his horse for the purpose of resting, he observed a few wild onions growing near where he lay. He pulled them up, and in doing so noticed the same kind of pebbles as those to which Castillero had called his attention. Remembering what Castillero had said about them, he took up a handful of earth and, upon carefully examining it, discovered gold. The news of the discovery, the exact location of which was a place called San Francisquito, about 35 miles northwest of Los Angeles, soon spread, and in a few weeks a good many persons were engaged in washing and winnowing the sands and earth in search of gold. The auriferous fields were found to extend from a point on the Santa Clara river, about 15 or 20 miles above its mouth, over all the country drained by its upper waters and thence easterly to Mount San Bernardino. On May 14, 1842, Alvarado wrote to the prefect of the district, reproving him for not having given official notice of the discovery, and directing him to gather and forward an account of all circumstances of interest relating to the gold for transmission to the supreme government. From that time to this day, there has been more or less working of these mines; but no placers of very great richness have been found, and none to compare with those afterwards discovered on the tributaries of the Sacramento and San Joaquin. Taking the whole country together, however, from the Santa Clara river to Mount San Bernardino, a very considerable quantity of gold has

been extracted. During the first year, though the methods of working were exceedingly rude, it is said that Lopez and a partner named Charles Barec with a company of Sonorians, took out over $8000. In November, 1842, a package of about 18 oz. of the gold was sent by Abel Stearns to the United States mint at Philadelphia, and upon assay it was found to be worth a little over $441."

The State Mineralogist in his report for 1888 states that, "the gravel averages 90 ft. in depth. According to the tests made with a dry washer, the gravel, it is stated, gave an average yield of 36c. of gold per cubic yard. Of course the dry washer does not separate the gold from the clay and lumpy portions of gravel."

In the fall of 1908 I visited this district and made a preliminary examination, spending some two months on the ground. The gravels, belonging to the Miocene period, are found at an elevation of about 1500 ft. above sea-level, covering the low hills north of the Santa Clara valley, and occupying an area about 20 miles in length by 10 in width. Placer gold, ranging in size from microscopic colors to nuggets of 5 dwt. or more, is found almost universally distributed over the entire area. The gold content is probably due to the innumerable quartz stringers found in the granites and schists of the northern part of Los Angeles county.

The results of a large number of samples showed the average gold content to be 28c. per cubic yard, and the depth to be at places as great as 100 ft., but, although the quantity of gravel in the entire district is considerable, the average depth is not sufficient for successful hydraulicking.

As fully one-third of the original gravels have been eroded and carried down, presumably to be redeposited in the valleys below, it was natural to conclude that in these valleys good dredging ground would be found. Other conditions, such as climate, bedrock, proximity to railway and power, and the like, were ideal. However, before proceeding further, I learned that the valleys had been drilled some time previously, and that the average gold-content of the gravels had been found to be less than 1c. per cubic yard. The reason for this upsetting of theory is plainly shown in Piru valley, in the western portion of the district. This valley, which a few years ago was a gravel-filled channel, is now a mass of large boulders with little or no sand or gravel. The country is subject to occasional very heavy rains, or cloud-bursts, which completely scour out the valleys, carrying everything but the heaviest boulders down to the Santa Clara river, where, becoming mixed with the barren sands of that valley, the average value is reduced too low for profitable working.

For a number of years these placers have been a source of revenue to some of the residents of that section, not, however, by sluicing or washing, but by bringing them to the attention of capitalists seeking dredging ground, obtaining a small cash payment as 'earnest money', and employment for teams until the true value of the ground is determined and the examination discontinued. A search for a new 'sucker' is then begun, and, backed by the report of the State Mineralogist, quoted above, and by numerous affidavits of Mexican 'gambocinos', it is soon successful. The results of former examinations, and even the fact that examinations had been made, are carefully concealed.

All over the district the rusting remnants of gold saving machinery bear mute testimony to the number of attempts which have been made to work the gravels. In Texas canyon is a reservoir built by a company with an ex-governor of California at its head. In Dry canyon are the sluices, bucket elevator, and 'black sand savers' installed by the late Frederick H. Rindge, while on a hill nearby are a number of patent gold-savers. In Tapia canyon a steam scraper was installed and about 500 cu. yd. of dirt handled, with a recovery of $21 and an expenditure of $25,000, before the machine was removed. In Santa Feliciana canyon about 5000 yards of gravel has been hydraulicked and a number of drifts driven on bedrock. This canyon is in the richest portion of the district. Much of the gravel on bedrock shows a gold-content of from 75c. to $3 per yard. However, it is to be presumed that operations were carried on at a loss, as no work has been done there for years, although the 'oldest inhabitants' solemnly told me that these workings had produced more than $100,000.

In the spring the smaller gulches are worked by the Mexicans who manage to clean up about $1 per day per man. Three miners working in Deadman's canyon, at the time of my visit, were cleaning up about $20 per day, or about $8 per yard, from 18 in. of gravel on bedrock, while I obtained results as high as $30 per cubic yard in some of the smaller gulches. However, these favored spots occupy only an insignificant area and are not often found. A preliminary examination shows the district to be very inviting, but it will not stand a rigid investigation.

The Mancayan copper deposit is the largest in the Far East. It is in Lepanto, Philippine Islands. The deposits were worked by the Spaniards and over a thousand tons of copper was taken out yearly at one time. After American occupation the smelter was burned by the Insurgents and active work was not resumed. American prospectors have occupied the property and the Lepanto Mining Co. has been interested in an option on the property. A contract was recently signed with a German company under which the Lepanto Mining Co. bonded the property under its control, including 11 claims and fractions, for a period of six to nine months. Experts are now investigating the property, and it is not improbable that a deal will be closed for the purchase and development of the group. Negotiations are also being carried on with other owners of property at Mancayan with a view to including adjacent groups. The deposits are valuable and have been most favorably reported upon several times. Transportation to the coast seems to be the greatest item of expense to be considered, but there is reason to believe that the large body of ore of high grade available would more than warrant the investment.—*Far Eastern Review.*

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Metallurgical Progress in Colorado.

The Editor:

Sir—I am sorry the management of the Modern Smelting & Refining Co., of Denver, consider the remarks in my article on 'Metallurgical Progress in Colorado', published in the MINING AND SCIENTIFIC PRESS, of January 1, as "obviously unfair." I do not hold a brief for anyone; my information came from a person familiar with the 'Modern Smelter,' and the practice prevailing there toward the close of the last year. I believe that he, equally with myself, desires to be fair and impartial. The point that I tried to make was that pyritic smelting in Colorado had a fair trial and failed everywhere except as noted by me, and, in that solitary instance of possible success, the smelter had large mines behind it that may have been an important factor in the case. Be that as it may, the statement that "we use 4% less coke, and make slags 8% higher in silica, than any plant now operating in Colorado," has a very familiar appearance, quite pyritic in fact, yet it tells but a small part of the story. Fuel is needed to heat the blast, silicious ores are not very plentiful in Colorado just now, and the final matte, after its various passages through the furnace for enrichment (and incidentally loss of precious metals), is not quite desirable from a monetary point of view, as is base bullion, the product of one smelting. Thus we come to the crux of the whole matter, the concentration of the precious metals in a product ready for the refinery. I hold that the lead base will give the higher extraction at the least cost, and, under the conditions that now obtain in Colorado, must prevail. An argument in favor of pyritic smelting might be predicated on a preliminary treatment or concentration of low-grade ore, at or near the mines, but to establish a pyritic smelter in Denver, drawing half of its supply of undesirable ore from Redcliff, Leadville, and other distant points in the State, does not appeal to me as sound business.

The Modern Smelting & Refining Co. is to be congratulated on the *slag* made "for days" (I hope continuously) "carrying only a trace of gold, 0.25 oz. silver and 0.05% copper", but at what cost is not stated, yet the cost is equally as important as the saving. A sailor cannot determine his position by longitude alone, nor can a metallurgist proclaim unqualified success on a few slag assays. Smelter campaigns need to be for much longer periods than a few days. Dust loss, and the recovery and working up of flue dust, is a large item of cost in pyritic smelting. Cases are known where it ate up all the profits accruing from the major operation of the plant. One thing, however, is certain, the company that can smelt cheapest and settle promptly for its ores need not fear the alleged "strangle hold" of the most powerful smelting interest in this or any other State, much less fair criticism in the technical press. Permit me to say in conclusion that I have no interest in or connection with any smelter in Colorado, but in the general interest of mining I would be pleased to see the successful establishment of a process that would reduce the treatment-charges and enable the handling of lower grade ores at a profit to the miner; but the first paragraph of the communication of the Modern Smelter company in your issue of February 5, is not the kind of talk that successful or even resourceful competition has need to resort to.

PHILIP H. ARGALL.

Pueblo, Colorado, February 14.

Disposal of Government Oil Lands.

The Editor:

Sir—It is gratifying to have the absurdity of the application of the placer mining laws to oil lands brought out by Mr. Ballinger's report as Secretary of the Interior and the statement of Mr. C. W. Hayes. It is to be hoped that the unfortunate legal misfit will be replaced soon by Congress. The matter is, however, an exceedingly difficult one and the elaboration of a proper law is a task which will demand a great deal of study. I have had experience in taking oil placer mining claims and with the regulations promulgated by the Department of the Interior for the leasing of oil lands in Oklahoma, and venture to suggest a remedy. The greatest difficulty which Congress will meet is the fact that the law must cover conditions which are very dissimilar. It is important to adopt a system which will work for the conservation of oil in certain regions where overproduction now prevails, and at the same time give encouragement to oil prospecting in districts far from producing fields where petroleum products are abnormally high in price. The only way to meet this difficulty is to recognize different classes of petroleum lands and to adopt different regulations for each.

It is not to the public interest to encourage the production of oil at present in California within a hundred miles of developed pools, since so much oil is being produced that it is necessary to store the surplus with a consequent loss of the more volatile parts. For such lands the Government may properly adopt stringent regulations which will bring it as much revenue from the sale of the oil as possible. On the other hand in all of the other Western States, except Kansas, Oklahoma, and Texas, petroleum products are in great demand. This necessitates transportation of oil over great distances and results in high prices, although there can be no doubt that in the State of Wyoming, at least, proper encouragement of prospecting would soon make this an exporting State. Since this would be to the general advantage of the people, it would seem desirable to adopt regulations for such lands which would be very encouraging to the prospector.

In order to avoid too sharp a distinction it would be desirable to have an intermediate class. The proposed classification is as follows:

Class A. Including all public lands within 100

miles of a field having a daily average production of 1000 barrels. Applications should be received for tracts of 320 acres or less. Royalty, 10%, payable upon the production of a well, after it has produced 2000 bbl. of oil.

Class B. Including lands more than 100 miles from a field having a daily average of 1000 bbl. per day, but within five miles of a producing well. Applications should be received for 640 acres or less. No royalty unless there is competitive bidding.

Class C. Including lands more than 100 miles from fields producing 1000 bbl. per day, and farther than five miles from a producing well. Applications should be received for tracts of 2560 acres (four sections) or less. No royalty unless there is competition.

Applications to be made to Commissioners of the Land Office and held in the confidential files one month. If, at the end of this time no other application has been made, the lease to be awarded to the applicant, provided a bond for $500 be filed within 15 days and a well drilled upon the tract within six months to a depth of 2000 ft., or to such depth as may be prescribed by the United States Geological Survey, unless a producing well is obtained at a less depth. If one or more others apply within the month, the several applicants, and these only, shall be asked to submit bids on the amount of royalty which they will offer on the production of oil or gas after 2000 bbl. of oil, or one month's flow of gas has been produced from each well. The lease to be recorded with the appropriate county clerk or recorder of deeds, as also notice of forfeiture if cancelled. If at the end of six months the well has not been completed, the bond to be forfeited to the Government and the land to be open for application.

The oil or gas rights on all Government land should be henceforth retained to be leased in this manner. These leases involve the oil and gas rights and give no rights to the surface except such privileges as to entry and use as are necessary for operation. Where a well results in discovery of minerals of value other than oil or gas, and which were not previously known, the operator shall be given 30 days in which to locate a mining claim. The whole procedure must be described with great care and detail with special reference to the ambiguities which have arisen in the interpretation of the mining laws.

It is believed that these regulations would have the effect of: (1) Restricting the profits of mere speculators at the expense of bona fide prospectors. (2) It would encourage oil production in regions where it is needed and not encourage it in districts where overproduction prevails, although permitting a gradual development there by genuine operators. (3) The Government would receive a considerable revenue from the oil without improperly restricting the oil development. (4) Petroleum would be conserved according to the best standards; namely, of bringing oil into use as needed with the avoidance of wasteful overproduction.

It is to be hoped that the Department of the Interior in its zeal to accomplish conservation will not make the conditions of prospecting so onerous that wild catting in the Rocky Mountain States will be prevented. There is an enormous area which should be tested, and suitable inducements must be held out. The conservation of petroleum for the future needs of the navy and country alike had best be accomplished by a leasing system which will restrict local overproduction rather than by the withdrawal of any definite tract of land. Such a withdrawal would work injustice to the communities concerned.

The other method of conserving oil for the use of the navy suggested by Mr. Lockwood, namely, that of storing mid-continent oil in tanks because it is now so cheap, is far too wasteful. The mid-continent oil contains a considerable percentage of the lighter products which must be separated from it before it could be safely used on battleships, and the storage of such oil for long periods would result in too serious a waste, from the evaporation of these valuable products.

R. H. Johnson.

Bartlesville, Oklahoma, January 19.

English in Our Technical Journals.

The Editor:

Sir—In one column the editor of the technical journal asks the operator for practical contributions and in another he ridicules the literary ability of those who comply. Mr. Strange, in his letter published in your issue of November 13, caps the climax by criticising the articles as they appear. In other words, he scorns the efforts of the editor as well as those who contribute. Mr. Strange said, "Surely a set of men cannot claim to be fitted for any profession until they are thoroughly prepared to express themselves." Only a supreme egotism can class mining, smelting, cyaniding, etc., other than as mechanical trades. Furthermore, "a set of men can be well fitted" to do many things with hands and brains without being able to express their thoughts or describe results in faultless English. As I understand it, there is a man—a mere grammar sharp—on the staff of the properly equipped technical journal, a drudge who is paid about what a mine mucker earns. This expert word-juggler is supposed to prevent the appearance in print of what Mr. Strange objects to. As regards the responsibility of the editor for the correct appearance of contributions, be assured, sir, that you will lose many correspondents as soon as you begin to publish articles without revising them. Although a contribution is supposed to reach you in proper form, it is your duty to clarify it where necessary. If the subject is one with which the editor is not familiar, he should ask the contributor for an explanation of obscure passages. Usually the man who does things has little time to devote to the continued study of English composition. Conversely, the one who continues dexterous with words may be of limited capacity in other directions. Those who ask for contribution as a matter of policy should ignore the shortcomings of those who comply, instead of frightening them with demands for perfection in orthography, syntax, and grammar. As well demand type-setting skill.

Mark R. Lamb.

Milwaukee, Wisconsin, February 7.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Colorado mining laws are not published separately. They will be found in the Revised Statutes of 1909. 'Morrison's Mining Rights' contains the principal mining laws of various States, including not only statutes, but judge-made law.

Chrome ore is used extensively in the open-hearth steel process as lining for the floor of the ports, especially in basic-steel work, and in the more exposed places where slag is liable to lodge and corrode. It was also applied to copper furnaces, but has not come into very general use. The attempt to make crushed chromite into bricks, which has met with partial success, would more effectually solve the problem for copper reverberatory work.

Use of steel in mine timbering can be no longer considered as an experiment. It is a material of construction tested under all kinds of conditions and service, is adapted to all forms of construction, is easy to obtain, convenient to fabricate and erect, and economical in all directions, and its long life, under all conditions of temperature, moisture, and stress, compensates for the increased first cost of its installation as compared with wood.

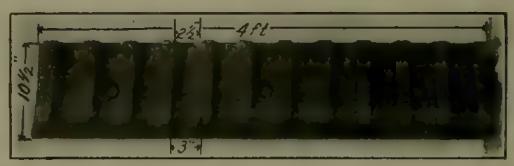
Wells drilled into water-bearing beds should carry the inner pipe entirely through them to some hard stratum lying next below, and sufficiently far into that stratum to hold the pipe rigidly. As it is needful to have the part of the pipe in the water bearing strata perforated, to admit the water, this portion of the pipe should be extra heavy. This pipe should pass through the upper casing so that it may be withdrawn for renewal or repair when necessary. If galvanized, the life of this pipe should be very long.

Titanium gives promise of extended use in steel and cast-iron. In steel it is ordinarily introduced as ferro-titanium, with from 10 to 20% tatanium, sufficient to make up approximately 0.1% of the steel. Rails treated thus show great resistance to wear. Gray cast-iron is also made harder by such treatment. Cupro-titanium is manufactured for use in bronze and other castings containing copper, making them much tougher. Titaniferous ore is mined chiefly in New York, Minnesota, and Wyoming; and a large deposit of rutile (titanium dioxide) is worked in Nelson county, Virginia.

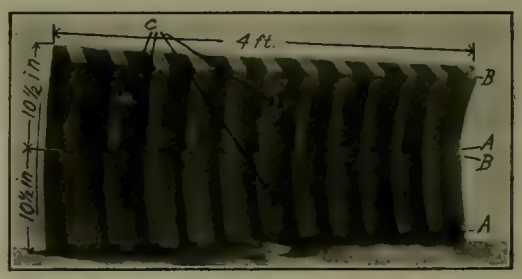
Blast-furnace capacity, other factors remaining unchanged, varies with the quantity of air delivered into it, or, with the same tuyere area, the smelting speed of the furnace varies directly with the blast-pressure. Not only is this so, but the successful operation of the furnace depends upon a correct adjustment between the quantity of air and the fuel on the charge. Therefore it is important to maintain a uniform delivery of air, which means a narrow range of fluctuation of the blast-pressure. Granting that the character and height of the charge in the furnace are maintained constant, this desired uniformity in air-pressure is maintained by properly governed blower-engine speed and by control of the air temperature. The latter is now accomplished successfully by the Gayley apparatus for iron blast-furnaces, but has not been adapted as yet to copper smelters.

Claim A is a valid claim which becomes subject to adverse location by reason of failure to perform assessment work during the year 1909. On December 22, 1909, claim B is located across claim A by parties other than the owners of A. On January 1, 1910, still other parties re-locate claim A. The area in conflict belongs to those who re-located claim A, for this area was on December 22, 1909, and up to the end of the year 1909, embraced in the valid and existing original location A. No valid rights could be acquired by adverse locators to any portion of claim A until the beginning of the new year, 1910.

The tube-mill liner illustrated herewith, used by Cooper Shapley at the mill of the Santa Natalia Mining & Milling Co., Guanajuato, Mexico, will be of interest. As shown, the ribs of the liner encircle the tube-mill, being at right angles to the axis of rotation. The ribs on each plate are cast with a slight taper from one side of the plate to the other, thus leaving



a wedge-shaped space between for the pebbles to catch and wedge themselves firmly into place. The plates are cast in such a manner that the butt end *B* of one rib comes against the pointed end *A* of the rib on the adjoining plate, thus leaving no points ex-



posed to excessive wear. The pebbles have the peculiarity of catching in this liner with their shorter diameter between the ribs, thus leaving a third or more of their bulk projecting above, exposing an exceptionally rough surface to the loose pebbles in the mill, as well as serving a further protection for the liners themselves. With this arrangement of rib, 26% more rock-lining can be obtained, and the lining itself weighs 30% less than the liners formerly used. These liners have been in use for six months, employing mine rock for tube-mill filling, and the wear cannot be detected. The liners are placed in the mill in such a manner as to use the wedge-space between the ribs to the best advantage for picking up and holding the pebbles. Bolt holes are shown by arrows from the letter *C*.

Special Correspondence.

SYDNEY, N. S. W.

Mineral Industry for 1909.—Broken Hill Mines and Processes.—Electrolytic Copper Refinery.—Mount Lyell.

Although the first discovery of gold in Australia was made in New South Wales as far back as 1851, and although that State had produced, to the end of 1908, not less than 13,258,794 fine ounces of the royal metal, valued at £56,319,736, gold mining does not occupy the first place in its mineral industries, this is filled by coal, the value of which has been £56,632,254. For many years past, however, New South Wales has been more widely known in the commercial world as a producer of silver lead ore, and it is a remarkable fact that, although this industry was hardly commenced until well on into the eighties, the value of the output is already considerably beyond £50,000,000, and the yearly production is now, in spite of the low market values of the metals, of far greater importance than the gold output of the State. The silver-lead statistics for the last year do not furnish a fair comparison with other recent years, because industrial troubles at Broken Hill, the centre of the industry, laid some of the principal mines idle for several months, and the largest producer of all, the Proprietary company, has not been working throughout the whole year. But in 1908 the silver (ingots and matte) amounted to 2,490,163 oz., valued at £253,920, and the silver-lead ore and concentrate to 358,729¾ tons, valued at £3,658,632. The exports for the first nine months of 1909 were as follows: silver (ingots and matte), 1,279,830 oz., valued at £125,642; silver-lead concentrate, etc., 170,947 tons, £984,187; lead in matte, 11,867 tons, £142,580; making a total value of £1,252,409. With respect to gold, since 1894, with the exception of 1901, '02, '08, and '09, the annual output has exceeded £1,000,000; in 1908 the amount dropped to £954,854, and for the first eleven months of 1909 it was only £777,451, as compared with £862,426 for the corresponding portion of last year. Next in importance ranks the copper output; the value of the product to the end of last year had reached £9,703,215, and although the year 1908 saw a decline, not only in value but also in quantity, the figures for 1909 when completed will probably show a larger production than usual. In 1907 copper ingots, matte, ore, etc., amounted to 10,098 tons, valued at £1,444,533, but in 1908 only 9071 tons was produced, and this, on account of low prices, brought only £999,376, whereas during the first nine months of last year the production was 9684 tons, valued at £558,485. The total production of tin and tin ore between 1872 and 1908 was valued at £8,243,261, the quantity being, ingots 74,820 tons, and ore 22,509 tons. The output for 1909 will doubtless show a marked improvement on the annual yields of the past twenty years, for during the first nine months it reached 2039 tons, which, at the same rate, will give over 2700 tons in ingots and ore for the year, an amount not reached since 1887 when the figures were 2917 tons. Of recent years the production of pig iron has received a fresh impetus, and whereas in 1900 only 7737 tons was produced, that being the highest figure to that date, the quantity reached close upon 30,000 tons in 1907, and 40,207 tons in 1908. Considering that the aggregate output of pig iron for the State during upward of thirty years has only reached 198,165 tons, the fact that upward of one-fifth of that amount was produced in one year, and upward of one-third in two years, indicates that the industry is in a fair way to increase. Zinc also should be mentioned as a metal which has of late years been produced on an increasing scale, mainly in the form of concentrate; in 1904 the production amounted to only 57,602 tons, but in 1908 it had reached 275,932 tons, or, including spelter, 276,720 tons, valued at £600,883. Among the minor mineral industries are the production of noble opal, amounting in 1908 to £41,800, and in 1907 to £79,000; portland cement, 1908, £184,400, 1907, £144,548; wolfram, scheelite, antimony, bismuth, molybdenum, and numerous other metals and ores which have a commercial value but which have not yet been produced in sufficient quantities to be commercially important.

In regard to the position and prospects of the various silver-lead mines at Broken Hill it need only be said that in most cases they are developing satisfactorily and give promise of yielding up their treasure for many years to come. The fly in the ointment, however, is that the Broken Hill Proprietary mine is practically an institution of the past, and the same may also be said in regard to the Broken Hill Block 10 Co. Not that the Broken Hill Proprietary has been wholly depleted of its ore—far from it—but under the high wage system which prevails it is impossible to carry on operations at the mine at a profit. The result is that the company has been looking around and has practically acquired a new mine which it is prospecting. It must not be reckoned that the Broken Hill Proprietary will be a back number if this new mine does not turn out well, for they have gradually built up an industrial concern—the treatment of concentrate and the manufacture of spelter and the production of sulphuric acid—which must return handsome profits to the shareholders. In regard to

Eastern Australia.

the Broken Hill Block 10 they have had to go farther afield for a basis for a fresh enterprise, and recently they purchased a silver-lead mine at Zeehan, Tasmania, to which place it is proposed to transfer operations. A development of a highly satisfactory nature has occurred at the Broken Hill South mine. The diamond-drill which started boring west at a point 430 ft. south on the No. 4 level has cut a lode which is supposed to be identical with that being followed in the north drift from the Block 5 shaft. The drill after boring west passed through 15 ft. of ore assaying 9% lead, 2 oz. silver, and 20% zinc. If this body of ore is the same that is cut in Block 5 shaft it will give the company a fine lot of ore. The Central mine of the Sulphide Corporation is at present producing on a large scale, and it is only with difficulty that the dispatch of material is being maintained at such a rate as to enable the big stocks of products on hand to be reduced to any appreciable extent.

Metallurgically there have not been many important additions to the treatment processes employed on the Hill. The new mill of the Broken Hill North will be the best in the district; three units have been completed, and are giving satisfaction. The principal feature of the machinery is the Weis-Meredith slime table, the design of employees at the mine. Mr. Weis is the general manager and Mr. Meredith

mill superintendent. The table, a description of which will be given on another occasion, is installed as a standard in the mill, and they have also been placed in other mills on the Hill.

The treatment of zinc-bearing tailing is now a big industry on Broken Hill. Altogether there are no fewer than five plants using flotation and vacuum processes. The Broken Hill Proprietary, treating 8000 tons of tailing per week, is employing the Potter-Delprat flotation process under license; the Sulphide Corporation (Mineral Separation Co.) is using a combination of Ballot-Cattermole and Sulman flotation, and treating 7000 tons of tailing per week; the Zinc Corporation, working the Elmore vacuum process, is putting through 4500 tons per week; De Bavay Co., using a modification of the De Bavay flotation patent, is operating on 1000 tons per week; the British Broken Hill Co. is erecting an Elmore plant; Block 10 proposes installing a similar plant, and the Broken Hill Block 14 has made arrangements for the installation of a Murex magnetic plant. Whether the latter will be carried out is greatly doubted in Australian mining circles.

Electrolytic copper-refining plants are in operation at the Great Cobar, Ltd., and at the Electrolytic Refining & Smelting Co. of Australia, Port Kembla, which is controlled by the Mount Morgan G. M. Co. of Queensland. The multiple system is in use at the various plants. At the Port Kembla plant, where double tanks are used, an adaptation of the three-wire system is employed, a small triangular copper piece being used as the centre conductor.

The two outstanding prizes in connection with Tasmanian mining are the Mount Lyell Mining & Railway Co. (copper) and the Mount Bishoff Tin Mining Co. (tin). The former has just closed another successful year and the outlook for the future is one of great promise. The parent mine of the company—it must be remembered they have two—is still providing a large quantity of low-grade ore, and though the copper content is low the ore is rich in sulphur and is being profitably converted into sulphuric acid for use in connection with the manufacture of super-phosphates. Works are now in operation in Victoria and South Australia, and a plant is being erected at Fremantle, Western Australia. The North Lyell mine is turning out riches as depth increases, and the ore at the 1100-ft. level is now of a high grade. As an indication of the success of the company it may be mentioned that the old and present company have distributed between them £2,436,574, assuming that copper maintains a value of £60 per ton for a period long enough to permit of the treatment of the necessary quantity of the Mount Lyell ore, it is evident that further considerable sum will be distributed in the way of dividends. At the Mount Bischoff mine the only important features are that the treatment plant is being duplicated, presumably to double the output, which is now 80 tons per month, and that the mine is being developed most satisfactorily. The numerous other tin, copper, and silver-lead ventures are being worked consistently but their output is not extensive.

TORONTO, CANADA.

Cobalt Shipments. — Gowganda. — Porcupine Development. — Alberta Wild-Cat Oil Companies.

Shipments of ore from Cobalt during January showed a falling off as compared with the output for January, 1909, the total being 2028 tons, as against 2375. Over one-half of last January's shipments was contributed by three mines, Nipissing supplying 384 tons, La Rose, 366, and Drummond, 332 tons. The delay in furnishing cheap electric power is mainly responsible for the slackness of operations, as many of the mines are curtailing their output or postponing development until the long-promised power is obtainable. The La Rose has a force of 200 men at work at the main mine, where a large stope is being taken off the roof of No. 10 vein from the level 75 ft. below the adit-level. A good ore-shoot has been developed at this depth. On No. 3 the drift at the 135-ft. level has been carried for several hundred feet, the vein showing an average of 3 in. of high-grade ore. A lengthy cross-cut is being driven under the high bluff on the east side of the property. Stoping is being done on the 75-ft. level of the McDonald vein, along a 250-ft. ore-shoot. Development is being actively carried on at the Lawson property where 130 men are at work with fair results. A larger force will be taken on as soon as power can be obtained. The Temiskaming has the deepest workings of any mine in the camp, the main shaft being down 420 ft. At this depth the vein has dipped to the east but at the bottom of the shaft there is a large body of milling ore, distinct from the vein. The company has a year's supply of concentrating ore on the dump and two years' supply above the 300-ft. level, to which winzes are being sunk. The Little Nipissing is taking out high-grade ore from a vein at the 100-ft. level, on which a winze has been started and a raise driven, blocking out ore 36 ft. in depth by 65 ft. in length. The vein is 14 in. wide, and the walls are shot with native silver. The annual statement of the McKinley-Darragh shows gross receipts, including balance from previous year, $639,442, from which were paid for operating expenses and improvements $294,262, and as dividends $224,493, leaving a balance on hand of $120,686. In 1909 the production was 1,297,530 oz. of silver. The ore reserves at the McKinley are estimated at 4,975,000 oz., and at the Savage 755,000.

The total shipments from the Gowganda district since January 1 amount to 124 tons. The Blackburn has furnished 60 tons, and the Reeve-Dobie 62, the Burke-Remey having made a test shipment of two tons. The Morrison property in this area has been turned over to an English syndicate on an option. The syndicate undertakes to spend $100,000 in equipment and development before August, the option price being $1,000,000.

The rush to Porcupine has slackened somewhat, but great activity is being shown in building and in taking in supplies. Development work is furthest advanced on the properties of the Timmons Brothers, who are endeavoring to solve the question as to whether the good ore persists in depth. At the Hollinger, McMahon, and other claims on which they hold options, they have 40 men at work, and two shafts are down about 40 ft. Mining experts attach but little importance to the continued occurrence of free-gold, which often tends to disappear not far below the surface, holding that the real problem to be settled before the worth of the area can be determined is whether it is followed by sulphide ore in depth. This will indicate whether Porcupine has a future as a mining camp. In any event mining will be a costly business, requiring much expensive machinery and the returns will necessarily be slow. It will be no poor man's camp like Cobalt in the early days, when the quick profits from surface ore laid the foundation for large fortunes, and furnished the capital for regular development. The Scottish Ontario Mining Co., the Canadian branch of J. S. MacArthur & Co., of Glasgow, Scotland, who hold six of the Bannerman claims, are preparing to install an up-to-date plant and undertake active development. Buildings are now in course of erection, and the equipment will include a 10-stamp mill, and should results justify it, operations will be undertaken on a very extensive scale. Numerous assays of ore from various portions of the company's properties are said to show an average of $200 per ton.

The Ontario Government is showing a little more activity in protecting the public from imposition by wild-cat promoters than it has done in the past. The small investor lately has turned a deaf ear to gold and silver flotations, and the industry of the promoter has been turned in a new direction. Following the discoveries of Alfred von Hammerstein in Alberta, the wild-catters have been booming Alberta oil companies, with holdings many miles away from any known deposits, the public having but a hazy idea of Western distances. The game, however, was brought to an abrupt conclusion by prosecutions for violating the Companies Act in failing to give the information required in every prospectus or stock advertisement. One of the oleaginous promoters, Henshaw Maddock, of the California-Alberta Oil Co., was fined $200, and A. J. Davis, of the Chicago-Alberta Oil Co., $100, which proved a sufficient deterrent to further proceedings. So far there has been a conspicuous scarcity of Porcupine flotations, good or bad.

GOLDFIELD, NEVADA.

Clermont. — Character of Ore in Depth — Florence Goldfield — Diamondfield Black Butte.—Gold Bar and C. O. D Consolidated

During the past week a constant improvement has been noted in the assays taken on the 1000 ft level of the Clermont workings of the Consolidated mines. For several days past average assays from large seams in the face of the drift have yielded 5 oz. gold. The manager, J. R. Finlay, said in an interview that he was unwilling to announce that the real ore shoot had been penetrated at this depth, but apparently an ore shoot was being approached, and the indications at the time were most encouraging, with the formation identical in character with that exposed on the 900 ft level. To reach the vein from the station at a depth of 1000 ft. it was necessary to cross cut a considerable distance, and the drift had progressed some 60 ft. in vein matter before the assays indicated the near proximity of paying ore. This ore still shows in seams only, according to the manager, and no large orebody has yet been penetrated on the deepest level. The raise above the 1000 ft. level is still in ore of good quality. The size of the ore shoot is as yet undetermined, but it is wider than the raise. Assays from this ore have varied from $20 to $90 per ton. The percentage of copper in the ore on and near the 1000 ft level is no greater than on the 100 ft. There is absolutely no truth in a widely circulated report to the effect that the Consolidated is making a separate dump of copper bearing ore at the Clermont mine. The manager's report, covering operations in January, shows a larger amount of concentrate than usual in process of treatment at the end of January, and it is estimated that 60 tons of concentrate, containing 1000 oz. gold, were carried over that should be included in the January production. This was owing to the larger tonnage treated, following the installation of additional equipment in the mill.

In the absence of Thomas G. Lockhart, president of the Florence Goldfield Co., who is now operating in the California oilfields, the policy of the Florence company as to future dividend-disbursements cannot be learned. From information obtainable the Florence is making excellent profits, treating 150 tons per day of $25 ore and better, by approved processes, and effecting a high recovery of gold. The manager states that preparations are being made to enlarge the main shaft to the 500-ft. level, and that he has sufficient ore of good quality broken in the Little-Florence stopes to supply the mill while the work in the shaft is in progress. One of the richest ore-shoots in the mine is now being opened on the 500-ft. level near the Engineers' lease-workings, and stopes of large size will be opened from the sill-floors on three levels near the main workings. It is said that ore reserves continue to increase well in advance of the tonnage required to supply the mill.

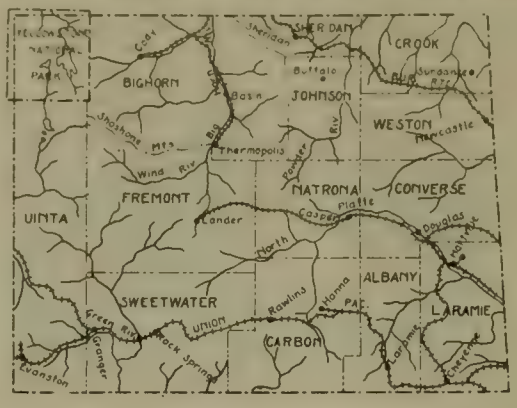
Stimulated by the discovery by lessees of a rich vein on the Diamondfield Black Butte, work has been started on company account. A cross-cut from the original adit is being driven toward the vein, and a change in the formation is already apparent, with seams of talc coming in. This is near the ground from which a large production of shipping ore was made four years ago, and where the high-grade ore in the flat vein apparently pinched out. The lessees on the Black Butte have recently made several shipments of ore, sampling $200 per ton, from the winze sunk at the end of the upper adit. A raise is being driven to the vein from the lower and longer adit, with the indication from surveys that this will require not over 40 ft. of work. Ore is now being shipped from the Gold Bar workings of the C. O. D. Consolidated by lessees who have a five-year lease on this shaft, and who will build a 50-ton mill. Late development in these workings has resulted in opening veins of shipping ore, and two carloads of $60 ore have just gone out. Late reports say that on the 300-ft. level there is a 9-ft. face of $120 ore, but the ore-shoots vary in width, and while there is a large tonnage of excellent milling ore exposed, the high-grade is by no means uniform in any of the veins. Driving is in progress from the 800-ft. station of the Annex shaft on the Polverde, where ore-bins have been installed, and shipping will begin at once. The shaft will be continued to the 1000 ft. level. The Grizzly Bear shaft is nearing the 1000 ft. point, and will sink to the Mohawk vein.

DENVER, COLORADO.

Coal Land Cases. — San Juan Conditions. — Petroleum.

The extent of the coal land fraud cases is realized by few people. In Colorado, alone, 20,000 acres of coal and forest lands are in litigation. The greater part is in Routt and adjoining counties. The famous Kletel case, involving 2400 acres, and the case against the Union Land Co., controlling 5600 acres, are now being argued. In Wyoming, the Government has secured a temporary injunction against the Owl Creek Coal Co., preventing it from operating its Gebo mine during the arguing of the case. This mine employs nearly 1000 men. The case is to decide the title to 9500 acres of the best coal land in the State, lying just north of Lander. The investigation has been going on for three years.

The San Juan district has been shut off from the outside world for several days at a time during the past month by the heavy snowstorms and slides so common at this time of the year in that district. The Yukon group of claims on Boulder mountain, near Silverton, has been steadily developed since its purchase by the W. B. Lowe Mining & Milling Co. last November. The management has recently increased the working force and expects to be able to make a heavy



Map of Wyoming.

shipment as soon as the season opens. The pyritic smelter north of Ouray has been sold to Easterners who intend to operate it during the coming summer. The first payment has been made and ore contracts are being negotiated with nearby producers. With the smelter in operation many properties now idle will resume operation. A contract has been let to rebuild the Midway terminal of the Silver Lake tram in Arastra gulch. The material is being assembled and the work will proceed despite the weather. It is understood that the company will shortly take over the leases and operate the Silver Lake mine on company account. The U. S. R. & R. Co. has re-classified their wage schedule which results in an increase to 70% of their employees at Colorado City.

The report of the State oil inspector indicates that production from the Florence and Boulder fields was slightly less for the past year than for 1908. Of the new localities showing oil the most promising are those in Routt and Rio Blanco counties. A producing well has been brought in near Cody, Wyoming, by C. L. Sheedy, operating under lease from the Western Oil & Gas Co. The Fidelity Oil & Gas Co., operating in the Boulder field, has struck oil at a depth of 2750 ft. on the Moffat place, about a mile north of any producing wells in the district. After two years of litigation the United Oil Co., of Florence, has won its suit against the Inland Oil Co., of Boulder. It was shown that the former secretary-treasurer of the United had used funds and equipment of that company to develop the properties of the Inland of which he was the principal stockholder. The decree gives the United three-fourths of the stock of the Inland, and a cash judgment of $14,671, to pay for the use of its property.

MEXICO.

Greene-Cananea.—Llanos de Oro. — Dolores, Chihuahua. — Conchos Dam and Railroad.— Tula Iron Works. — Pachuca Enterprises.—Oil Situation.

The Greene-Cananea Copper Co. has started the present year with a smaller production than at the beginning of 1908. The January output was 3,500,000 lb. copper, 464 oz. gold, and 85,132 oz. silver, as against 3,848,000 lb. copper, 558 oz. gold, and 89,495 oz. silver in January of the preceding year. The work of reconstructing, and installing new equipment, which has claimed the attention of the company since the Cole-Ryan interests secured control, has been practically completed, and the Greene-Cananea is now in a position to greatly increase its output.

The affairs of the Llanos de Oro Consolidated Mining Co., operating in the Altar district of Sonora, have been taken into court at Hermosillo, and Louis H. Mooser, of San Francisco, has been appointed receiver. The original company was organized to work extensive deposits of auriferous gravel, and when they failed to develop according to expectations, adjacent gold veins were acquired and a reorganization effected. The company placed a 50-stamp mill in commission last year. Epes Randolph, of Tucson, Arizona, has been prominently identified with the enterprise. The Lucky Tiger Gold Mining Co., owning the rich El Tigre mine, has commenced work on a cyanide annex that will materially increase its production. The mine is developing in a most satisfactory manner, and ore to the value of millions of dollars is now blocked. Much excitement is reported from the vicinity of Nacori, 100 miles south of Nacozari, as the result of the discovery of a rich and wide gold-silver vein, which can be traced, it is said, for several miles. Many denouncements are being made. Mrs. Myra T. Seymour, owner of the Torres & Prietas railway, who has been in England for some time, is said to have arranged with British interests for the extension of the line east through the Barranca region to a connection with the Yaqui river extension of the Southern Pacific.

The annual report of the Dolores Mines Co., operating in western Chihuahua, shows a total income for 1909 of $1,160,531, and net profits of $462,896. Dividends to the amount of $238,800 were paid, and a surplus exists of $740,646. The 1909 earnings were nearly $400,000 greater than those of 1908, and the net earnings increased $120,000. The ore reserves at the end of the year were estimated to have a value of $1,702,620. Bernard MacDonald, the Guanajuato cyanide expert, has taken the management of the Veta Colorado Mining & Smelting Co., at Minas Nuevas, in the Parral district of Chihuahua, and will push the completion of the 500-ton cyanide plant, which was started several years ago. Contracts for the additional equipment necessary have been made. It is planned to immediately resume development in the Quebradillas and other mines of the company. The Veta Colorado has been at a standstill since 1907, as a result of the financial depression in the United States. The English firm of S. Pearson & Son, Ltd., has finished grading for the railroad that will handle materials from Santa Rosalía, on the National Railways, to the site of the great dam and power-plant on the Conchos river, to be built at a cost of ₱15,000,000 by the Mexican Northern Power Co., a Canadian concern. As soon as track can be built work on the dam will start, and 3000 men will be given employment. Power from the Conchos river plant will be transmitted to the Naica, Parral, Santa Eulalia, and other mining districts of Chihuahua.

Alfred Rodriguez, a Mexican congressman, who for several months has been working on a project for the erection of a zinc smelter in Torreón, states that the plant is practically assured. French capitalists are now negotiating for productive zinc properties owned by José Lago at Plomosas, on the Orient railway in Chihuahua.

The Tula iron mines, in the Tapalpa district of Jalisco, which have been worked for more than a century, and which are known throughout Mexico for the superior quality of their product, have passed into the control of the Mexico Iron & Steel Co., of Boston, through a fourth payment of ₱100,000 on the purchase price of ₱1,000,000. A deal for the properties was made by Boston people last July, and the company formed with a capital of $5,000,000. It is announced that French capitalists will join with the Boston men in the exploitation of the iron deposits, and the timber and lands that go with them. An investment of $500,000 in smelting furnaces, a steel plant, tool and implement factory, and tramways is planned. The Lupita Mines Co., of Colorado Springs, owning the Lupita mines in the Mascota district of Jalisco, is resuming milling after three years of idleness. A cyanide plant has been added to the reduction works. In an extension of the Lupita mines, recently opened by the company, ore running as high as 14 kilograms silver per ton has been opened.

After securing data on the probable tonnage from mines in the Magdalena district of Oaxaca, the management of the National Railways has decided to build 17 miles of railroad to reach that district. The railroad is expected to result in the blowing in of the 50-ton Magdalena smelter, which has been idle for a long period. A number of Oaxaca mining enterprises were crippled by the failure of the United States Banking Co., of Mexico City, which maintained a branch in Oaxaca. The failure caused the suspension of work on the 100-ton reduction plant at the San Francisco mine, in the Taviche district, and it may be some time before the plant can be completed. The property is held by the Tehuantepec Silver Mines Co. Good progress is being made in the erection of the Victoria-Tapada reduction plant in the Totolapam district of Oaxaca. The plant will handle custom ores, and is expected to be of much benefit to mining interests in that region.

Santa Gertrudis Patio.

The Pachuca district of the State of Hidalgo, now in the limelight by reason of the Santa Gertrúdis purchase, promises to secure additional British capital through the transfer of the Dos Carlos properties, adjoining the Santa Gertrúdis mines. M. W. Greit, representing the British-Mexican Exploration Syndicate, of London, has taken an option to purchase Dos Carlos No. 2 and No. 3 for ₱1,000,000, and H. S. Walker, a mining engineer who examined the properties, has left Mexico for England to render his report. The option calls for a substantial payment within 60 days, and the remainder within a period of three years. The Dos Carlos properties, comprising 114 pertenencias, are owned by Pachuca men, and the western portion, known as Dos Carlos No. 1, and having an area of 42 pertenencias, was leased some time ago to the Phoebe Mining & Milling Co., which concern is sinking a shaft. It is the opinion of engineers who have made investigations that the Santa Gertrúdis veins will be found also in the Dos Carlos properties in depth, and if the deal is closed the sinking of a deep shaft will be commenced at once. The British interests represented by Captain Greit have holdings in Sonora, and recently options on several properties in that State were arranged. Hugh Rose, manager of Santa Gertrúdis, announces that the 300-ton cyanide plant, practically completed by the old Santa Gertrúdis company, will be given the finishing touches and soon placed in commission. The Camp Bird representatives are not impressed with the lo-

cation of the new plant, and it was thought that it might not be operated. Plans for another and larger plant, to be built near the San Francisco shaft, are being prepared. It is now announced that the Mexican Light & Power Co., the big Canadian concern, has purchased all the stock of the Hidalgo Electric & Irrigation Co., and is consequently in complete control of the power situation in the Pachuca district. A working agreement was at first announced. The mining concerns of the Pachuca district are now using several thousand horse-power, and much additional power is demanded. Power from Necaxa will reach Pachuca in June.

A pipe line and narrow gauge railway, giving the Furbero oilfields of the Oil Fields of Mexico Co., in the State of Vera Cruz, connection with the Gulf port of Tuxpam, are nearing completion, and it is expected to start pumping oil early in March. The pipe line and railway have been built at a cost of ₱2,500,000 by S. Pearson & Son, Ltd., which firm has a contract with the Oil Fields of Mexico Co. for a maximum of 6000 bbl. of oil daily for a period of 12 years. The Pearson interests and their Mexican ally, the Compañía Mexicana de Petroleo El Aguila, are anxious to place the Furbero pipe line in commission, as for months they have been compelled to import Texas crude oil for their refinery at Minatitlán. Their war with the Waters Pierce Oil Co., the Standard concern, for the control of the Mexican field has created a demand at the refinery that their wells are at present unable to supply. Officers of the Oil Fields of Mexico Co. estimate the production of the Furbero wells at 20,000 bbl. daily, and the pipe-line has a daily capacity of 12,000. The Pearsons may arrange to take up to the full capacity of the pipe-line. The East Coast Oil Co., a Southern Pacific concern, has contracted to purchase 60,000 acres of oil land in the Topila district of Vera Cruz for ₱1,250,000. The company is now sinking a well on the land, and will put down others. In that district, a short time ago, a well was brought in by the Mexican Fuel Co., a Waters Pierce concern. The Southern Pacific interests are anxious to develop fuel-oil supplies for their Mexico lines, and contemplate extensive oil exploration work along the west coast of Mexico. They recently abandoned a well in the Tuxpám district of Vera Cruz, after reaching a depth of 4000 ft. without a satisfactory showing.

BUTTE, MONTANA.

February Copper Output.—Decision in Magone Case.—East Butte and Davis-Daly.—The Merger with the Anaconda.—Hypocka Mine.—John Gillie to Retire.—Piltsmont Smelter.

The copper production by the Butte companies in February was the lowest monthly output in years, caused by the strike of engineers and the shorter month, together with the policy of curtailment that had been observed before the strike began. According to estimates the total production amounted to 14,000,000 lb., the different companies contributing as follows:

Companies.	Copper, lb.
Boston & Montana	4,200,000
Anaconda	3,100,000
Butte Coalition	2,100,000
North Butte	1,225,000
Original	720,000
East Butte	534,000
Butte & Boston	435,000
Trenton	333,000
Washoe	230,000
Parrot	150,000
Miscellaneous	973,000
Total	14,000,000

Mining men from the Atlantic to the Pacific will be interested in the decision just handed down by Federal Judge William H. Hunt in favor of the defendant smelting companies in the celebrated Hugh Magone case. This was first brought to public attention a few years ago when Mr. Magone applied for an injunction to restrain milling and smelting companies operating in this city and Anaconda from polluting the Deer Lodge river, and demanding damages for injury claimed to have been done to his land in the Deer Lodge valley. Judge Hunt referred the matter to the master in chancery to hear evidence, and taking of testimony consumed a large amount of time. The litigation has became nearly as famous as the smoke case. From the findings of the master in chancery, Judge Hunt refused to issue the injunction, but Mr. Magone is given judgment for $572.50. He demanded damages on account of tailing and other waste distributed over his farm through irrigation ditches. Judge Hunt held that Magone was not entitled to any such damages but may collect for injury done by the overflow of the river upon his land. The court held that the chief damage resulted from the use of polluted water in the irrigation ditches, and that there was no foundation for the complaint. Judge Hunt then further pointed out in his decision that the prior appropriator has the right as against a subsequent appropriator to use the water for mining and smelting as well as for irrigation purposes. He says that in the enjoyment of this right there is also necessarily included the right of pollution of the water to some extent, provided the use makes pollution necessary. It may be very light perhaps, if the use is for irrigation, but oftentimes comparatively serious if the use be for mining or smelting. The judge points out that

Anaconda Mill.

defendants' appropriations were several years earlier than the appropriation made by complainant. He says that complainant knew of the earlier right and their uses, and the pollution of the stream has been no greater than necessarily and unavoidably connected with the successful operation of the defendants' smelters. The Anaconda Copper Co. was included in the suit, but the judge held that it had done no substantial damage and dismissed it from the action. The percentages of payment fixed by the court against the companies involved were: Colorado Smelting & Mining Co., 24%; the Colusa-Parrot Mining & Smelting Co., 16; Parrot Silver & Copper Co., 18⅔; Montana Ore Purchasing Co., 24; and the Butte & Boston Consolidated Mining Co., 17⅓. The court gave the defendants 60 days in which to make the payment, and if at the end of that time payment is not made, an injunction will issue.

A story is circulating in the East to the effect that a movement is on foot for a consolidation of the East Butte and Davis-Daly interests, it being stated that a brokerage firm of Boston is willing to pay the proposed assessment of Davis-Daly on condition that it be given control of the Heinze company and the expenditure of the money received from the assessment. However, the whole story is denied. The Davis-Daly company is capitalized for 670,000 shares, of which 70,000 shares are in the treasury, so that the Davis-Daly people take the view that the Boston brokerage firm which controls East Butte would willingly pay, say, a $3 assessment, in order to get control of the property. There seems to be a well founded report that an effort to

raise $150,000 has failed, and now Mr. Heinze proposes to sell the 70,000 shares of treasury stock to replenish the treasury, and thus escape levying an assessment. As soon as the proposed tramway is built from the Colorado mine to connect with the railway, the shipment of Davis-Daly ore to the Basin concentrator will be commenced, and the company will begin to earn money.

Another story is out concerning Tuolumne. It has been stated that North Butte is not to be taken into the merger, but that Tuolumne will. Both the North Butte and Tuolumne people deny the story, and among people supposed to be well posted in what is transpiring in mining circles there is a belief that there is nothing to it.

B. B. Thayer, president of the Anaconda Copper Mining Co., and C. F. Kelley, chief counsel of the Amalgamated Copper Co., have arrived in this city from New York to make preparations for the meeting of the Anaconda company on March 23 for the purpose of increasing the stock of the company and completing the plans for the merger of the Butte mines. There is not the least shadow of doubt that the plans as agreed on will go through without serious opposition. In this connection it may be mentioned that a special meeting of the Boston & Montana company is called for March 26, three days after the Anaconda meeting, for the purpose, as set out in the notice, to consider a proposition to sell and dispose of the whole of the property and assets of every kind to the Anaconda company for a part of the capital stock of the Anaconda company. The meeting will take place in this city at 10 o'clock in the morning.

The East Gem mine case has been decided in favor of Maurice Eisenburg and against the H. L. Frank estate, the court finding that Eisenburg is entitled to an eighth interest in the property. Eisenburg and the late H. L. Frank had a lease on the property. Later Frank bought the property and sold it to the North Butte. It was Frank's contention that Eisenburg's interest ceased with the lease, and that he bought the property on his own account and with his own money.

The Tuolumne Copper Mining Co. has filed its annual statement as required by law. The capital stock of the company is $8,000,000, fully paid up, while the assets consist of mining claims to the value of $400,000, cash $142,444, machinery, etc., $43,918, miscellaneous items $4500, making a total of $590,862. There are no liabilities.

An order of court has been made appointing a receiver for Heinze's Hypocka Mining Co. The appointment was made in order to collect an unsatisfied judgment of $12,500 secured against the company by an employee who was injured while at work in the Minnie Healy mine under the Heinze ownership. The Hypocka was organized by Heinze several years ago to meet some of his purposes during his mining litigation, and the company was supposed to own the shaft and cages of the Minnie Healy. The company was capitalized with 4000 shares of stock of a par value of $25 per share. Only a few shares were issued, as Heinze retained 3925 shares. Under the laws of Montana the stockholders are liable for the full par value of the stock, and it is proposed to ask Heinze to pay for the shares he owned in the company.

There is also an unsatisfied judgment against the Pittsburg & Montana Copper Mining Co., and a receiver is asked to collect the amount, but action has been deferred pending word from the stockholders. The Pittsburg & Montana company is practically out of existence, as its properties were sold to satisfy mortgage-bonds held by the Pittsmont company, and the latter in turn transferred the property to the East Butte Mining Co. The recent labor troubles have renewed the rumors concerning the retirement of John Gillie as general superintendent of the Amalgamated properties, it being stated that Mr. Gillie rather inclined to the side of the engineers who walked out, which was not in accordance with the desire of John D. Ryan, president of the Amalgamated Copper Co. Rumor declares the retirement of Mr. Gillie will take place on April 1, the date when the merger of the Butte mines goes into effect. Mr. Gillie has been connected with the mines here for many years, and should the rumor prove true there will be a feeling of regret among all classes of citizens.

Official reports show that the East Butte Copper Mining Co. and the Pittsmont smelter are turning out copper at the rate of about 7,000,000 lb. per annum. It is stated that whenever the market justifies it the company will double the production. In October, November, December, and January the total output was 2,315,776 lb., which is at the rate of 6,947,228 lb. per year. The East Butte mine and the Pittsmont smelter were not interfered with during the engineer trouble.

RAY, ARIZONA.

Ray Consolidated Ore and Mill.—Arizona-Hercules.

At Ray are the properties of the Ray Consolidated Copper Co., situated mainly on the west side of Mineral creek, six miles north from Kelvin, a station on the Arizona Eastern, situated on the Gila river. To facilitate mining and milling operations the Ray company has built a standard-gauge railroad from Kelvin to the mines at Ray. Its mill-site is two miles east of Winkelman, a station 12 miles up the Gila from Kelvin, where an ample water supply and sufficient tailing area have been obtained. The orebody is in altered Pinal schist, is flat in position, has a strike northwest approximately 6000 ft., and is of undetermined width. This mineralized area has a schistose capping impregnated with oxidized iron, 200 to 250 ft. in depth, below which is the main body of chalcocite, said to average 2¼% copper. While the copper glance is generally disseminated through the gangue, there are many streaks and bands of this ore in concentrated form. The development work shows some narrow dikes of granite-porphyry and diabase which are also mineralized. A main haulage level starts some 20 ft. higher than the bed of Mineral creek, going 2000 ft. horizontally into the orebody to a place near the southern boundary of the mineralized zone. This level is 8 by 14 ft. and double-tracked. On both sides the ore is blocked out to a considerable extent. This level connects with a 300-ft. 2-compartment shaft which sinks close to the northern limit of the orebody, from the three stations in which levels have been driven in ore. An ore-loading pocket of 600 tons capacity is being put in at each station to receive the ore from these levels. Ore is to be drawn from the pockets through air-actuated gates into 12½-ton skips in the shaft. The haulage system will consist of 5-ton cars in train, drawn by 10-ton electric locomotives. Three cars at a time are to be dumped by a revolving tipple at each ore pocket. The hoisting will be done by electrical equipment of the company's design. A 30° incline, 7 by 16 ft., 3-compartment, has been driven down on the edge of the orebody, connecting with the various levels, which is to be used exclusively as a passageway for men and the haulage of supplies. Besides the development work in progress on the principal levels, as above outlined, there are 12 churn-drills kept busy doing exploratory work on other parts of the group. The coarse-crushing plant will be at the mine, the crushed ore from which is to pass into the bins, thence loaded into railroad cars and transported to the mill. The storage bins at the mill are to hold 28,000 tons of crushed ore. The milling plant, in course of construction, is to have the capacity to concentrate 5000 tons of ore every 24 hours. The crushing department will consist of 16 sets of 42-in. rolls, having 10-in. faces; 24 Garfield Chilean mills, 6-ft. size; both rolls and Chilean mills are of this company's design. The sizing will be done on 48 impact screens, the concentrating by Garfield roughing tables, 72 Wilfley tables, and a type of horizontal-motion suspended vanner. The power plant will contain water-tube boilers, triple-expansion engines, direct-connected to electric generators, equal in the aggregate to 10,000 hp., from which power is to be distributed to the mill and mine. The mill, power plant, and other similar work has been designed by George O. Bradley, the company's mechanical engineer. E. M. Stewart is in charge of the mine work, Ernest Stenger being general superintendent.

The 240-acre group of the Arizona Hercules adjoins the Ray Consolidated and Ray Central on the east, lying mostly on the opposite side of Mineral creek, covering the Ray fault, and extending some distance east of it. The Arizona Hercules holdings extend 3900 ft. along this fault, which is virtually a lode on the contact of diabase and schist with

porphyry. Work on this group is under direction of W. P. Dunham, one of the principal stockholders, who has kept two Star drills in operation for several months, having completed 17 holes in exploration work. Of these holes, 14 are 200 ft. apart, the others being scout holes, 1200 ft. from the regular lines of development. The No. 13 hole, on the east side of the fault, is at a depth of 850 ft., and is said to have passed through three strata of ore, the last one being a body of chalcocite at 850 ft. depth, in diabase. This is taken as good evidence that the copper ores of the Ray district are not confined to the schist, but that they extend to the formation lying east of the Ray fault, which strikes nearly north.

WASHINGTON, D. C.

Alaska Coal Lands.—Mr. Birch and Mr. Steele Testify.—Copper Properties of the Alaska Syndicate.

The biggest surprise of the year in Washington came when representatives of the so-called Morgan-Guggenheim syndicate appeared before the Senate Committee on Territories and asked for an opportunity to tell about its mineral holdings in Alaska, how they were acquired, how business was being done, and what was wanted for the future. In these days when the heads of great corporations are objecting strenuously to publicity, to Federal incorporation, and to the interference proposed in the administration's legislative progress, this made people sit up. The agents of the syndicate who took this stand were John N. Steele, counsel of the Morgan Guggenheim people, a brother of Charles Steele of J. P. Morgan & Co., and Stephen Birch, managing director of the syndicate. They announced that they came voluntarily, following a request by J. P. Morgan & Co. for permission to appear to "answer exaggerated reports printed in the magazines and newspapers of the work of the syndicate, formed by that company and the Messrs. Guggenheim". A statement was presented in which it was admitted that an option on the Cunningham coal lands in Alaska was held. It was denied that the syndicate owned any coal lands in Alaska, the following language being used. "The syndicate has not and has never had any interest in any coal lands in Alaska except the interest it obtained under an option given by what are known as the Cunningham claimants in the latter part of 1907. At the time this option was given, Mr. Cunningham and his associates had paid the Government for their claims, and had received from the Government final receiver's certificates". This statement called out a fusillade of questions from Albert J. Beveridge, Senator from Indiana, and chairman of the committee. The representatives of the syndicate admitted that Messrs. Guggenheim had agreed to form a $5,000,000 corporation to develop the coal lands, one-half interest to be held by the Guggenheims and the other half by Mr. Cunningham and his associates. The Guggenheims were to pay $250,000 for their share, and, in addition to that sum, agreed to loan $100,000 if it were needed. Admission was also made that the syndicate paid Cunningham $1359.60 for traveling and other expenses in connection with the examination of the coal properties. Then followed an argument bearing on the right of the Cunninghams to sell their claims. Continuing, the syndicate's statement says: "An examination of their coal properties and of the Bering river field generally was made for the syndicate by a coal expert, who reported very large and extensive tracts of coal lands containing coal of a high grade. In the latter part of December, 1907, the option given by the agreement of July of the same year was exercised." At this point James B. Frazier, Senator from Tennessee and a member of the committee, took up the questioning of Mr. Birch. He drew from him that the coal fields of which the Cunningham 5000 acres are a part contained minable coal to the extent of 500,000,000 tons. As a practical engineer, Birch estimated that this tonnage in the ground was worth $900,000,000. He said that it would take $700,000,000 to mine this coal, leaving a net profit of $200,000,000. He also admitted, under questioning, that the value of the Cunningham coal claims, upon which the syndicate had an option, was $25,000,000. He meant by that, he said, the net profits.

At the suggestion of members of the committee the syndicate representatives produced a copy of the agreement between a committee of the entrymen on the Cunningham coal lands and a representative of the Alaska syndicate. In answer to questions Mr. Birch stated that the syndicate would not get the coal property unless, or until, the claims were patented by the Interior Department.

"What have you done toward securing patents?" Mr. Beveridge asked.

"Nothing," Mr. Birch replied. "It was not in our province to do anything."

"What have you done in the way of developing the coal lands?"

"We have never done anything. The property was never in our hands for us to do anything," said Mr. Birch.

"If the claims were patented tomorrow, would your option still be good?" asked Mr. Beveridge.

"That is what we hope and believe," said Mr. Steele.

"The coal in the Cunningham claims, on which you have an option, you estimate to be worth about $25,000,000?" Mr. Frazier asked Mr. Birch.

"Yes, sir," replied Mr. Birch.

"And your syndicate was to pay $250,000 for an equal interest in them?"

"That was one of the stipulations; yes, sir," was the reply. He explained that the syndicate was to furnish transportation for the coal to seaboard.

"You were greatly interested in seeing these Cunningham people get their patents?" persisted Mr. Frazier.

"Naturally."

"And you say you have taken no interest or steps in getting the claims patented?"

"We have taken an interest but have taken no steps," answered the witness.

The details of the copper mining properties belonging to the syndicate were also the subject of many questions. The syndicate, it was testified, bought out the Alaska Copper & Coal Co. After buying these holdings, some more copper lands were found nearby. These were secured by the syndicate's copper mining company from the Government.

"The company used members to make claims and furnished the money," said one of the witnesses. "After patents had been issued the company got the properties."

"The entrymen were dummies, then?" asked Mr. Frazier.

"No, sir," answered Mr. Birch. Mr. Birch further said that he was one of the locators on the tracts and that others interested in the company were also locators.

"How much land did you locate?" Mr. Birch was asked.

"I couldn't tell you that now," he replied.

"More than one tract?"

"I think so."

"And when you perfected title you turned the property over to the company?"

"Yes, sir, I acted as their agent."

"Did others interested in the company do the same?"

"Yes, sir."

"After we secured control of the property of the Alaska Copper & Coal Co," said Mr. Birch, continuing, "I found some lands nearby that were not located. I took them up for protection, using my own name and the names of others interested in the company."

The lands secured in this way, Mr. Birch said, are only a small portion of the 3200 acres of copper mining land which the syndicate has.

During the course of the hearing Mr. Birch pointed out that the copper and coal properties are worth little without transportation facilities. Railroads are necessary to get the machinery to work the mines to them and to haul the ore to the seaboard. It was brought out that the Alaska syndicate controls the railroad affording transportation to and from the district in which its copper mines are located.

"Controlling the transportation by which to get the machinery in and the ore out, wouldn't it seem that the Alaska syndicate has a tremendous advantage in the purchase of mines it does not own?" asked Mr. Beveridge.

"The Government will prevent that," Mr. Birch replied.

"How?"

"By governing the rates."

General Mining News.

ARIZONA.

COCHISE COUNTY.

(Special Correspondence).—The Copper Queen company has decided to withdraw from the Courtland district after having kept a force there on development work for a year, during which time a considerable amount of work has been done at the Casey, Brown, and Silverton shafts, under direction of P. G. Beckett. It is considered now that results obtained do not justify further development. The steam-electric power-plant built jointly by the Copper Queen company and the Great Western Copper Co., will be operated by the latter for air-compressors and hoists. The Great Western Copper Co., operating two shafts at Courtland, is shipping 100 tons of ore per day to the El Paso smelting plant. This ore consists of azurite, malachite, and chrysocolla, with a small amount of cuprite. A pitch-like ore which occurs in considerable quantity, is locally called black chrysocolla. Thus far, the shipments are made from the company's Mary shaft, in the north end of the district, mostly from stopes between the 100 and 200-ft. levels. Work is in progress on the Mamie group, in the south part of the district, where there is a 300-ft. shaft, sunk within the last year. A cross-cut will be driven from this to the old workings that were made 12 to 15 years ago, known as the Humboldt. An adit drainage level has also been driven to the old workings. W. G. McBride is now superintendent of the property and has 85 men employed.——The Calumet & Arizona company has done a great deal of work in Courtland camp in the last year, and has shipped some ore as the result of development. Its Germania shaft, 500 ft. deep, is on the same lode as that on which the Great Western sank its Mary shaft. Its April Fool shaft, 900 ft. north of the Germania, has reached a depth of 500 ft., and the two shafts are connected on the 500-ft. level. It is understood that the results of the year's work are not especially satisfactory.——The Gold Queen Mining & Milling Co., in which local people are concerned, has done considerable work on a quartz vein, in a granite-porphyry hill two miles north of Courtland, where free-milling gold ore has been found, assaying $6 to $8 per ton. A 200-ft. shaft has been sunk with the aid of a whim, and now a gasoline hoist is to be put in.——The Copper Belle mine at Gleeson, controlled by N. L. Amster, is being operated by the Shannon Copper Co. as lessee. As Mr. Amster is president of the Shannon Copper Co. and Arizona Commercial Co., the three concerns are closely allied. The Copper Belle has an irregular orebody in limestone, along a contact with porphyry. It is opened by a 300-ft. vertical shaft, having working levels from the 100, 200, and 300-ft. stations. The ore contains about 1% copper, 45% iron, 40% sulphur, 10% silica, the balance lime, with $1.25 per ton in gold and silver. It is valuable chiefly as a fluxing ore to mix with the silicious copper ores of Globe and Clifton. Shipments consist of 50 tons per day to the smelting plant of the Arizona Commercial Co., at Globe, and 125 tons per day to the Shannon plant at Clifton. There is a working force at the mine of 125 men, with H. H. Dyer as superintendent.——The Tejon Mining Co., with W. H. McKittrick as principal stockholder, is developing a north and south lode that parallels the Copper Belle ore-zone. Its hanging wall is the limestone cap-rock of the mountain, the foot-wall being porphyry. The vein, which has a dip east of 35°, is opened by a cross-cut of 174 ft. from the side of the mountain, then by an incline on the foot-wall. The ore assays 85% silica, and $6 per ton in gold and silver. About six cars per week is to be shipped to the smelting plants at Douglas to be used as converter lining. This vein is identical with the old Tom Scott and Silver Bill veins, worked profitably 30 years ago. The Tejon, of which L. I. Thiers is superintendent, has another vein wholly in the porphyry, containing sulphide ore.

Courtland, February 26.

GILA COUNTY.

(Special Correspondence).—The north and south cross-cuts on the 650-ft. level of the Superior & Globe property, near Globe, has been driven 230 and 245 ft., respectively.——The Live Oak Development Co. is installing a 10-drill compressor, which is expected to be in operation within a week.——The Superior & Boston Copper Co. is installing a 1000-gal. Prescott pump at the sixth level of the McGaw shaft. Sinking is being continued in the shaft below this level to the eighth, where the Great Eastern vein will be explored.——An 8-ft. stratum of slate and shale has been passed through in sinking the Williams shaft of the National Mining Exploration Co., which is now 580 ft. deep.——The second churn-drill hole on the Cordova Copper Co.'s property has cut considerable sulphide from the depth of 60 ft. to the present depth of 250 ft. This hole is 500 ft. east of hole No. 1, where 300 ft. of sulphide was drilled through.——On the property of the Miami Copper Co., the No. 4 drill-hole is in sulphide ore at a depth of 350 ft., and the fifth drill-hole is being started.

Globe, February 26.

CALIFORNIA.

AMADOR COUNTY.

The drift at the Fremont-Gover mine, near Drytown, opened a pocket and approximately $50,000 worth of high-grade ore was taken out.——The Bunker Hill company paid its regular dividend of 5c. per share February 15.——The South Eureka, at Sutter Creek, has finished the installation of 20 stamps in the mill and now has 60 stamps dropping on ore from the South Eureka mine, 40 in the South Eureka, and 20 in the Central Eureka mill. It is the intention of the company to add another 20 stamps to its mill.——The Mason mine has been sold to local operators. There is about 160 acres in the group and a mill has been erected on the property.

INYO COUNTY.

The Four Metals company, operating in the Keeler district, is stoping on the 1100-ft. level of the old Union mine which is 200 ft. below the old workings. The vein is from 2½ to 3 ft. wide, and the ore is shipped without sorting to the plant of the United States Smelting Co., at Salt Lake.——The turbine for the power-plant at the Buckeye mine, south of Fish Springs, has been installed and it is thought that the mill will be ready for operation within the next two months.——About 12 carloads of ore per month is being shipped from the New Coso property. The ore is being stoped on the 400-ft. level where the richest portion of the vein is about 4 ft. wide and nets the company approximately $50 per ton.

LOS ANGELES COUNTY.

The Sierra Madre club, of Los Angeles, has guaranteed $10,000 to defray the expenses of holding the meeting of the American Mining Congress in that city September 26 to October 1 and will endeavor to increase the fund to $25,000.

NEVADA COUNTY.

(Special Correspondence).—Operations have been temporarily suspended at the Diana mine, in the Grass Valley district.——The Jenny Lind mill will commence a trial run on 200 tons of gravel this week. It is reported that the main channel has been intersected.——The Fairview is arranging for the completion of its mill and tramway.——The Giant King, in the Washington district, is sinking an air shaft.——In the North Star mill 80 stamps are dropping steadily and about $100,000 per month is being produced. Considerable development is under way below the 4000-ft. level.——The Curnow group of seven quartz claims at Columbia have been bonded by the Roseville Mining & Milling Co. The adit is in 170 ft. and is expected to cut the main vein in about 100 ft.——The shaft at the Prudential is going down steadily. It is planned to drive a cross-cut from the shaft to open the vein at a point 200 ft. below the present workings. The mill is operating 10 hours per day.——The 10-stamp mill at the Pittsburg has resumed on ore from the drift on the 1000-ft. level. The vein at this point is but a few inches wide, but assays well. A station is being cut at the 1100-ft. level from which a cross-cut will be driven to the vein. Mark B. Kerr is manager.——The erection of the head-frame at the Mountaineer shaft will be

under way before the end of the week. 10,000 ft. of Oregon pine has just been received for the work.

Grass Valley, February 28.

SIERRA COUNTY.

The lawsuit which has stopped the work at the Sixteen to One mine at Alleghany, has been settled and operations have been resumed at the property. H. L. Johnson, owner of the Tightner mine in the same district, is now manager for the new company which has been organized to work the property.——The new hoist at the Sierra Buttes has been finished and work is to be started putting in several thousand feet of new pipe to the mill.——A rich shoot of ore has been opened in the Rainbow mine near Alleghany. The discovery was made east of the portion of the mine in which the former rich ore has been opened.——On the Phippen Davis property, at Mountain House, a drift is being driven on a 3-ft. vein rich in arsenical sulphide.——The drift at the Swastika mine, at Sierra City, opened a new shoot and some rich ore is being taken out. Lawrence H. Holley is superintendent.

TUOLUMNE COUNTY.

(Special Correspondence).—The Republican mine, near Jacksonville, will be operated by a company composed entirely of local people, among whom are T. F. McGovern, of Sonora, who for many years has been in charge of the property, and G. W. Price. The work of unwatering the mine has been started.——G. K. Allen has secured a bond on a promising claim above the Riverside mine and owned by Fred Hibbing. A 3-ft. vein with considerable rich sulphide has been opened.——As a result of the recent rich discovery, the company working the Gold Spring mine will probably equip the property with a larger surface plant than at first decided upon.——William Heath and associates, who are working a claim in the Buchanan district, report they have an 8-in. vein from which they are obtaining $35 per ton with an arrastre.——The Talahoosa Mining Co., whose property is situated east of Groveland, will soon commence development work on a large scale. The company is soon to make the final payment on the property.——Machine-drills are now used in the Mangante mine, near Jamestown, the work of installing the compressor having been completed several days ago.——The hoist at the Shawmut mine is again in operation, but the milling of ore will not be resumed for a few weeks more.——The mill at the Dutch mine has been thoroughly repaired and will be started soon on ore which is being extracted from three levels.——The re-trial of the case of Daniel Manning v. App Consolidated Gold Mining Co., in the Tuolumne County Superior Court, ended February 19, the verdict of the jury awarding plaintiff damages in the sum of $17,500. Manning was injured in the App mine, at Quartz, in 1901, by a timber, which fell from the skip to the bottom of the shaft, where he was working. The first trial, which was in 1902, resulted in awarding the plaintiff $5000.

Tuolumne, February 28.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—A bonanza discovery was made last week at the Saxon mine, in the Georgetown district. In driving the adit the vein was intersected 55 ft. from the portal, containing a streak of ore that is from 6 to 10 in. wide and assays from $125 to $150 per ton gold and silver. A. Robert is operating under bond and lease.——Another vein has just been cut by the LaMoe adit, on Breckenridge mountain, a body of ore having been cut that is from 8 to 12 in. wide.——Work has been resumed on the Pinion & Annex property on Alpine mountain.——The Two American Sisters Mining, Milling, Power & Electric Co. is preparing to resume work in the Princess of India adit, the portal of which is situated on Columbian mountain. It is to be driven 1200 ft. farther to intersect the American Sisters vein. J. J. White is manager.——The Central adit of the Big Five company, operating in the Idaho Springs district, was driven 95 ft. during the month of January, making the total distance 8067 ft. The next property of promise to be reached is the Lake, which has been a heavy producer from the shaft workings.——A body of ore 8 ft. wide has been opened in the New Era property at Free land and the entire width is being stoped, the product being sent to the Modern smelter.——J. Conzins is the lessee.——A 6-in. streak of smelting ore has been opened in the Indiana vein, on Chicago mountain, that assays $2.60 gold and 8 oz. silver per ton, with 4% copper.——E. M. Moscript, owner of the Blue Bird, has granted a bond and lease to A. Morelli.——Charles Taylor has just completed a 5-stamp mill on Ute creek and as soon as sufficient water is available the machinery will be started. It is estimated that there are 100 tons of free milling ore on the dump.

Idaho Springs, February 26.

GILPIN COUNTY.

(Special Correspondence).—The shaft building on the Alps mine, in the Central City district, was consumed by fire last week. James Williams, the lessee, states that a new building will be constructed at once.——A 3-year lease and bond on the Stewart mine, in Leavenworth gulch, has been secured by McMasters Brothers. The shaft is down 80 ft., exposing a 3-in. streak of smelting ore.——H. Altvater & Co. have taken a lease on the O. K. mine. A small engine-house has just been completed, and the shaft, down 180 ft., is to be sunk another 100.——A force of men is being employed at the Senator property and heavy shipments of ore have been started. Returns of 1.1 oz. gold and 17.5 oz. silver per ton are being realized. On an average 25 tons per week are being sold.——Work is to be resumed at an early date on the Gunnell mine, one of the former heavy producers of the district.

Central City, February 25.

LAKE COUNTY.

The north drift from the Dinero adit at Leadville has opened a 5-ft. shoot of ore that assays 100 oz. silver and 2½ oz. gold per ton. John Harrison is superintendent.——Operations have been resumed in the Boulder shaft which was injured by fire some months ago.——The lessees of the Coronado and Hibschle properties are shipping from 25 to 30 tons of ore per day. The ore is being mined on the 450-ft. level and contains a fair percentage of lead.——Shipments have been started from the Little Bob property in South Evans gulch which was recently taken under bond by George Champion and associates.——A body of zinc ore has been opened on the 700-ft. level of the Louisville mine which is being worked through the Yak tunnel and shipping will be resumed in the near future.——The New Monarch mine, on Little Ellen hill, is to be unwatered and a new electric pump installed.

TELLER COUNTY.

A new cross vein assaying about $25 per ton has been cut on the 900-ft. level of the Rexall mine at Victor. The vein is about 3 ft. wide, but no development work will be done on it till the main vein on that level is opened.——Charles Anderson and associates, leasing on the eighth level of the American Eagles property, shipped 25 tons of ore, the return on which amounted to $23 per ton.——S. A. Worcester, operating the Conundrum mine on Gold hill under lease, shipped two carloads of ore, the value of the screenings being estimated at $35 and the coarse ore $20 per ton.——The Petrol Gold Mining & Milling Co. has been organized to take over the holdings of the Papoose Gold Mining Co. on Squaw mountain.——A shoot from 6 to 20 ft. wide has been opened on the 1000-ft. level of the Cresson Consolidated and samples taken across the width of the vein run from $22 to $27 per ton.

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—The Sara Mining Co. has filed articles of incorporation with a capital stock of $18,000, and will open an old mine in the Webb City camp which has been idle some time. A mill is on the property and operations will be started as soon as the mine is drained.——The Fullerton Mining Co. has recently sold to Frederick Cook and associates an 80-acre tract in the Prosperity camp for a consideration of $70,000. The land adjoins the Ground & Irwin tract.——The mill at the Weaver

Tri-City mine, northwest of Carthage, is idle for the present to undergo extensive repairs made necessary by the slow sinking of the plant, due to the cutting out of a large ore deposit directly beneath it.——The Bohemian Girl is a new 200-ton plant under erection on the Kelley land north of Webb City. Ore here is found at shallow levels as well as in the sheet ground formation at 210 ft. The shallow levels will be left for the present and the sheet ground worked.——The large 500-ton plant of the Hercules company, west of Joplin, in the disseminated ore-field, is now completed and will be started as soon as the ventilation plant is completed.

Joplin, February 25.

MONTANA.

JEFFERSON COUNTY.

(Special Correspondence).—Samples of ore taken from the Montana-Corbin Copper Co.'s properties near Corbin give an assay return of 7.1% copper, about 40c. gold, and over 8 oz. silver per ton. The ore was taken from the cross-cut on the 400-ft. level of the main lead in the hanging wall. It is believed that a much better quality of ore will be found on the foot-wall side of the vein, as on the 235-ft. level where the orebody was fairly well opened the best assays were obtained there. On that level there is 2 ft. of high-grade ore.——W. C. Hosking, superintendent for the Calumet-Corbin company, reports that the company which was formerly held by Michigan capitalists is now controlled by St. Paul and Duluth people who propose to start active development work at once.——W. Q. Ranft, president of the Robert Emmet Copper Co., and Robert McArthur, consulting engineer, recently made an examination of the property in the Corbin-Wickes district. Preparations have been made to resume work on the vein eastward on the 350-ft. level where a good body of high-grade ore was opened lately. Sinking is soon to be resumed with the intention of going to a depth of 500 ft. before opening another level. The Robert Emmet is now supplying power from its electric plant to the Blue Bird mine and to the Amazon-Montana mine which is operating the Silver Star property, a mile and a half south of the Emmet.

Corbin, February 25.

SILVER BOW COUNTY.

(Special Correspondence).—The west cross-cut on the 1800-ft. level of the Colorado mine of the Davis-Daly company at Butte, is about 150 ft. from the main vein. At the present time a drift is being run on the small vein a short distance from the shaft which has been opened for a distance of about 150 ft. This is from 6 to 20 in. wide, and assays 2 to 4½% copper.——A vein about 3 ft. wide which assays 40% zinc, 40c. gold, and 8 oz. silver per ton, is being opened on the 1800-ft. level.——The ore on the lower levels of the Butte Coalition is reported to be improving. On the 1700-ft. level of the new vein opened on the 1500 and 1700-ft. levels, a 26-ft. orebody is said to average 7% copper. At the present time the company is producing about 4,100,000 lb. copper per month.

Butte, February 25.

NEVADA.

CLARK COUNTY.

(Special Correspondence).—The Quartette company is operating to a depth of 1200 ft. with good ore opened on the lower levels. The 40-stamp mill and cyanide annex are operating at full capacity and the monthly production of bullion is increasing.——The Spokane-Searchlight has opened ore to the 300-ft. level and is arranging to sink the shaft to water level. It is expected that the 10-stamp mill will be in operation soon. Richard Lloyd is manager.——Driving from the 300-ft. point on the New York Searchlight is progressing rapidly, and some good ore has been opened. This property is one of the best equipped in the district.——The Homestead properties are idle as far as the parent company is concerned though several parties of lessees are working with good results.——The 600-ft. shaft of the Philadelphia-Searchlight is being repaired for the resumption of activities, and it is reported that a diamond-drill will be installed.——The shaft of the Lenape Gold & Copper Mining Co. is down over 400 ft. The quartz vein was cut on the 200-ft. level, but it is expected to enter a body of copper ore near the 500-ft. point.——The Searchlight Mining & Milling Co. has resumed operations.

Searchlight, February 26.

The Knight mill, erected by the Joshua Hendy company on the Homestead Mining & Milling Co.'s property, has been completed and is now running on custom ore. The mill is fitted with a crusher and three 1000-lb. stamps and will treat from 10 to 15 tons per day. The company is to erect a cyanide annex at once.——The Perkins lease, on the Homestead property in the Searchlight district, is sinking on an 18-in. stringer below the 50-ft. level and has sent 20 tons of ore to the Knight mill.——A carload of ore has been forwarded from the I. X. L. lease to the Needles plant and the lessees have another 100 tons ready for shipment.

ESMERALDA COUNTY.

(Special Correspondence).—Reports by the manager of the Florence Goldfield mine indicate that both mine and mill are making an excellent record of production and treatment. A return to direct amalgamation has resulted in saving fully 40% of the gold in amalgam, and the cyanide feed is held at an average of $8 per ton. The tonnage of concentrate has been materially reduced, effecting a corresponding economy in costs of transportation on the latter product. T. G. Lockhart, president of the Florence company, returned to Goldfield to attend the annual meeting at which a dividend of 10%, amounting to $105,000, was declared.——On the Combination Fraction sinking is in progress in the main shaft, and stations will be cut soon from which the work of exploring proved veins will be carried on at the 750 and probably at the 800-ft. levels.——The return from a shipment of 17 tons of ore from the Campbell lease on the Black Butte showed an average gold content of $170 per ton. This ore was taken from a winze sunk from the upper adit at a distance of 75 ft. from the portal. The vein has been cut in the lower adit by the lessees, and the company is now developing and driving for the same orebody on the north side of the hill.——A continued improvement is shown in the workings of the Gold Bar, where ore of shipping grade has been exposed by the lessees on the 150, 200, and 300-ft. levels. A shipment of the ore has been sent to the smelter, consisting of two carloads which is expected to return fully $60 per ton.

Goldfield, February 26.

The Sandstorm-Kendall consolidation is being carried out. The Cook bank will bring suit in foreclosure after which the two properties will be sold to George Wingfield for the amount of the indebtedness, $53,000, and a new company will be incorporated to take over and operate both, the stock of the new concern to be assessable.——Driving continues on the Nancy Donaldson in the eastern part of the district.——The shaft of the Yellow Tiger is being unwatered to the 700-ft. level from which point development will proceed.——On the Atlanta the vein cut from the Maloney shaft at the 630-ft. level is yielding low assays.——The Lincoln Goldfield lease on the Combination No. 2 is being opened by a cross-cut at a depth of 600 ft. from the Moore shaft.——Lessees are still taking small quantities of ore from the Daisy and occasional shipments are made from the Goldfield Belmont.——A raise from the lower adit on the Black Butte Consolidated is being driven for the rich ore-shoot opened above.

STOREY COUNTY.

The retimbering in the Ward shaft near Virginia City which has caused so much trouble recently has been completed and work is centered on the 2100-ft. level. A new station is being cut at the 2475-ft. level, and two pumps each, having a capacity of 2000 gal. per minute, have been ordered.——The face of the cross-cut on the 2300-ft. level of the Mexican mine is in quartz from which low assays are being obtained. The work on this level that is being done jointly by the Ophir and Mexican companies has opened the shoot for a distance of 250 ft. along the vein and 50 ft. across it.——The old south drift on the 1750-ft.

level of the Consolidated Virginia has been reopened and cleaned out for a distance of 450 ft. On the 1800-ft. level 202 carloads was stoped averaging $10.34 per ton.

NEW MEIXICO.

SIERRA COUNTY.

(Special Correspondence.) The Black Range district is situated in the northwest portion of the county which the mountains cross in an almost north and south course. The mining district proper is from 15 to 18 miles in length and from 4 to 6 miles in width. Locally, the term Apache district is also used to designate the extreme south end, but there are not actually two portions, for the Apache district, so called, merges imperceptibly into the Black Range district north and the two form and properly take the name of the Black Range. The most used route into the district is by good wagon road from Engle, a point on the El Paso branch of the Santa Fe railway, about 50 miles from Chloride, the main town of the district and the end of the stage route. A daily Government mail-stage, carrying passengers, runs to and from Engle and connects with

U. S. Treasury Shaft.

the Santa Fe trains to Albuquerque on the north and El Paso on the south. This route crosses the Rio Grande about 14 miles from Engle. The other route is by way of Socorro and Magdalena and is about 20 miles longer than the other one, but there are no rivers to cross and the road is excellent all the way, with an easy grade. The average altitude of the Black range is between 4000 and 6000 ft., although some of the peaks attain an elevation of 8000 to 10,000 ft., but the entire range is of easy access. The district is covered with a liberal growth of piñon, scrub oak, and pines, and there is ample water for all mining, milling, and domestic purposes. The principal property in the south end of the district is the old United States Treasury mine, a patented property which was located many years ago and from which a considerable production was made. It contains a large amount of low-grade milling ore and has recently become the sensation of the district by reason of extraordinary high-grade discoveries. Recent shipments from this property to the smelters at El Paso assayed 104 oz. silver and 10.14 oz. gold, and 153.2 oz. silver with 18.32 oz. gold per ton. It was this discovery which started the inrush and resulted in the rejuvenation of the district. It is understood that a big mill will be installed at this property during the coming year. In the north end of the district in the vicinity of the new town of Elmorine, considerable shipping ore has been exposed, some of it assaying as high as several hundred dollars per ton. In one vein, 3 ft. wide, in the Great Republic mine, which is the biggest mine in the north end of the district, there is a showing of ore which averages close to $60 per ton across the entire vein. In the central and north central portion of the district the Dreadnaught group shows both milling and shipping ore, and the old Ivanhoe mine also contains shipping and milling ore. The Silver Monument mine, one of the copper-silver properties, has had something over 2000 ft. of development and is one of the best properties in the camp. It is completely equipped with machinery and the development work thus far done has exposed large quantities of ore.

Chloride, February 25.

OKLAHOMA.

OTTAWA COUNTY.

(Special Correspondence).—A new discovery has been made in the Oklahoma field three miles northwest of Miami on the Ensworth land, the main orebody being opened at a depth of 72 ft. Both lead and zinc are found comparatively free from iron which is usually present in this part of the field. Hand jigs will be used for the present to clean the ore. The most important feature of the find is that it occurred in new territory and a number of drill-holes in the same vicinity also cut the deposit.——While the Miami Yankee company is engaged in sinking to a lower level the mill has been leased to the Willow Branch company to clean its ores. The Miami Yankee formerly operated at a depth of 90 ft., but is sinking the shaft to 140 ft. where a better run of ore is found. A fissure vein containing almost pure zinc blende was found and a winze sunk on it which led the company to deepen the shaft.——To the north, at Lincolnville, the Tennessee Metal Producing Co. is making preparations for a more extended development. It has taken over the Mascotte property, is building a tramway from this shaft to the Tennessee mill, and erecting a power-plant and derrick at the Mascotte shaft. The mill on the original property is being overhauled and oil burners installed.

Miami, February 26.

TEXAS.

EL PASO COUNTY.

(Special Correspondence).—More mining development is now in progress in the Quitman, Chinati, Davis, and Van Horn ranges of mountains than for many years. Many of the older prospects which have been idle for some time are being reopened with good prospects of becoming profitable producers of ore. It is announced that the Republic Mining & Milling Co. will soon start the mill and concentrating plant at its Bonanza mine in the Quitman mountains for the treatment of lead-zinc ore. William B. Phillips, director of the Bureau of Economic Geology of the University of Texas, who recently made an examination of the territory around the Bonanza mine, says: "It is a copper district of considerable promise, and very little attention need be given to the lead ores. Several cars of copper ore have been shipped, and the average of the selected material assayed 18% copper and $2 gold per ton. The best ore that has been taken out assayed 24% copper, 39 oz. silver, and 1.32 oz. gold."——A. D. Hudson, who is operating a turquoise mine in the Van Horn mountains, near the town of Van Horn, recently cut a vein that assays high in gold. ——The Little Lightning Copper Co. recently shipped several cars of high-grade copper ore from its mine in the Quitman mountains to the El Paso smelter. The company has increased its force of men and is getting out considerable ore.——A large body of ore that assays about 50 oz. silver per ton has been found on the claims owned by John Gilcrease, near the new station of Lasca on the Southern Pacific railroad. T. D. McKinney is superintendent.——A silver claim, situated in the foothills of the Quitman mountains, is being developed under the direction of John Moffet. The property is owned by Thomas O'Keefe, of El Paso.

El Paso, February 26.

UTAH.

JUAB COUNTY.

The shaft at the Tintic Central property at Tintic is now down 555 ft. The ground is loose and considerable water has been met, causing the work to advance rather slowly. A. N. Haldaway is manager.——On the 500-ft. level of the Iron Blossom No. 1 a drift has been driven 35 ft. from the station that was recently completed.——Four carloads of ore per week is being shipped from the Gemini and Ridge & Valley mines and a 500-gal. pump is to be added to the equipment. Jackson McChrystal is manager of both properties.——Two large boilers and a new hoist have been ordered for the Chief Consolidated mine and will be installed within the next 60 days.——During February 16 carloads of ore was shipped from the Eagle & Blue Bell mine. This was taken largely from the shoot recently opened on the 1200-ft. level. William Owens is superintendent.——Electric pumps capable of handling 1000 gal. per minute have been ordered by the management of the Centennial Eureka mine and will be installed on the lowest level of the property. Machinery for the new power plant is being shipped in and the work of construction is advancing rapidly.——A whim has been ordered for the Tintic Humboldt claim and sinking will be resumed at the 800-ft. level.

Conditions at the Chief Consolidated mining properties are improving. During the past week the management loaded nine cars of ore within seven days with high-grade silver-lead ore, mined from above the 1600-ft. level. Shipments are now netting the company above $30,000 per month, and this earning will be doubled during the coming summer months. Chief Consolidated is counted upon to become one of the regular dividend payers.

SALT LAKE COUNTY.

The Bingham Mines Co., Ltd., operating at Bingham Canyon, has issued its first annual report for the year ended December 11, in which it states that during the year $331,000 worth of the Bingham Consolidated Mining & Smelting Co.'s bonds have been cancelled, reducing the outstanding debt to $572,000, that there is a balance of cash and loans on hand of $10,111, and that the net profit for the year amounts to $55,774.——The Utah Metal Mining Co. has filed a suit in the United States Circuit Court against the New England Gold & Copper Co. to recover $1,350,000 for ore alleged to have been extracted from the property which was purchased from the Bingham Standard company. The plaintiff company at the same time filed a suit in equity against the New England company to preserve the property involved in the suit.

SUMMIT COUNTY.

The Daly West property is shipping considerable zinc concentrate, having sent out over 500 tons in January, 1100 tons in February, and is planning for an increased output this month. The annual meeting of the Daly West stockholders resulted in the re-election of the directors.——The bulk of the work at the Uintah Treasure Hill mine is now being carried on at the 250 and 600-ft. levels and is opening some fair ore.

WASHINGTON.

SNOHOMISH COUNTY.

(Special Correspondence).—The transportation problem, which has been the most difficult one confronting owners of mining property in the Sultan district, and which has greatly retarded one of the richest of the county's districts, is about to be solved. The Sultan Railway & Power Co., which, during the past three years has expended $60,000 in the development of a water-power at the head of the Sultan canyon, is under contract with the Government to commence construction of its electric road between the Great Northern railway and the power-plant before July 1. It is learned that Boston and other Eastern capitalists interested in the Forty-Five and other mining properties of the district are arranging to build an extension of this line up the valley, and that operations are to be resumed at the Forty-Five on a larger scale than ever before. The distance from the Great Northern to the power-plant is sixteen miles, and from the latter point to one equally accessible to the Forty-Five, North Coast, Little Chief, and Blackman properties it is about eight miles. The estimated maximum of the power-plant is 45,000 hp., the dam being 125 ft. high.——The North Coast Copper Co., at its annual meeting last week, authorized the purchase and installation of a 4-drill water-power compressor plant, and extensive development work is to be carried on this season under direction of George C. Clarke. At this meeting J. A. Falconer was elected president.——V. V. Clark, consulting engineer for the Copper Belle Mining & Smelting Co., who has just returned from a consultation with officers of the company in New York, stated that there was no immediate prospect of their smelter resuming operations. The company has expanded $600,000 in development and equipment of its property near Index, including a 100-ton concentrator and a 50-ton oil-burning matte-furnace.——Operations of the Wayside mine, at Granite Falls, which have been conducted for about a year under an agreement between the receiver and creditors, have been suspended and the mine is flooded. While the big pump was being removed one day last week, the auxiliary pump broke down and the water gained so fast that the crew had to abandon both. No plans for resumption of work have been announced. The last shot put in at the 850-ft. level exposed the best ore that has ever been seen in the mine.

Everett, February 19.

CANADA.

BRITISH COLUMBIA.

(Special Correspondence).—A new deposit of gold-copper ore assaying about $35 per ton has been cut by the diamond-drill on the ninth level of the War Eagle claim of the Consolidated group at Rossland. A new 5-ft. shoot has also been found on the third level of the Centre Star property of the same group.——The monthly report of the Le Roi No. 2, Ltd., for December shows shipments of 2480 tons of selected ore during that month. The approximate figures for January are 2300 tons. The company has declared a dividend of two shillings per share, payable March 8.——The Blue Bird Mining Co. is to resume work on its property in the south belt in a few days. The property was operated under lease last year and shipped some ore of excellent grade.——A new orebody has been cut on the 300-ft. level of the Inland Empire.——Though shut down several months, the British Columbia Copper Co. during its fiscal year ended November 30, treated 373,336 tons of ore at its Greenwood smelter, producing 6,325,000 lb. blister copper, 18,244 oz. gold, and 64,234 oz. silver. The cost per pound was 9.829c. which included all charges. The net profits for the fiscal year was $236,338, being $142,378 greater than for the same period the previous year. The average price received for copper sold was 13.08c. per lb.——It is understood that the board acting under the Conciliation Act, which was appointed to adjust the difficulty between the company and employees, failed to agree. The majority were against the union and its stand for the closed shop.——Arrangements have been made by A. E. Rand, of Westminster, to reopen the Dundee mine at Ymir. C. W. Riley, of Nelson, will be in charge. To reduce mining and pumping costs work will first be started on an 1800-ft. adit.——A rich shoot of ore from 12 to 14 ft. wide has been opened in the east cross-cut from the shaft on the Queen property at Salmo.——The Canadian Pacific railway will soon start work on its branch line from Elko to meet the line building southward from Golden. This line, 174 miles in length, will open a valley rich in mineral wealth.——The Ikeda Bay mine, on Moresby island, of the Queen Charlotte group, has now been taken on a $250,000 bond by a syndicate of Vancouver capitalists, of which S. J. Castleman is the leading figure. The property was recently examined by A. G. Larson, superintendent of the Le Roi mine, for the syndicate, and a contract for $20,000 worth of diamond-drilling let to O. L. Knight & Co., of Rossland.——The Guggenheim interests are to begin work on their $400,000 power-plant at Concrete. The dam in the gorge on Baker river will be 160 ft. high. When power is available from this plant several large saw-mills, coal and metal mines, and clay and marble beds in the district are to be opened.

Rossland, February 26.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

M. K. Shaler is in New York.

E. R. Buckley is in Colorado.

S. H. Ball has gone to Brussels.

W. F. Ferrier was in San Francisco.

H. V. Winchell is at Cripple Creek, Colorado.

E. F. Burchard has been at Chicago and Pittsburg.

Sumner S. Smith and Errol. MacBoyle have gone to La Dura, Mexico.

Arthur Houle, of Douglas, Arizona, has gone to South Africa on mine examination work.

O. H. Bergstrom, of Butte, has been visiting Copperopolis and San Francisco. He has gone to Seattle.

John Tyssowski, of the staff of *The Engineering & Mining Journal*, visited San Francisco this week.

Francis A. Thomson has returned to Pullman, Washington, from a professional trip to Butte and Anaconda.

H. W. Hardinge is making a professional trip through the Lake Superior copper and Cobalt, Ontario, districts.

George Thow, of the Paymaster mine at Gold Rock, Ontario, was in San Francisco, on his way to Sonora, this week.

T. A. Harper and J. A. Fortesquieu have gone to Honduras. From there Mr. Harper will go to Alaska to take charge of work for Pearse, Kingston & Browne.

C. O. Moss, formerly manager for the Kansas City-Goldfield Mining Co., at Goldfield, Nevada, is now superintendent of the Sierra Morena mine, near Paso Robles, California.

C. A. Heberlein has returned to 15 Calle Madrid, Mexico, D. F., from Achotla, Campo Morado, where he has been erecting a smelting plant for the Suriana Mining & Smelting Company.

W. S. Heger, who has occupied various executive positions with the Allis-Chalmers Co., has been appointed manager of the San Francisco and Los Angeles branches of this company, with headquarters in San Francisco.

John A. Farwell, who has for a number of years been secretary-treasurer and sales manager for the J. Geo. Leyner Engineering Works Co., has retired from the company to return to Chicago. His address will be room 305, No. 115 Dearborn street.

Obituary.

David P. Cameron, who died of diabetes at San Francisco February 24, had been closely identified with the gold dredging industry since the beginning of this branch of placer mining in California. He constructed the first bucket-elevator dredge in the Oroville district, built many of the early dredges installed in the Oroville, Yuba, Folsom, and Calaveras districts. In 1900, with Frank W. and Maurice E. Griffin, he formed the firm of Griffin & Cameron. In 1902 this firm was incorporated under the name of the Western Engineering & Construction Co. At the time of his death he was vice-president and superintendent of construction for this corporation. Mr. Cameron was actively engaged for years in constructing stamp-mills and milling plants, and he erected many of the large plants in Mexico and South America. At one time he held the position of superintendent of construction for Leland Stanford at Palo Alto. He was also associated with the Pelton Water Wheel Co., for which company he installed a large number of plants. Later he became identified with the Risdon Iron Works, superintending the construction of a large number of the early dredges built by that company. Mr. Cameron was a native of Nova Scotia. His knowledge of the construction of stamp-mills, water-power installations, and placer dredges was unusual. He was regarded by all as without a peer in the design and construction of placer mining dredges.

Metal Prices.

LOCAL METAL PRICES

San Francisco, March 2.

Antimony	12–12½c	Quicksilver (flask)	$40.–40.50
Electrolytic Copper	15½–16½c	Spelter	7½–8⅛c
Pig Lead	4.90–5.00c	Tin	36–37½c

METAL PRICES

By wire from New York

Average daily prices in cents per pound

Date	Electrolytic Copper.	Lead	Spelter	Silver, per oz.
Feb. 24	13.25	4.61	5.48	62
" 25	13.25	4.68	5.63	60⅝
" 26	13.25	4.68	5.68	60⅝
" 27	Sunday.	No market.		
" 28	13.25	4.68	5.63	60⅝
Mar. 1	13.25	4.68	5.68	60¼
" 2	13.31	4.68	5.73	60⅛

The Anaconda Copper Co. has made a statement to the listing committee of the New York Stock Exchange in connection with its application to transfer its $30,000,000 of capital stock from the unlisted department to the regular side of the Exchange. Heretofore both Anaconda and Amalgamated have been unlisted and regular reports and statements of financial condition have not been required. The statement of the Amalgamated has now been submitted to the listing committee, but the application will not be acted upon until February 9. The data given by the Anaconda is interesting, as this was the nucleus around which the Amalgamated was originally constructed, and it is soon to absorb in turn not only Amalgamated but practically all of the larger mines of Butte. The Anaconda company's holdings today consist of 1168 acres of mining ground in Silver Bow county, Montana, with mines operated through 11 shafts, all save one being reported to be more than 2200, and one as much as 2900 ft. deep. Development on the lower levels is described as being better than could have been expected from indications above. In addition to the mining property in Butte, the Anaconda owns more than 12,000 acres of land in Deer Lodge county, 2600 acres of coal land in Cascade county, and other scattered lands. The Washoe smelter is held by lease from the Washoe Copper Co., the lease expiring in about two years. The company also owns 51% of the stock of the Anaconda & Pacific Railway Co. and 30,471 acres of timber land in Ravalli county, Montana. The coal properties mentioned are at Belt, Montana, and have been in operation for many years. In addition to all of the above, the company owns practically everything in the town of Anaconda; electric light plant and railway, water works, hotel, and most of the town-site. The production of the Anaconda Copper Co. for 1909 was: copper, 75,860,194 lb.; silver, 2,363,184 oz.; gold, 7466 oz.; the profit and loss account for the first six months of 1909 shows a net profit of $1,221,910, while the balance sheet of the same date shows assets in mines and mining claims, coal properties, saw-mills, water works, etc., of $23,555,586, and investments in railway and other stocks amounting to $534,113. For the first time Anaconda and Amalgamated have taken the public into their confidence. Amalgamated is soon to pass into history, and of its memory, like Caligula, as described in the small boy's essay, "the less said, the better." The Stock Exchange has not yet made public the statement of the Amalgamated company.

Comstock Assessments.

Assessments on the listed stocks are now due and payable, and the amounts per share and date of delinquency in the boards are as follows:

Companies.	Amt.	Del. in Board.	Companies.	Amt.	Del. in Board.
Savage	.10	Feb. 10	Challar	.10	Mar. 5
Caledonia	.10	Feb. 12	Hale & Norcross	.10	Mar. 7
Julia Con.	.03	Feb. 12	Union	.10	Mar. 7
Challenge	.10	Feb. 15	Alpha Con.	.05	Mar. 12
Mexican	.15	Feb. 18	Central Eureka	.02½	Mar. 13
Yellow Jacket	.10	Mar. 4	Gould & Curry	.10	Mar. 14
Crown Point	.10	Mar. 4	Confidence	.20	Mar. 21
Belcher	.10	Mar. 4	Overman	.10	Mar. 31
Seg. Belcher	.03	Mar. 5			

MARKET REPORTS.

ANGLO-AMERICAN SHARES.

Cabled from London.

	Feb. 24. £ s. d.	Mar. 2. £ s. d.	
Camp Bird	1 8 0	1 7 0	ex. div.
El Oro	1 8 6	1 8 6	
Esperanza	2 17 6	2 15 0	
Dolores	1 8 9	1 8 9	
Oroville Dredging	0 10 0	0 10 0	
Mexico Mines	8 5 0	8 2 6	
Tomboy	0 17 6	0 17 6	

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, March 2.		Closing prices, March 2.
Adventure	7½	Mass Copper	6
Allouez	57	Mayflower	1⅛
Apex	4⅛	Mexican Con	4
Arcadian	7⅛	Miami	24
Arizona Commercial	39⅝	Michigan	6½
Atlantic	9⅜	Mohawk	44½
Boston Con	19½	Nevada Con	23
Butte Coal	25½	North Butte	38¼
Calumet & Arizona	73¾	Old Dominion	44¾
Calumet & Hecla	635	Parrot	20
Centennial	24	Quincy	87½
Con. Mercur	10	Santa Fe	2
Copper Range	77	Shannon	15
Corbin	18¼	Superior Copper	58
Daly West	8	Superior & Boston	13¾
East Butte	10¼	Superior & Pittsburg	14⅛
Elm River	1⅞	Tamarack	73
Franklin	19½	Trinity	8¾
Granby	88	U. S. Smelting	47⅝
Greene-Cananea, ctf	10½	U. S. Pref'd	51
Hancock	26⅞	Utah Con	42¼
Isle Royale	24¼	Victoria	4
Keewenaw	4¼	Winona	10⅛
Lake	7⅞	Wolverine	142
La Salle	18½	Wyandot	2¾

(By courtesy of J. C. Wilson, Mills Building.)

COMSTOCKS.

San Francisco, March 2.

Alpha	$ 10	Kentuck	$ 19
Alta	24	Lady Washington	15
Andes	26	Mexican	2.02
Belcher	1.20	New York Con	5
Bullion	30	North G. & C.	29
Caledonia	88	Occident	35
Challenge Con	45	Ophir	2.32
Choliar	30	Overman	1.37
Confidence	1 30	Potosi	74
Con. Imperial	8	Savage	60
Con Virginia	1.97	Scorpion	15
Crown Point	1.20	Seg. Belcher	23
Exchequer	33	Sierra Nevada	80
Gould & Curry	37	Silver Hill	18
Hale & Norcross	58	Union	90
Julia	25	Utah	14
Justice	23	Yellow Jacket	1.30

SOUTHERN NEVADA STOCKS.

San Francisco, March 2.

Atlanta	$ 17	Mayflower	$ 4
Belmont	1.62	Midway	25
Booth	17	Montana Tonopah	89
Columbia Mtn	6	Nevada Hills	55
Combination Fraction	33	Pittsburg Silver Peak	70
Daisy	8	Rawhide Coalition	17
Fairview Eagle	12	Rawhide Queen	17
Florence	2.40	Round Mountain	51
Goldfield Con	8.30	Sandstorm	3
Gold Kewenas	7	Silver Pick	9
Great Bend	3	St. Ives	19
Jim Butler	11	Tonopah Extension	70
Jumbo Extension	37	Tonopah of Nevada	6.95
MacNamara	27	West End	35

(By courtesy of the San Francisco Stock & Exchange Board.)

OIL SHARES.

San Francisco, March 2.

Associated Oil	$47.50	Monte Cristo	$ 1.85
Bay City	2.00	Palmer	1.17
Blue Moon	21	Paraffine	1.45
Chicago Crude	11	Premier	1.27
Claremont	1.85	Record	6.00
Enos	1.30	S. F. & McK	27 50
Four	30	Sauer Dough	2.45
Illinois Crude	53	Sesnon	8.00
Junction	40	S. W. & B.	41.00
Kern River	8.00	W. K. Oil	2.25

(Courtesy California Stock & Oil Exchange.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, March 2.		Closing prices. March 2.
Amalgamated Copper	79¼	Miami Copper	24
A. S. & R. Co	84⅛	Mines Co. of America	½
Boston Copper	19⅝	Montgomery-Shoshone	⅞
B. C. Copper Co	6⅞	Nevada Con	22¾
Butte Coalition	24⅝	Nevada Utah	1¼
Cumberland-Ely	7½	Nipissing	10⅛
Davis-Daly	3½	Ohio Copper	4
Dolores	6¾	Ray Central	3⅜
El Rayo	2½	Ray Con	21⅝
Ely Central	1½	South Utah	2¾
First National	4½	Superior & Pittsburg	13¾
Giroux	9¾	Tenn. Copper	33½
Guanajuato Con	1¾	Trinity	8¾
Inspiration	8⅝	Tuolumne Copper	4⅝
Kerr Lake	9	United Copper	6⅝
La Rose	4½	Utah Copper	49⅝
Mason Valley	1¾	Yukon Gold	4⅜

Monthly Statement of Dividends Paid by Active Listed Oil Companies to February 28, 1910.

Company.	No. of Div.	Date paid	Amount per share.	Amount of dividend.	Total paid to date.
Alma	14	Jan. '10	3	11,400.00	$159,600.00
Amalgamated Oil.	28	Jan. '10	1.00	50,000.00	1,400,000.00
Amer. Petroleum.	8	Feb. '10	1.00	126,735.00	929,960.50
Apollo	2	Mar. '05	1	2,000.00	4,000 00
Associated Oil Co.	4	Mar. '07	1.50	446,055.00	1,548,368.55
Bay City	4	Feb. '10	20	20,000.00	90,000.00
Brookshire	45	Jan. '10	1	5,000.00	442,500.00
Caribou	58	Feb. '10	25	20,175.75	680,355.99
Chicago Crude	2	Mar. '07	0½	5,000.00	15,000.00
Claremont	57	Feb. '10	2	10,000.00	315,000.00
Coalinga Pacific	18	Dec. '09	10	6,500.00	107,250.00
Columbia	36-37	Feb. '10	½-½	9,992.62	264,804.25
Del Rey	3	May '09	0½	3,927.50	11,782.50
Esperanza	26	Dec. '09	2	3,200.00	49,450.00
Euclid	36	Feb. '10	1	3,500.00	120,500.00
Four	68	Feb. '09	1	3,000.00	213,000.00
Globe	20	Jan. '10	1	6,000.00	81,000.00
Hanford	12	Jan. '06	2.00	4,000.00	80,000.00
Home	A16	Feb. '10	2	2,000.00	472,000.00
Homestake	45	Feb. '09	10	1,000.00	77,250.00
Illinois Crude	36	Feb. '10	1	2,000.00	86,000.00
Imperial	67	Jan. '10	60	60,000.00	1,940,000.00
Junction	8	June '09	1	2,500.00	20,000.00
Kern Oil	2	Nov. '09	22	22,000.00	42,000.00
Kern River	39	Feb. '09	10	2,000.00	98,000.00
Linda Vista	18	Nov. '09	1	3,838.50	65,254.50
Lucile	16	Dec. '09	10	2,670.44	42,727.04
Mascot	1	Feb. '10	1	5,000.00	5,000.00
Mex. Petroleum	42	Feb. '10	1½	85,616.70	3,391,626.84
Mecca	6	July '09	3	12,675.00	71,825.00
Monte Cristo	58	Oct. '09	3	15,000.00	340,000.00
Nevada County	3	Oct. '08	4	10,000.00	40,000.00
Palmer	9	Feb. '10	1	18,020.05	232,340.85
Paraffine	4	Feb. '10	1	3,000.00	12,000.00
Peerless	77	Sept. '09	6	6,000.00	801,000.00
Piedmont	6	Aug. '09	1	3,890.00	22,987.30
Pinal	54	Feb. '10	10	14,992.00	872,109.50
Pittsburg	10	Nov. '07	24½	58,800.00	124,800.00
Record	8	Feb. '10	7½	7,500.00	47,500.00
Reed Crude	11	Dec. '09	12	12,000.00	1,124,000.00
Rice Ranch	17	Feb. '10	1	3,000.00	96,000.00
Royalty	15	Feb. '10	2	400.00	8,400.00
S. F. & McKittrick	22	Feb. '10	30	15,000.00	325,000.00
Sauer Dough	48	Feb. '10	2½	4,987.50	512,316.00
Sesnon	6	Jan. '10	15	15,000.00	90,000.00
Silver Tip Oil Co.	4	Feb. '09	10	7,500.00	30,000.00
Sovereign	17	Jan. '10	1	5,000.00	90,000.00
Sterling	22	Dec. '09	25	62,500.00	747,000.00
Superior	11	Feb. '09	1	5,000.00	57,500.00
S. W. & B.	7	Sept. '09	1	3,770.00	41,470.00
Thirty Three	58	Sept. '09	30	30,000.00	670,000.00
Traders		Feb. '10	1.00	14,000.00	165,186.50
Union	163	Feb. '10	50	124,813.00	6,243,442.15
United Petroleum	102	Feb. '10	50	40,375.50	2,138,584.43
Wabash	26	Feb. '10	1	3,000.00	117,000.00
West Coast (pfd.)	3	Nov. '09	2.00	20,816.00	62,448.00
Western Union		Dec. '07	2.00	20,000.00	484,951.00
West Shore	47	Dec. '08	5	5,000.00	235,000.00

Total dividends paid to date $28,555,290.90

Total dividends paid by the above companies for February 1910 ..... 550,608.12

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS

LOCATION OF PLACER CLAIMS—RIGHTS OF INNOCENT LOCATORS. Where the location of an association placer mining claim was decided to be invalid because of the fraud on the part of some of the locators, if the required assessment work had been kept up and the law and district regulations complied with, the locators who were not implicated in the fraud, but acted in good faith, had the right to select and hold their proportionate part of the land within the limits of the association claim.

Cook v. Klonos, 168 Fed. 700, March, '09.

INJURY TO MINE—RIGHT OF LESSEE TO RECOVER. A lessee of a mine may recover for injuries thereto by a third person though the injury exceeded the value of the lease, so as to give a right of action to the lessor. Thus where a third person, by a breach of a contract to drain a mine prevented it from being worked, the fact that the cost of restoring the mine exceeded the value of the lease, was not sufficient to prevent a recovery by the lessor.

Carter v. Cairo, etc., R. Co. (Ill.), 88 Northeast. 493, Apr., '09.

INJURY TO MINE—MEASURE OF DAMAGES. A railroad company in consideration of being permitted to build an embankment over the mouth of a mine which was leased to a third person, agreed with such lessee to keep the mine properly and sufficiently drained. By reason of a breach of the contract and the failure to perform its duty in keeping the water out the mine was flooded. The measure of the lessor's damages in an action to recover for the injury was held to be the cost of restoring the mine to its condition before it was damaged; but where such cost exceeded the fair cash market value of the unexpired term of the lease, then the lessee could only recover the fair cash market value of his leasehold.

Carter *v.* Cairo, etc., R. Co. (Ill.), 88 Northeast. 493, Apr., '09.

LEASE OF MINES—RECOVERY FOR BREACH. The owners of a lease of mineral lands contracted with certain persons by which they agreed to sub-lease such mineral land to them for ten years if they would develop paying ore. In an action for damages on a breach of such lease, the fact that such sub-lessee at the date of the contract had a good and subsisting lease of the land which the sub-lessors knew was subject to forfeiture for their failure to do the work required, was not sufficient to prevent such sub-lessors from recovering from the sub-lessee damages for failure to comply with the contract caused by the subsequent forfeiture of their lease.

Ragland *v.* Conqueror Zinc Co. (Mo.), 118 Southwest 1194, May, '09.

STATUTE REGULATING THE USE OF EXPLOSIVES IN MINES. The statute of New York regulating mines and the use of explosives, authorizes the commissioner of labor to see that every precaution be taken to insure the health and safety of employees in mines and quarries, and prescribe rules and regulations therefor. Under this authority the commissioner of labor prescribed certain regulations as to the use of a fuse and the method of igniting the same. The statute also provides for the explosion of gas by electricity with electric exploders. It was accordingly decided in an action for damages for the death of a miner, where the electric exploders were used instead of a fuse as required by the commissioner of labor, that the regulation requiring the use of safety fuse did not apply where the blasts were exploded by electricity. It was also decided that the owner of a quarry was not liable where the shots were prepared for exploding by electricity in the usual manner, but two of the blasts were exploded by a flash of lightning during a thunder storm which resulted in the injury complained of.

Baccelli *v.* North River Stone Co., 118 N. Y. Sup. 29, June, '09.

Publications Received.

Any of the books noticed in these columns are for sale by or can be procured from the MINING AND SCIENTIFIC PRESS.

SCIENTIFIC WRITINGS OF CHARLES R. KEYES. Pamphlet. Pp. 23. Baltimore, 1909.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY CATALOGUE. Bull., Vol. 45, No. 1. Pp. 466. December 1909.

PRODUCTION OF NATURAL GAS IN 1908. By B. Hill. U. S. Geol. Surv., Min. Res. Pp. 317-344. Washington, 1910.

PRODUCTION OF IRON AND STEEL IN CANADA, 1907 AND 1908. Department of Mines, Mines Branch. Pp. 35. Ottawa, 1909.

FLORIDA GEOLOGICAL SURVEY. SECOND ANNUAL REPORT. By E. H. Sellards. Pp. 299, Ill., maps, Index. Tallahassee, 1909.

ANNUAL REPORT OF THE SMITHSONIAN INSTITUTE, 1908. By C. D. Walcott, secretary. Pp. 785, Ill., index. Washington, 1909.

LEAD IN 1908. By C. E. Siebenthal. U. S. Geol. Surv., advance pages Mineral Resources. Pp. 19. Washington, 1909.

PROGRAM AT THE DEDICATION OF THE LABORATORY OF PHYSICS. Univ. of Illinois, Bull., Vol. 7, No. 6. October. Urbana, 1909.

EUROPEAN ENGINEERING LABORATORIES. By R. W. Angus. Applied Science, N. S., Vol. 3, No. 2. Pp. 43-55. University of Toronto, 1909.

VALUATION OF THE PUBLIC COAL LANDS. By G. H. Ashley and C. A. Fisher. U. S. Geol. Surv., Bull. 424. Pp. 75. Washington, 1910.

PRODUCTION OF NATURAL GAS AND PETROLEUM IN CANADA, 1907 AND 1908. Department of Mines, Mines Branch. Pp. 16. Ottawa, 1909.

PRODUCTION OF COPPER IN 1908. By B. S. Butler. U. S. Geol. Surv., advance pages Mineral Resources. Pp. 46. Washington, 1909.

PALEONTOLOGY OF THE COALINGA DISTRICT, CALIFORNIA. By Ralph Arnold. U. S. Geol. Surv., Bull. 396. Pp. 173. Ill., Index. Washington, 1909.

NOTES ON SOME MINING DISTRICTS IN HUMBOLDT COUNTY, NEVADA. By F. L. Ransome. U. S. Geol. Surv., Bull. 414. Pp. 75. Washington, 1909.

PRIMER ON EXPLOSIVES FOR COAL MINERS. By Charles E. Munroe and Clarence Hall. U. S. Geol. Surv., Bull. 423. Pp. 61. Washington, 1909.

STATISTICAL RECORD OF THE PROGRESS OF THE UNITED STATES, 1800-1908. Department of Commerce and Labor. Pp. 72. Washington, 1909.

MINERAL PRODUCTIONS, COUNTY MAPS AND MINING LAWS OF CALIFORNIA. Bull. 56. California State Mining Bureau. Pp. 100. San Francisco, 1909.

MERCURY MINERALS FROM TERLINGUA, TEXAS. By W. F. Hillebrand and W. T. Schaller. U. S. Geol. Surv., Bull. 405. Pp 174. Washington, 1909.

RESULTS OF SPIRIT LEVELING IN OHIO, 1898-1908. Compiled by S. S. Gannett and D. H. Baldwin. U. S. Geol. Surv., Bull. 411. Pp. 147. Washington, 1909.

FUEL TESTS WITH HOUSE-HEATING BOILERS. By J. M. Snodgrass. Bull. 31. Univ. Illinois Engineering Experiment Station. Pp. 108. Urbana, 1909.

RECENT DEVELOPMENT OF THE PRODUCER-GAS POWER PLANT IN THE UNITED STATES. By R. H. Fernald. U. S. Geol. Surv., Bull. 416. Pp. 82. Maps. Washington, 1909.

MINERAL RESOURCES OF THE UNITED STATES FOR 1908. U. S. Geological Survey, Washington, 1909.

Additional advance chapters as follows are now available: Zinc, by C. E. Siebenthal; Cadmium, by C. E. Sieben-

thal; Lead, by C. E. Siebenthal; Quicksilver, by H. D. McCaskey; Copper, by B. S. Butler; Gold, Silver, Copper, Lead, and Zinc in the Eastern States in 1908, Mine Production, by H. D. McCaskey.

MINERAL DEPOSITS OF THE CERBAT RANGE, BLACK MOUNTAINS, AND GRAND WASH CLIFFS, MOJAVE COUNTY, ARIZONA. By F. C. Schrader. U. S. Geol. Surv., Bull. 379. Pp. 226. Ill., map, index. Washington, 1909.

NEW ZEALAND. PAPERS AND REPORTS RELATING TO MINERALS AND MINING. Comprising statements by the Minister of Mines; Report on the Goldfields; Report on Coal Mines; State Coal Mines. Wellington, 1909.

PROCEEDINGS OF THE SYDNEY UNIVERSITY ENGINEERING SOCIETY, 1908. Sydney, N. S. W., 1909.

Containing an elaborate account of the treatment of Broken Hill ores by W. Poole, and other engineering papers.

COAL INDUSTRY OF NEW SOUTH WALES. By F. Danvers Power. Presidential Address before the Sydney University Engineering Society. Pamphlet. Pp. 12. Sydney, 1909.

An excellent discussion of the main economic aspects of an important coalfield by one well qualified to pass judgment.

MINERAL RESOURCES OF ALASKA—FAIRBANKS; YUKON—TANANA; AND LOWER YUKON REGIONS. By L. M. Prindle, F. J. Katz, C. C. Covert, C. E. Ellsworth, and A. G. Maddren. U. S. Geol. Surv., Bull. 379-E. Pp. 181-266, maps. Washington, 1909.

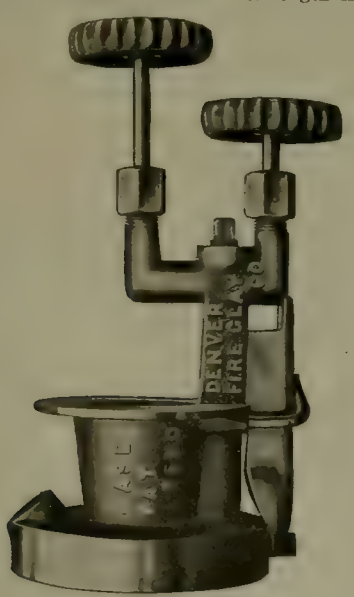
A part of the report on progress of investigations in 1908.

TWENTY-SEVENTH ANNUAL COAL REPORT. Illinois Bureau of Labor Statistics, David Ross, secretary. 8vo. Pp. 443. Springfield, 1909.

This report, which includes complete statistics of production and labor with supplementary reports by each of the mine inspectors, is a standing refutation of the common statement that no office which is 'in politics' can do good work. Illinois statistics of coal production have long been known to be among the best and most complete issued.

A New Burner.

THE DENVER FIRE CLAY CO., Denver, Colorado, is distributing a small pamphlet descriptive of the Case hydrocarbon burner. Great economy of fuel, compactness, uniformity of operation, and freedom from leaks are the strong features claimed for this burner. Its length is less than



any other burner, due to an improved design of mixing chamber. The usual, and nearly always troublesome, needle-valve is dispensed with. The regulation of the flow is accomplished by constructing in the channels between the valve seat and the opening through which the gas is emitted, a groove whose cross section increases proportionately as the valve is opened. The groove is so constructed that the gas on passing through it is reflected from the upper surface of the channel, this surface being exactly perpendicular to the plane of the front of the burner and perfectly centering the opening into the furnace, forcing the flow of gas directly through the centre of the burner.

Commercial Paragraphs.

WALLACE & SUMMERHAYES have been retained as consulting engineers for the Tularosa Copper Co., at Bent, New Mexico.

THE H. W. JOHNS-MANVILLE CO. announces that its Chicago branch has been moved to 27-29 Michigan avenue, and that its Baltimore office, store, and warehouse will, in the future, be at 30 Light street.

PARROTT & CO., San Francisco, Pacific Coast agents of the Grant flaming arc lamp, are distributing a circular announcing the fact that these lamps have been adopted by the lighting company of Bakersfield, Cal., for use in the illumination of the streets and stores of that town.

THE CYCLONE DRILL CO., Orrville, Ohio, has opened a New York office at 1456 Hudson Terminal Bdg. C. H. McCarthy will be in charge. The company reports that its 1909 business showed an increase of 90% and that it is now preparing plans for a large increase in shop facilities.

T. H. PROSKE, Denver, Colorado, recently shipped to the Isthmian Canal Commission for use at the Panama Canal, one D 24 Ajax drill-sharpener for sharpening drills up to 25 ft. in length, and has just shipped to Christiana, Norway, a similar machine for use in the iron mines of that country.

THE SWEETLAND FILTER PRESS CO., Los Angeles, California, now has under construction two Sweetland Type D slime filters of 150 tons daily capacity each, for the Providencia Mining & Milling Co., of Guanajuato, Mexico. Each press will have 30 frames, carrying a 4 by 6-in. filter leaf. Hydraulic devices will be provided for rapidly opening and closing the presses.

The ALLIS-CHALMERS CO. has appointed W. S. Heger manager of its San Francisco and Los Angeles branches with headquarters at the San Francisco office, 160 Second street. Particular attention will be given to the mining and milling machinery department of its business as heretofore. Mr. Heger is well known on the Pacific Coast and the interests of his company will be well cared for under his administration.

The TRAYLOR ENGINEERING CO., which went into the hands of a receiver about the end of last year, due to difficulties contracted during the hard times of 1907-8, reports that a speedy reorganization of its affairs may be expected. Meanwhile its engineering works and shops at Allentown, Penn., have been leased to Bruce W. Traylor, who continues uninterruptedly the manufacture of the Traylor Engineering Co. machinery.

Catalogues Received.

THE SAMSON MFG. CO., 1650 Champa street, Denver, Colorado, 'The Samson Crusher' Catalogue No. 4. Illustrated. 6 by 9½ inches. 16 pages.

A. LESCHEN & SONS ROPE CO., St. Louis, Missouri, 'Locked Wire Rope for Cableways'. A circular giving list prices of locked coil cables and a brief argument in favor of that style of construction. Illustrated. 6¼ by 6¼ inches. 4 pages.

THE GALIGHER MACHINERY CO., Salt Lake City, Utah, Bulletin No. 500. 'The Callow Traveling Belt Screen'. A concise description of this well known device giving details of the latest improved features. Illustrated. 8½ by 11 inches. 24 pages.

THE J. GEO. LEYNER ENGINEERING WORKS CO., Littleton, Colorado. Bulletin No. 1012. 'Tunnel Driving in Colorado'. By H. Foster Bain. A reprint of an article in the MINING AND SCIENTIFIC PRESS. Illustrated. 6 by 9 inches. 8 pages. Bulletin No. 1013. 'The Leyner Cut'. A brief description of a round of holes said to be particularly effective for driving. Illustrated. 6 by 9 inches. 1 page.

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EDITORIAL.

JAPANESE laborers, like 'before the war negroes' and 'before exclusion Chinamen', seem likely to go to premium. In the two years ended December 31, 1909, the net excess of arrivals in Japan over departures for the United States, amounted to 7253, according to statistics collected by the Japanese Foreign Office.

ZACATECAS has long been out of favor with capitalists, and the oft-heralded revival of mining has been postponed by the persistent low price of silver. The district, however, has not merited neglect. This seems to be indicated by the promptness with which the custom mill, recently completed near Zacatecas, has been overwhelmed with offers of ore. This fact gives practical demonstration of the possibilities of the district.

SOUR DOUGH bread was as essential as blasting powder in the development of many Western prospects. Time was when every miner was considered to be *ex officio* a competent cook. Conditions have evidently changed, as the Cooks' Association of the Pacific Coast is extending an invitation to mining men to attend an exhibition at the Auditorium March 21 to 26 and see what real cooking is. We would like to think this a recognition of our skill in constructing biscuit, but we suspect instead it is a missionary effort designed to give us new standards.

WIDE difference exists between the desirability of *a* ship subsidy bill, and *the* ship subsidy bill now before Congress. Mr. Halvor Steenerson, Representative from Minnesota, in a speech on the floor of the House the other day, charged that many congressmen had been threatened with defeat in the next election unless they would support the pending measure. This pernicious activity is said to be displayed by the Merchants' Marine League, an accusation which has properly been made the subject of investigation by the Judiciary Committee of the House. A lobby reveals an anxiety on the part of 'special interests' that is enough to give pause in the enactment of any law.

ZINC OXIDE manufacture, described on another page by Mr. William F. Gordon, formerly manager of the Ozark Oxide works, is one of the most interesting of metallurgical processes. Whereas in lead and zinc smelting proper, persistent effort is made to prevent oxidation, and in all smelting furnaces dust is avoided as a plague, in this particular industry and the related manufacture of basic lead sulphate, oxide and dust are the products sought. Zinc smelting in the United States was long considered

to be in a backward state, but it is worth remembering that the process of direct manufacture of oxide was an early American invention, and the later extension of the same principles to the treatment of lead ores at Joplin and of complex Western ores at Canyon City was also an American triumph. Zinc oxide furnaces have even been used by Mr. J. A. Van Mater, in Virginia, for fire concentration of low-grade ore, much as matte smelting is utilized in copper reduction. For Western ore producers the work described by Mr. Gordon is of large interest as pointing a way to handling complex zincy ores.

DEFINITION of industrial terms is to be undertaken by the Division of Industrial Chemists and Chemical Engineers, of the American Chemical Society. A committee with Mr. Clifford Richardson as chairman has been constituted and proposes to organize sub-committees in co-operation with trade organizations. Such terms as petroleum, ether, gasoline, benzol, bronze, steel, portland cement, and others are in current use without exact and authoritative definition. Much confusion results, and much good may well come from co-operative efforts toward uniformity. Correspondence regarding the matter should be directed to Mr. Richardson, 30 Church street, New York.

SUCH A CATASTROPHE as that caused by an explosion of dynamite in the Mexican mine of the Alaska Treadwell, on Douglas Island, Alaska, is rare in recent years. Press dispatches give the quantity of powder as 275 pounds. It may be said that no magazine or temporary storage box for dynamite is maintained near the stations of the Mexican shaft. Evidently the powder was in transit. The principal magazine of the company is in special tunnels 3600 feet distant from the nearest workings. From this magazine it is brought by railroad along the shore of the island to the mines. Subsidiary storage at the Mexican is at the end of a long adit, driven into the foot-wall, on the first level of the mine. The accident occurred on the 1100-foot level. Full details are not available, but the sympathy of the world is drawn to the sufferers in this terrible disaster.

The Comstock Merger.

Announcement is made of well matured plans to effect a consolidation of the group of companies which together hold the total length of the Comstock Lode. This involves a distance of 10,300 feet from the northern to the southern forks. Such a consolidation is an economic necessity. The separate operation of the mines is rendered extremely difficult owing to the serious problems of drainage and ventilation. Failure to satisfactorily solve these problems has been one cause of the demoralized condition existing on the Lode for many years. The partial successes made from time to time, aided by discoveries of small bodies of good ore, served the purpose of stock speculators and kept alive a unique system of bleeding a certain part of the public by a combination of 'Irish dividends' and 'wash sales'.

By virtue of consolidation the mines can be unwatered and ventilated in accord with a rationally conceived and systematically executed design, and deep mining can be resumed on a large scale. The splendid work done by Mr. Whitman Symmes, in the Mexican and Ophir mines, has pointed the way to engineering success, and to intelligent prospecting based upon the recognized geologic features of the Lode as shown by his remarkable discoveries of ore outside the main fissure of the Comstock vein. This practical demonstration has been of great assistance to Mr. Franklin Leonard, Jr., through whose efforts the consolidation is being brought about. The most interesting feature of the announcement, which means so much for Virginia City and for the State of Nevada, is the high financial standing of the men identified with the new order of things. These details will be found in our news columns. The statement that the merger has been effected is premature, however. Even the plan of consolidation has not yet been divulged. That will be announced in a circular to the stockholders in the several companies at a later date. A syndicate was formed some time ago to purchase floating stock of the companies on the Lode. As a result, large holdings have been acquired, amounting to the control of several of the mines. This syndicate included Messrs. Adolph Lewisohn, Ernst Thalmann, A. L. Scheuer, and others. A committee of stockholders now requests that shares be deposited with the Crocker National Bank, in San Francisco, or the Bankers' Trust Company, of New York. Negotiable certificates of deposit will be issued for such shares, which can be traded in the same as stock. Shares may be deposited up to April 15, inclusive, and the plan of consolidation will be announced at some period between that date and August 1. The depositors then have thirty days within which to accept or reject the plan, and the shares may be withdrawn on surrender of the trust receipt, without expense to the holder. Under such circumstances it would give to the shareholders a material advantage, unaccompanied by risks, to deposit their stock, so as to stand in line for benefits that might accrue to the first comers. The committee further states that if the San Francisco Stock Exchange should decline to recognize the banks' receipts as good delivery, an arrangement will be made with one or more firms of brokers to furnish the actual shares to any person desiring to deliver them to buyers. No effort is made to tie up anyone's stock for the purpose of preventing a free sale.

A rejuvenation of the Comstock Lode would be as gratifying an event as the waste of opportunity for decades has been disgraceful. No one believes that the Comstock Lode is exhausted; everyone believes that it may become a great producer. This was the foundation on which the stock-gamblers rested their nefarious business; and the same conviction now leads men of national standing in finance to open the way for a new career of mining on the most famous deposit of silver-gold ore in the United States. It is interesting to observe that the limitation of holdings to small areas on this historic lode has long helped to delay its larger development, and that after more than forty years it is just coming to a condition for economic mining such as the great new copper properties of the Southwest enjoy from the beginning.

Smelter Fume Compromise.

Previous mention has been made in these columns of the rational procedure of both the farmers and smelters in Shasta county, California, in their negotiations for a settlement of the contest over smelter fume. The tentative agreement between the Shasta County Farmers' Protective Association and the Mammoth Copper Company, a subsidiary of the United States Smelting, Mining & Refining Company, was clinched on February 23, when the farmers signed the contract amid much enthusiasm. This happy termination of a dispute that originally threatened to produce bitter legal warfare, is in the last analysis a tribute to the good sense displayed by Judge J. A. Marshall of the United States Circuit Court of Appeals. In the group of cases arising under similar circumstances in Utah, brought by James Godfrey *et al.* against the American Smelting & Refining Company, the United States Smelting Company, and others (158 Fed. 225), the demands of the farmers were originally recognized by the granting of injunctions. Later, after demonstration by the United States Smelting Company that it had installed equipment capable of removing the obnoxious sulphuric anhydride from the fume, a decree was granted permitting the resumption of operations at the Bingham Junction plant. Since that time, nearly eighteen months ago, the lead roasters and blast-furnaces have been running without causing damage to the surrounding forms, and under a modified decree in July 1909 the operation of the copper furnaces has been permitted. With this object lesson the farmers in Shasta county have become convinced that the spirit of live and let live can be given another practical application. This wise action will doubtless establish a precedent that will be followed elsewhere when like troubles arise. The attorneys in the case, Mr. T. W. H. Shanahan for the farmers, and Messrs. Alfred Sutro and D. G. Reed for the smelter, deserve congratulation for the manner in which they have guided their clients to a compromise.

The contract now ratified requires the Mammoth Copper Company to complete a bag-house and equipment for neutralizing the fume, and to put these into service within ninety days, and the contracting parties have agreed that the Farmers' Protective Association shall bring a friendly action in the Circuit Court, stipulating a form of decree, stated in the same terms as that handed down by Judge Marshall, that will be accepted as binding upon both. This sets forth that "all the sulphuric acid arising from the operation of the copper smelter, and contained in the fumes and gases from its copper furnaces, shall be neutralized by the introduction into said fumes and gases before reaching the bag-house hereinafter mentioned, of a sufficient quantity of zinc oxide or other effective agent, so that after such treatment no sulphuric acid shall exist in a free state in said gases." The decree further states that all solid matter held in suspension, including copper, lead, arsenic, and soluble sulphates emitted from the furnaces, and sulphates resulting from the neutralization of the sulphuric acid, shall be filtered out, and that the gases after passing through the bag-house, when discharged into the atmosphere shall not contain more than seventy five hundredths of one per cent of sulphur dioxide by volume. This requirement, of course, necessitates extensive dilution of the escaping gases. These are, furthermore, to be so discharged as to insure diffusion, preventing injury to crops, trees, or other vegetation, or to domestic animals, and the surrounding population. The farmers are also given the right to appoint a committee of three, with experts, to visit the smelter at any time to ascertain whether or not the stipulations made in the court decree are being observed. The smelter is likewise conceded the privilege of making inspection of the farms to ascertain whether damage is being caused by fume issuing from its stacks. In case of supposed injury from fume any member of the Association is required to notify the manager of the smelter so that suitable action may be taken to prevent its continuance. The contract expressly states that none of the provisions of the decree shall operate as a waiver or estoppel in the matter of damages claimed as arising prior to the installation of the equipment specified.

The smelter at Balaklala is not a party to the contract just signed, but negotiations are pending which will evidently lead to a somewhat similar *modus vivendi*. It is understood that the electrostatic precipitation system of Mr. F. G. Cottrell, which has been tried at the Selby smelter on San Francisco Bay, will be applied at Balaklala, so that no further contest over smelter fume is anticipated in Shasta county. The suppression of the smoke difficulty is thus finally accepted by the Shasta smelters as the solution of the problem. This is in contrast with the outcome of the struggle at Anaconda, Montana, where the injunction against the Anaconda smelter was dissolved by Judge William H. Hunt on the ground that the company had done all that modern skill could accomplish to abate the nuisance, and that the greater number of persons dependent upon the copper industry necessitated the continuance of operations. In fairness it must be said that the magnitude of the Anaconda smelter renders the problem there much more difficult. That elimination of the objectionable substances from the smoke of a relatively small smelter is economically possible does not prove the applicability of similar means to such enormous volumes as would require treatment at the Montana works. Nevertheless the decree of Judge Hunt was not accepted as conclusive and appeal has been taken to the Circuit Court of the ninth circuit, and the case will shortly be tried in San Francisco. The testimony in the case of Bliss *v.* Anaconda, above referred to, is the most voluminous ever taken in any litigation over smelter fume, comprising over twenty-five thousand typewritten pages. The technology of the subject has been reviewed in the most elaborate manner in the evidence submitted, and the ultimate decision of the courts in this instance will have a powerful influence on the future relations between the farmers and the smelters. The agreement effected in Shasta county, however, based as it is upon a Federal Court decree, will establish a precedent inclining others to compromise rather than pursue the expensive and harrassing course of litigation. It is the way of peace, economy, and goodwill.

Hoag District, California.

Written for the MINING AND SCIENTIFIC PRESS
By NORMAN C. STINES.

In the extreme northeastern corner of Modoc county, California, is a district $1\frac{1}{2}$ miles wide by 4 long, known as the Hoag mining district. It extends on the north to the Oregon line, and on the east to within seven miles of the Nevada line, and is more definitely described as occurring in sections 1, 2, 11, 12, 13, and 14, T. 47 N., R. 15 E.; sections 35 and 36, T. 48 N., R. 15 E.; and what would be, were it surveyed, section 31, T. 48 N., R. 16 E., and sections 6 and 7, T. 47 N., R. 16 E., M. D. B. & M. It is, by the shortest route, 52 miles from Alturas, the county seat of Modoc county, which is the present terminus of the Nevada-California-Oregon railway. The other terminus of this line is at Reno, Nevada, distant 185 miles southeast. The nearest communities (each of which is reached by a good wagon-road), are Fort Bidwell, 12 miles distant in Surprise valley, and New Pine Creek, in Goose Lake valley, 8 miles distant.

Gold and silver-bearing quartz was first discovered in this district 30 or 40 years ago by an army scout named Hogue. Before he could locate anything he was killed in a skirmish with the Indians. After his death no further attention was paid to this area until 1905. In that year a sheep-herder brought to Fort Bidwell some quartz specimens showing free gold. J. O. Kafader, with others of Fort Bidwell, after learning in what region the specimens were found, came to the mountains, and, after several days spent in prospecting, located the ground now held by the Bidwell Discovery Gold Mining Co. This started a local rush, and by the following summer, when practically the whole area had been located, the Hoag mining district was organized.

The district is an area of eruptive rock, composed of rhyolite, quartz andesite or dacite, andesite, and basalt, occupying the summit of the Warner mountains, a chain varying in altitude from 6000 to 9000 ft., extending south from Oregon about 60 miles into California, from which State they pass into Nevada. In California these mountains run a little east of south, and separate the Goose Lake valley, on the west, from Surprise valley, on the east. The eruptives have been forced through the flat-lying basaltic flows which form the crest of these mountains. They really make, as it were, an island of eruptive rocks in a sea of basalt.

Ample evidences exist that this area occupies an anticlinal fold. To the east on Mt. Bidwell, the basaltic rocks dip sharply to the northeast; on the north these same rocks dip to the north, the angle decreasing until at Warner, 22 miles distant, they are nearly flat; and to the west, beyond Goose lake, the strata dip southwesterly. The opportunities for observation on the south are obscured by dense forests and its accompanying heavy soil. The axis of the anticline runs N.50°W.

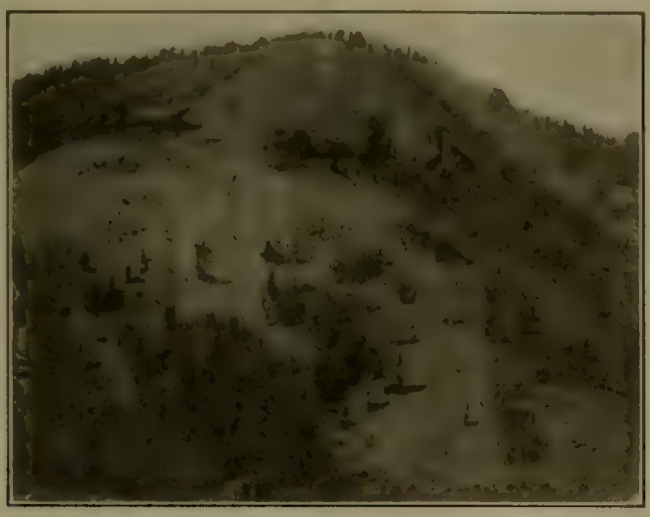
Some distance north of the district, at what is known as Twenty-Mile creek, the stream has cut a canyon through the flat-lying basalt. The section so exposed shows that the basalt accumulation was a result not of one flow but of several distinct ones. A period of flow was followed by one in which only tuffs were formed; that, in time, was followed by another flow. The basalt varies in thickness from 4 to 100 ft. or more, and the separating tuffs, of a light gray to brown color, vary in thickness from a mere seam to several feet. Whether or not a period of basaltic flow was followed by one of erosion before the tuff was deposited could not be determined from the limited chance for observations. In two places, lying between the tuff and the underlying basalt, were found thin horizontal lenses of brown clay. There are three of these tuff deposits exposed, and there were at least four flows of basalt. Toward the eastern base of Mt. Bidwell are seen evidences of tuffs, their position marked by talus. At the base of the range to the west, that is, on the east side of Goose lake, underlying and conforming to the basalt, are layers of fine-grained conglomerates and solidified volcanic mud-flows. These strata, or their continuations, are exposed in Cedarville pass, a low gap in the Warner mountains, 25 miles south of the district. Here the dip is to the southwest.

Scattered over the surface of the basalt, north and east, are many fragments of obsidian. These vary in size from sand-particles to pieces weighing 10 lb. They are wholly absent from the surface of the dacite, andesite, and basalt dikes. Their occurrence, with vesicular fragments of a basic rock, at least suggest that both are products of volcanic explosion.

The eruptions forming this 'island' vary from the most acidic to a very basic one. No direct evidence, further than that of inclusions, mentioned below, was observed to fix the relative age of these rocks, but the basalt dikes are probably the oldest, and were followed successively by the andesite, dacite, and rhyolite. The basalt occurs as dikes in the southern end of the district, comprising about one-eighth of the total area. It is a fine-grained rock, not much altered, showing long, lath-shaped crystals of augite in a ground-mass of a mixture of the same mineral with a basic feldspar, probably labradorite. Toward the northern boundary of this basalt were found a few hand specimens which showed quartz phenocrysts, much corroded. In the 'wash' from this area are found rocks the originals of which were sandstones, although they are now thoroughly metamorphosed. Their presence can only be accounted for by their having been broken from the rocks through which this basalt has passed, being brought up as inclusions. Later erosion exposed and liberated them.

Just north of the basalt is a small area of andesite. On the contact with the basalt this andesite has been vesicular, the vesicles having since been filled with quartz. These amygdules are clearly secondary in origin. The principal minerals of the andesite are phenocrysts of a basic feldspar, probably andesine, and altered augite. These phenocrysts occur in a fine-grained ground-mass in which the minerals were undetermined. Near the contacts and in proximity to the veins, the rock takes on a much greener appearance, due to alteration of the augite and to the formation of chlorite.

Next on the north is the dacite. This occupies about 75% of the area of the district. Economically it is the most important. It occupies all of the northern part of the district and is only lost when it passes under the basaltic flows. It is found both as a compact porphyritic rock and also brecciated. This large mass of dacite has been extensively fractured and later altered, the fracture or shear-zones having been almost completely silicified. The silicification has been so extensive that diligent search over a considerable area was necessary before a hand-specimen which did not show secondary quartz could be found. It is along these shear-zones that the rock takes on the appearance of a breccia. The fractured pieces of the dacite, from small cubes to those weighing several tons, have been consolidated into a solid mass by the silica. Fresh specimens of the dacite are light colored and show hexagonal phenocrysts of quartz, more or less corroded, and a plagioclase feldspar, andesine or acid labradorite, in an almost wholly vitreous ground-mass. Small dark crystals of some ferro-magnesian mineral occur disseminated sparingly through the ground-mass.



Mineral Hill, on Which the Claims are Situated.

There are a number of rock inclusions, small and large. The smaller ones are completely altered, and it is practically impossible to determine their original character. Some have now the characteristics of a quartzite, and were probably fragments broken from a sandstone. Others are very dark, almost black, and extremely hard, having somewhat the appearance of the andesite and basalt dikes. They are probably fragments of those rocks, as these inclusions are more numerous in the southern part of the mass. These foreign masses were broken from the rocks passed through, and were brought up by the dacite.

On section 1, T. 47 N., R. 15 E., are examples of inclusions of large size. Here whole rock-masses have been brought up and exposed at the present surface, overlying the dacite. The inclusion still retains plainly the evidences of its former sedimentary character, namely, bedding planes; and cleavage planes have been developed also.

On the highest peak of this area, Yellow mountain, 8540 ft. high, is a capping of rhyolite. It is a light colored rock, composed wholly of corroded quartz phenocrysts in a perfectly glassy ground-mass. This same rhyolite caps the formation along the ridge on the east side of section 1, T. 47 N., R. 15 E. Here, too, is found a much fractured obsidian. It is dark colored, and at a distance somewhat resembles a granite. At close range it looks like a coarse-grained sandstone, the particles of which are angular and glassy.

There are two distinct occurrences of ore in this district; the quartz veins in the basalt and andesite, and replacement deposits in the dacite. The quartz veins in the basalt and andesite are 'gash' veins. These strike nearly east and west, and none of them is persistent in either dip or strike. In width they vary from a thread to 2 ft., with an average of about 12 in. In assay value they are just as erratic. The quartz is coarse-grained and vitreous. Some crystals 10 in. long and 1½ in. thick have been found.

The ore occurrences in the dacite are decidedly different. They are, with one exception, replacement deposits along zones of shearing. The replacing material is gold and silver-bearing quartz. It is not unusual to find a hand-specimen in which all gradations from unaltered dacite to secondary quartz can be seen. These deposits are banded to some extent, and the width of the zone in which replacement has occurred may reach 20 ft. in places. This will not all be quartz, but will consist of fragments of dacite partly altered to quartz, and thoroughly consolidated by silica into one mass. This character of ore resembles a breccia. Accompanying this, in the payshoots, is a vein of quartz. This will vary in width

Outcrop of Oregon Vein in Basalt.

from a few inches to 2 ft. It is the presence of this quartz that determines the pay-shoot. These zones are persistent in strike and depth, as far as developed. The Sugar Pine vein can be traced for 2000 ft., and one other, the Big Four, for an equal distance. The former strikes almost east and west, and dips between 60 and 70° to the south. The latter strikes N.45°W., and dips 65 to 75° to the northeast. The quartz is fine-grained and a little yellow in color. The exposed faces resemble the surfaces of lime accretions on rocks.

There is on the Big Four a quartz vein filling a well defined fissure. This fissure strikes N.40°W. and dips steeply to the northeast. It is very persistent in strike, outcropping for over 1000 ft. The quartz is fine-grained, of 'sugary' texture, and is separated from the walls by a small selvage. The quartz varies in width from a few inches to 4½ ft., and seems to follow the line of a former dike. This dike is a dense blue, thoroughly silicified rock, carrying variable amounts of pyrite. In some places the quartz is on one side, at others in the middle, and elsewhere on the other side of the dike. The dike and quartz average 6 ft. in width.

In the extreme northwest corner of the district, in a region of mineral springs, are some veins of chalcedonic quartz. As yet they show no promise of being economically important.

The ore is a clean silicious one, and gold and silver are the only elements of economic value which it contains. Those ores from the andesite and basalt areas yield sparingly chalcopyrite and carbonates of copper. The ores from the dacite area, with one exception, hold the metals as free-milling gold and silver. Ore from a vein on the school section (Sec. 36, T. 48 N., R. 15 E.) has little or no free gold, but considerable in combination with sulphides. The best ore in the district, from the Sunshine vein, yields native silver as well as gold. The ratio of the gold to the silver content in the ore is 1 to 1.5. The rich ore from the Sunshine is an exception to this, giving 1 of gold to 6.5 of silver. The ore from the basalt and andesite veins will average $10 in gold, and from 0.5 to 2 oz. silver per ton. An exception to this is the ore from the Mountain View, which averages $25 per ton. There are some rich streaks in these veins, but their total volume is small. One seam on the Mountain View assays $6000 per ton. There has not been sufficient systematic work done in this part of the district to determine the dimensions and trend of the ore-shoots.

The orebodies in the dacite shear-zones have not been sufficiently developed as yet to definitely determine their trend, or the causes which have produced the present concentrations, further than that the shoots pitch at a low angle to the east. One shoot on the Sugar Pine is at least 150 ft. long, with an average width as developed of 5 ft. Sixty feet west of this shoot the west drift had just entered another. In these shoots the gold and silver content gradually increases on entering from the east, and it drops suddenly as the west edge is approached. The ore from the shear-zones varies from $7.50 to $30 per ton, depending upon how cleanly it is broken. For some distance from the ore, the dacite assays from 40c. to $1.50 gold per ton. The quartz vein on the Big Four has a well defined pay-shoot, pitching 45° to the southeast, over 300 ft. long. The ore in this shoot varies in width from 6 in. to 4½ ft., and in value from $7.50 to $65 per ton, with an average value of $18.50 per ton for 18 in. width. This is a persistent vein, and its development is fulfilling its surface promise.

The Sunshine vein is small and rich, following a shear-zone. The surface in its vicinity was covered with 'float', 10 tons of which were collected and milled, yielding $75 per ton. The vein is only about 10 in. wide, but contains ore which averages higher than $100 per ton. The float from this vein can be picked up for a distance of 1200 ft. along the strike. This will probably develop into a valuable small property.

The elevation of the camp, 6000 to 8500 ft. above sea-level, makes the winters long and severe. The snow comes about November 15, and is on the ground until July 1. Poor roads, as yet but little traveled, intensify the discomforts of the winter. The contour of the district is of such a character that, for some time, no deep mining need be done by anything but tunnels. Adits 3000 to 5000 ft. long will develop from 1000 to 1500 ft. of backs, with a corresponding proportion of backs from shorter ones. There is, on most of the locations, an abundance of timber, such as fir, pine, and spruce, of sufficient quality for all mining purposes. Water in sufficient quantity for all domestic, steam, or milling needs springs from the district, but water for power-purposes cannot be obtained short of 25 miles from Deep creek, Oregon.

Up to the present time there have been no milling facilities in or near the district. This has held back development materially, as with the present system of transportation, and the distances to be transported, nothing short of $50 ore can be worked profitably. However, a custom mill is now being built, which is half completed. It will be ready to accept ores for treatment next spring. In this mill the ore will pass from a Blake breaker to a Lane Chilean mill. The pulp, after passing a 100-mesh screen, will flow over silver-plated plates to a classifier, from which the sand will go to vats for cyanidation, and the slime to slime-tanks. The gold is fine and therefore fine grinding is necessary.

The Innoko is a tributary of the lower Yukon near the Kuskokwim, which is next to the Yukon among Alaska rivers. Many placers occur on small streams in areas that are drained into the lower Yukon or the lower Kuskokwim, and their occurrence is interesting to the miner because it proves that the formations of the upper Yukon gold-belts extend much farther southwest than has generally been supposed and that they are gold bearing at many scattered localities throughout their extent.

Batan coal mines are now turning out 6000 tons per month, and the demand for the product already exceeds the supply. The Manila Electric Railroad & Light Co. has placed an order for a continued supply of this coal for its plant in Manila.

Whitepine Iron-Ore Deposits.

By E. C. Harder.

*The Whitepine district lies on the west slope of the Sawatch range about ten miles north of Marshall Pass, in the southeastern part of Gunnison county, Colorado. The principal deposits lie on the east slope of the valley of Little Tomichi creek, about half a mile northeast of Whitepine, at an elevation of about 9500 feet.

The ore-bearing area has a northwest-southeast trend lying along the contact of a granite with shale and limestone. The granite, which is on the northeast and occupies the upper part of the slope, is directly connected with the great pre-Cambrian granite mass forming the Sawatch range. The sediments are presumably Paleozoic, being lithologically similar to those of the Taylor Peak district. Next to the granite there is generally a layer of vitreous quartzite, of varying thickness up to 30 ft., which may represent the Cambrian. The iron ores occur locally between this quartzite and the overlying rocks. Outside of the quartzite and ores, where these are present, there is a strip of dark-colored limestone and shale, chiefly the latter, and outside of this is a blue or white crystalline limestone, which occupies the lower and principal part of the slope. This limestone is similar to the Carboniferous limestone of Taylor peak. Besides these rocks a light-gray rhyolite is present as an intrusive into the dark shale formation and along the granite contact. The rhyolite has been intruded in disconnected masses, whose forms could not be determined from the exposures found. The rocks are much fractured and faulted, but the details have not been worked out.

The iron-ore deposits of this district are of two kinds—limonitic bog ores and replacement deposits of magnetite and limonite ores. The former occur in a small deposit along Little Tomichi creek within the granite area, about a mile above the principal deposits. The latter are found in small irregular masses in the limestone-shale formation near the granite contact. In some places only a few feet of vitreous quartzite intervene between ore and granite; in others a mass of rhyolite and layers of the dark limestone-shale formation are present in addition to the quartzite. No place is known where the iron is immediately in contact with the granite. In the Iron King cut, the largest deposit in the district, no quartzite is exposed between ore and granite, but the direct contact cannot be seen. As a rule the dip of the contact is steeply toward the iron.

Detailed Map of the Whitepine Iron-Ore Deposits.

The principal deposits vary in thickness from 5 to 40 ft., and extend along the contact for a distance of several hundred yards. Beyond in either direction is merely a local staining and a few small veins. Ore occurs also in small bodies where the rhyolite has intruded the sediments away from the granite contact, especially where the sediments are limestone, and a few deposits are found in the limestone away from the intrusive masses. The deposits along the granite contact and in association with the rhyolite consist largely of magnetite, but those entirely within the limestone, at some distance from the igneous rocks, are composed of dark brown porous limonite.

The ore associated with the igneous rocks is mainly a glossy, black, compact magnetite with seams and specks of limonite. Locally this ore grades into blue fine-grained magnetite with chlorite, quartz, and

*Abstract from 'Contributions to Economic Geology, 1908', U. S. Geol. Surv., Bull. 380.

calcite disseminated through it, similar to some of the Taylor Peak ore. In the Iron King cut masses of serpentine and quartzite are interleaved with the magnetite. Large masses of brown ocherous material, which probably represent incomplete replacements of the limestone-shale formation, occur between the sediments and the orebodies. This partly replaced border varies in thickness and degree of alteration; in some places it consists merely of stained quartzite, but elsewhere it is soft and friable and contains numerous veins of magnetite, limonite, chlorite, and kaolin. Here and there masses of partly replaced sandstone and shale occur as lenses surrounded by ore or as bands between adjacent ore deposits. The sediments near the ore deposits are heavily impregnated with contact minerals, among which the most conspicuous are epidote, chlorite, amphibole, pyroxene, garnet, pyrite, and magnetite.

From the foregoing statements it is clear that the iron ores are replacements of the calcareous parts of the limestone-shale formation. The nature of the gangue minerals shows the solutions to have had a deep seated source, but the distribution of the deposits does not show as clearly as the Taylor Peak deposits the nature of this source. The fact that the deposits lie along the granite contact seems to point to the granite as the source, yet that rock is presumably much older than the overlying rocks that contain the ores. The association of the intrusive rhyolite with the granite contact and hence with the ores appears more significant. It is probable that the rhyolite intruded at this horizon, because it was easier of access, on account of the fracturing, and that the ore-bearing solutions were associated with it. Direct evidence for this hypothesis is not everywhere plain, yet the orebodies and the rhyolite are closely associated and the sediments become altered and iron stained as the intrusive rock is approached. The limonite ore within the limestone occurs as veins, breccia deposits, and small irregular replacement masses and is clearly of a different type from the contact ores. It was probably deposited by iron-bearing meteoric waters along open channels and replaced the adjoining rocks. The deposits are of small size and of no importance, few of them being more than 15 or 20 ft. in diameter.

The bog-ore deposit occurs in the valley bottom along Little Tomichi creek, about 1½ miles northeast of Whitepine. The granite contact crosses the creek between it and the contact deposits, and the bog ore is a considerable distance within the granite area. The deposit is 3 or 4 ft. thick and perhaps 2 or 3 rods square and consists of successive layers of ore several inches in thickness. The ore is light and porous and is made up largely of evergreen needles and other vegetation, replaced by limonite. At several places along Little Tomichi creek, between this deposit and Whitepine, where the valley bottom is boggy, bog ore is being formed at the present time. This process is especially noticeable below the slope where the contact deposits occur.

So far as present developments show the Whitepine deposits can be considered of but small economic value. They occur in a narrow contact zone, and are probably too thin to make mining profitable.

Aroroy District, Masbate.

*During the past two years miners of the Aroroy district, Masbate, Philippine Islands, have been steadily engaged in legitimate development, with the result that they have succeeded in pulling the mining industry of this district out of the mire into which it was plunged by the reckless operations of some of the earlier companies. H. G. Ferguson, geologist of the Division of Mines, has been in the district almost continuously since last August, collecting material for a bulletin on the geology of the area. The following details of the mining operations are presented in advance of the publication of the report.

Geologically, the district is composed of a series of old sediments which have been intruded by a mass of quartz diorite. Later a large amount of volcanic action has taken place, giving the series of andesites and breccias which today cover most of the district and contain all the more important veins. Vein formation took place in Tertiary times. The principal veins of the district occupy the three large hills, Mounts Aroroy, elevation 255 metres; Bagadilla, 350 metres; and Kalakbao, 205 metres. As a rule, the veins are broad, straight, and well defined. Widths of over 20 ft. are not uncommon, and faults are rare. The ore commonly occurs as banded honeycombed quartz filled with manganese or iron oxide, the banding being most pronounced near the walls. Varying amounts of calcite also occur in several of the veins. In many veins there is evidence of different periods of mineralization. The walls are nearly always well marked and the ore breaks cleanly from the country rock. In some cases the country rock, a decomposed andesite locally called porphyry, shows workable ore for several feet from the vein proper. So far exploration has been carried on only in the oxidized zone, which extends to great depth, reaching nearly to the permanent water-level. At this depth the ores show a tendency to change to a massive blue quartz, impregnated with pyrite. The strong relief of the district places a large amount of the available ore above the water-level, and consequently it is in the easily worked oxidized form. Tests which have been made in the United States for different companies have given from 20 to 33% extraction by amalgamation. It is probable that actual practice might even give less; this low amalgamation being probably due to the large amount of manganese in the ore. On the other hand, the ore is particularly adapted to cyanidation, tests made in the United States and by the Bureau of Science at Manila showing that an exceptionally large recovery can be obtained by this method. One company which is now preparing to erect a modern mill and cyanide plant, plans to dispense with plates entirely, the stamps crushing in the weak cyanide solution. Suggestions have been made at different times that Chilean mills might be used on account of their cheapness, but the large amount of hard massive quartz which must be handled would probably make this method impracticable.

*Abstract published by courtesy of Warren D. Smith, Chief, Division of Mines, Manila.

The question of power is one of the most serious in the district. The Gumobatan river runs nearly dry at times, and it is doubtful if even with a dam and storage reservoir it could be regarded as a source of power. Good water power might be developed by a dam at the upper gorge of the Lanang river, which has a greater and more constant volume than the Gumobatan. At present, mangrove firewood can be delivered at the mines at an average cost of about ₱5 per cord, a cord being considered approximately equivalent to one-half ton of Australian coal. If several power-plants were working, however, the more accessible parts of the mangrove area would soon be cut away and the price would increase. The enforcement of the local Forestry Bureau regulations in regard to the cutting of the large trees only, would also tend to increase the price. On the other hand, there is every probability that a sufficient supply of Philippine coal will soon be available at a reasonable price. Coal from the Batan mines, which at present have a monopoly of Philippine coal mining, sells at the mine for ₱6.50 per ton, and could be brought to Aroroy. Besides this, coal of better quality has been recently found on the island of Masbate, about forty miles down the coast from Aroroy. It is hoped that a company will soon be formed to prospect these deposits. If satisfactory results are obtained, the mines at Aroroy should be able to secure their coal at a much better figure. The islands of Cebú and Mindoro also contain coal, and no apprehension need be felt in regard to fuel.

In regard to timber, the district is most favored. Molave and other timbers of the 'first group' sufficient to satisfy all immediate requirements are to be found on most of the claims, particularly those of the Colorado, Syndicate, Tengo, and Aroroy companies. At present, the following represent the average prices paid for timbers: first group timber, 7 ft. long, squared 7 in. (in some cases only molave accepted), ₱1; same wood, rough, 75cv.; lagging (molave boards or other first group wood), per running foot, 2cv.; ties, 4 ft. by 8 in. by 4 in., each, 10 to 12 centavos.

The following timbers are commonly used in the district, listed in the order of their preference: (1) Woods suitable for permanent workings: molave, dungan, kobe, bansalangan, matamata colorada, matamata blanca. (2) Woods available for temporary timbering, as in stopes which will eventually be filled: lauan, mangasinoro, to-og. Prices will increase somewhat as the timber in the immediate vicinity of the mines is cut, but the whole central range of the island is heavily wooded and there need be no fear of a shortage of timber.

As elsewhere in the Philippines, the labor supply is not entirely satisfactory, though up to the present time there has been no difficulty in securing the necessary labor at 60cv. per day if food is provided, or 80cv. if the laborers board themselves; and a number of fairly efficient miners have been trained. Wherever possible, work is let by contract, as this has been found to secure better results, owing to the close supervision necessary where native labor is paid by the day. There may be a temporary shortage of labor in the district when mines begin operations on a large scale, but there would probably be little difficulty in getting laborers from neighboring islands if necessary, in which event Government assistance can be counted on. The native is an irregular laborer, and it would always be necessary to have available a larger force than actually needed. It might not be possible to work a full force on Sundays and fiestas, but enough steady men could always be secured to keep a mill running continuously, even if mining work was occasionally broken into.

As stated before, the district is exceptionally situated for cheap mining. The mines are from a mile and a half to three miles distant from an excellent harbor, and this, together with the nearness to Manila, should be an important item when it comes to getting in heavy machinery. The high relief of the country gives excellent opportunity for attack by adit, and a large proportion of the best ore can be so won. While no definite figures are available, Mr. Ferguson believes that in a properly managed company the total costs of mining and treatment should not exceed ₱6 per ton. Allowing 20% for loss in treatment, this would give a profit of ₱2 per ton on ₱10 ore, and the great mass of available ore runs higher than this. The following figures, based on data which he has collected in the district, give average costs of prospecting and development work: drifts, ₱4 to ₱6 per foot; raises, ₱4 to ₱8; shafts, ₱12 to ₱30.

The Keystone Mining Co., operating on Aroroy mountain, the Colorado Mining Co., on Mount Bagadilla, the Syndicate Mining Co., operating the claims of the Eastern Mining Co. on Mount Kalakbao, and the Tengo Mining & Development Co., working the claims of the former Mount Cogran Mining Co. on Mount Cogran, have all been engaged in vigorous development during the year. Besides these, the Aroroy Mining Co. has lately taken over four groups of claims on Mounts Bagadilla and Kalakbao, including the former Gold Bug property, all formerly belonging to Messrs. Edelmaier and Beasley, and prospecting is being carried on vigorously and intelligently. In all cases the development now going on is the result of careful planning and is being well done. As a consequence, large quantities of ore are being blocked, and when production begins again it should show a constant increase from year to year. Other operators in the district who have continued steady work are Messrs. Hayes, Draper, and Schwab. Placer mining in the district has not recovered from the damage done by the hurricane of a year ago, when the dredge of the Lanang Dredging Co. was wrecked and their camp destroyed. The placer grounds of this company are now being re-tested and it is possible that the dredge will be re-built. In conclusion, it may be said that the condition of the district was never better, and it is Mr. Ferguson's opinion that while Aroroy may never rank with the great mining districts of the United States or Australia, the next three or four years should show several large and profitable mines.

Natural gas is being developed in Carelmapu, southern Chile, in proximity to deposits of iron and copper.

Zinc Oxide Manufacture.

Written for the MINING AND SCIENTIFIC PRESS
By WILLIAM F. GORDON.

The manufacture of zinc oxide on a commercial scale in the United States commenced in 1855 under patents issued to Samuel Wetherill and Samuel T. Jones. The Wetherill patents cover the type of furnace and the preparation of the material, and the Jones patent the manner of collecting the fume. The Wetherill furnace consists of an arched chamber of rectangular horizontal section. The hearth is composed of perforated cast iron grate-bars, the whole forming a closed chamber resembling the ash-pit of a boiler. It is supplied with air under pressure. The arched roof of the furnace is pierced with an opening connecting with the clarifying and collecting apparatus. The furnace is operated by spreading over the grates a layer of fine coal or coke, and above this in another layer, the mixed fuel and ore. An average charge consists of about 30 lb. of fuel and ore to each square foot of hearth. The air under pressure coming through the perforated grate bars, upon which the charge rests, oxidizes the lowest coal to carbonic acid, which passing through the bed of coal is reduced to carbon monoxide. The monoxide reduces the zinc oxide of the ore to metallic zinc, being reoxidized in the process of carbonic acid. The zinc, at the high temperature of the furnace, volatilizes and its heated vapors, uniting with the oxygen of the carbonic acid, are again oxidized. This reduction and oxidation of the zinc taking place in the same furnace chamber is one of the interesting features of the process. The oxidation must take place from the carbonic acid, as the nature of the process prohibits sufficient atmospheric oxygen.

The residue or slag is removed from the furnace after the charge is treated and consists of ash and the non-volatile matters of the ore. It is entirely scoriacious in character. If the ore contains gold, silver, or copper, these are found in the slag and retreated by ordinary smelting. The oxide formed is carried by exhaust fans through the clarifying and cooling systems, and is finally collected in large muslin bags. A great number of these bags are connected to the sheet iron conveying pipes, permitting the entry of the gases in which is suspended the amorphous zinc oxide. The gases escape through the porous cloth and the zinc oxide is strained out. The bags are shaken at intervals, the oxide falling and being collected in proper receptacles. This, in brief, is the zinc oxide process.

Some years later E. O. Bartlett attempted the manufacture of basic lead sulphate from galena, using in part the zinc oxide method, modified to suit the new conditions. Basic lead sulphate, when properly made by sublimation, shows characteristics which make it the equal, if not superior, of carbonate of lead (the white lead of commerce), for paint purposes. It is not nearly so poisonous. It possesses great stability under atmospheric conditions, neither oxidizing and chalking off as does white lead, nor turning black in presence of sulphur compounds generated by burning coal. After much trial and experiment the results justified Mr. Bartlett's faith, and now great quantities are manufactured by the Picher Lead Co., at Joplin, Missouri. This pigment, as now made, is the peer of any on the market.

The process is as follows: The furnace used is a modification of the Scotch hearth. The mixture of ore and coke is supplied with a heated blast and the lead volatilizes in the form of a mixture of oxide, sulphate, and sulphide. The first product is a blue-black powder and contains an excess of sulphur. This blue powder is collected in a bag-room like zinc oxide. It is next placed on a floor and ignited, there being enough sulphur to burn without the addition of other fuel. This burning reduces the sulphur to proper quantity. The ignited blue powder, together with tin-scrap and coke, is charged into a furnace of cupola type, and is again volatilized, this fume or powder being collected in a second bag-room similar to the first. The fume is a white, impalpable powder, and is packed and sold as sublimed white lead. It is a basic sulphate of lead or a mixture of sulphate and oxide.

When I was managing the zinc oxide works at Joplin, Missouri, I found it possible to build a plant which would use the complex zinc-lead ores of the West, and at one process produce zinc oxide and basic lead sulphate. From a chemical point of view it looked unreasonable, but trial showed that a plant properly built would produce the results. Such works was built at Coffeyville, Kansas, and its success was very marked. This plant is owned by Sherwin-Williams company, which manufactures the pigment for use in paints.

This process is bringing into use the very complex zinc-lead ores and permitting their treatment without separation. The pigment produced is a compound of zinc oxide and basic lead sulphate and is second to none for quality and color. Ores which contain zinc and lead, and also copper, silver, and gold, are successfully treated. The non-volatile metals remain in the slag and are treated for these metals by ordinary methods.

That tungsten is used in making armor plate has been stated, and there has been a general belief that most of the tungsten mined was so used. It is stated, however, by the Ordnance Bureau of the Navy Department that tungsten is not now and, so far as known to that bureau, never has been used in the manufacture of armor plate in this country, and it is not known to have been so used in other countries, though it has probably been used in experimental armor plates. One of the most essential properties of armor plate is its ability to resist shock, and this property is not imparted to steel by tungsten. As the melting point of tungsten is very high—about 3080°C.—the metal is valuable for use as a filament in incandescent electric lamps, and such lamps are rapidly coming into common use. The whiteness of the light given by the tungsten filament makes it much superior to that of carbon, and the efficiency of the tungsten lamp is more than twice as great as that of the carbon lamp. Thousands of filaments can be made from a pound of tungsten.

Stoping Methods at Kalgoorlie.

By J. Currie.

*In dealing with this subject it is not my intention to write a detailed description of the various methods in vogue in the Kalgoorlie field, but rather to give a brief outline of three which are most universally used, and to make a few comparisons. The three methods are known as 'the Rill', 'the Flatback', and 'the Shrinkage.' For comparative purposes each method will be applied to a block of ore 500 ft. in length, and opened up by levels 200 ft. apart. It is necessary in 'the Rill' system, in order to facilitate handling the waste, to make connections between levels by raises and winzes about every 100 or 150 ft. along the orebody. After the leading stope is open for the full length of the drive, the level is timbered. Single stulls are put in up to a width of 14 ft. If the span is too great for stulls, set timbers or saddleback stulls are used. Stulls are lagged over with 4-in. gimlet poles, and wooden chutes are built at intervals of 50 ft. Ore passes are cribbed up through the filling directly above each chute, and are constructed of 7-in. round timber or 3 by 9 square timber, the passes measuring 4 by 4 ft. in the clear. Occasionally a double pass may be carried up, one side serving as a traveling way. Stoping is commenced off the winzes, and rills are gradually formed, one on either end of each winze. The rills are generally at an angle of 37° off the horizontal, this allowing for the boring of all water-holes. After the rill is cut through, and the ore, which gravitates down the rill to the ore pass, is cleaned up, machines are transferred to another portion of the stope, ore passes built up, and filling proceeds. The filling, which usually consists of residues, is dumped down the winzes from the level above and gravitates down the rill into position, although at the extreme points of rills a certain amount of handling is required.

The flatback system is similar to the rill, the difference being that the stope is carried horizontally. As the ore does not gravitate, but lies where it is broken, it is necessary to have ore passes at shorter intervals. Filling is also more expensive on account of the extra handling required. This method is usually used where the ground is heavy, and bulk heads are required to keep up the back or walls, as the flat bed of broken ore and rock forms a solid foundation.

In the shrinkage or lay system one connection between levels at about the centre of the block is all that is needed. The level is timbered as in the rill system, except that the chutes, which are put in every 20 ft., are constructed of ⅜-in. steel. These chutes practically consist of a steel lip protruding into the level, the bottom of the chute being formed by the broken ore itself. Any rocks which are too large to pass through the opening can be blasted without damaging the chute. The stope is rilled at an angle of 23°, all water-holes being bored. Sufficient of the broken ore, approximately 44%, is drawn off to allow comfortable working room between the back of the stope and the top of the broken ore, which acts as filling until the stope is completed. Two ladderways are cribbed up through the ore, one near either end of stope, built of 6-in. half joggled logs, and measuring 3 by 3 ft. in the clear. These manways are commenced between two chutes, so that the shrinkage of the ore directly over the chute will not affect them. When blasting, only a few holes are fired in a round, so as to allow the large rocks to be broken down sufficiently small to pass through the chutes. After the stope is broken through to level above, all ladders and air pipes are removed and the balance of the ore remaining in the stope is drawn off. The passes then collapse, and the timbers are regained through the chutes, to be utilized in other places. Filling is then a simple matter, as, the stope being open, the broken ore may be dumped at whatever point required.

Where conditions permit of the satisfactory working of the shrinkage system I prefer it. In the rill system, in opening up the block of ore, three or four winzes are essential to economical mining, while in the shrinkage system one winze is sufficient. A considerable saving in the cost of development is thus effected. Expensive ore passes, which have to be installed and maintained in the rill system, are entirely dispensed with in the shrinkage system. Loss of time, in shifting machines preparatory to filling, is avoided, because in the shrinkage system the stope is not filled until after it is broken through and the ore drawn off. In the rill system a certain percentage of ore, no matter what care is exercised in cleaning up rills, is lost in the filling; while in the shrinkage system a certain amount of low-grade material scales off the walls and reduces the grade slightly. This can be reduced to a minimum by strict supervision in the breaking of the stope. There are certain conditions under which the shrinkage system, if applied, would be unsuccessful, such as in flat veins or in stopes where the walls and backs are bad; but where the lode is at all near vertical and the walls fairly good I am satisfied that it is a cheaper and just as satisfactory as the rill system. In isolated patches of ore, which probably would not be worth considering if a lot of dead work were necessary to deliver the ore in the stope, this system can be used to advantage.

*Abstract from Trans. Aust. Inst. Min. Eng., Vol. XIII.

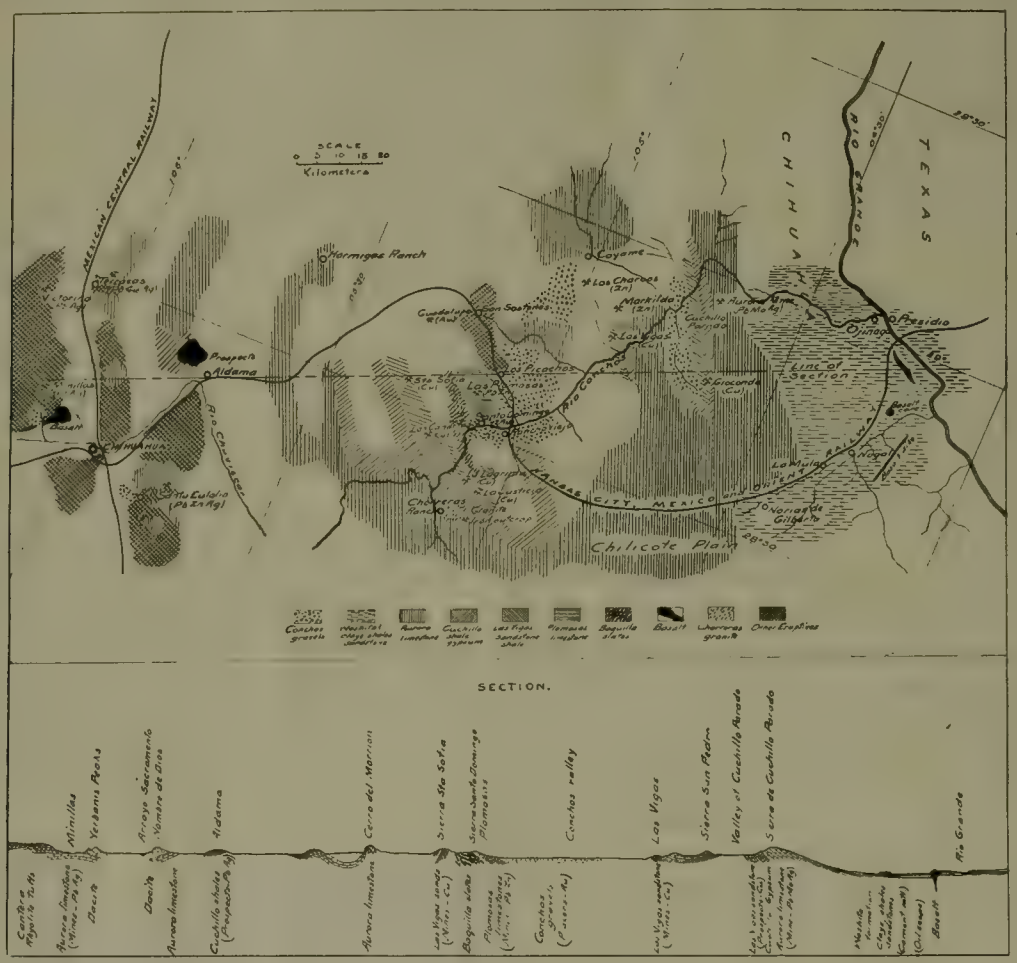
The Illinois runs from petroleum wells showed an increase during January as compared with the month previous, but there was also a substantial increase in the deliveries, so that the net results represented a reduction in the stocks. The January runs from wells in Illinois as credited to the Standard, or Ohio Oil Co., were 2,226,107 bbl., as compared with 2,130,736 in December. The regular deliveries for January were 1,226,378 bbl.; the other deliveries were 1,184,565 bbl., as compared with 1,382,412 during the previous month. The gross stocks of Illinois oil held by the Ohio Oil Co. at the close of December were given at 28,671,543 bbl.; and at the close of January 28,455,129, a reduction of the stocks in January amounting to 216,414 barrels.

The Utah Copper Co. has reported to the New York Stock Exchange for the year 1909 a production of 51,749,233 lb. fine copper, with the average price received, 12.96c. per pound, and net profits, $2,159,786.

Prospecting in Chihuahua.

Written for the MINING AND SCIENTIFIC PRESS
By R. H. BURROWS.

Among the less explored regions of Mexico, that least known is the eastern part of Chihuahua, and northern portion of Coahuila, lying north of the 27th parallel of latitude, bounded on the west by the line of the Mexican Central railway, and on the east by the National railway and the Rio Grande. The lack of knowledge regarding this part of the Republic is due to its want of water. The rainfall is slight and the springs are few and far between.



Due to these conditions this country constituted the last stronghold of the Comanche Indians in Mexico, from which they were with much difficulty dislodged by the combined forces of the Mexican and United States governments. In some instances, the springs are so hard to find and so far apart that no small risk is incurred in traveling without a guide.

Although water is scarce, grass is everywhere plentiful, besides a large variety of thorny shrubs peculiar to arid localities. Timber worthy of the name is exceedingly scarce; cottonwoods grow in the vicinity of springs and along the few watercourses. A sparse growth of pine and oak crowns the higher summits that border the Rio Grande, as in the Sierra Rica. Wood for camp-fires, however, is not lacking, the chief supply being mesquite, that most useful of desert shrubs, which during the period of its fruiting in June and July is also capable of affording food for man and beast. It is said that the aborigines always became fat at this period, subsisting entirely on the sweet succulent pods. These are still made use of by the Mexicans who grind the bean together with the pod into a paste called *mesquitamal*, which is both palatable and nutritious. Travel is comparatively easy so far as topographic features are concerned, and a great deal of the country may be covered by wagon. The country in general is similar to that seen along the Mexican Central railway from Jimenez northward to the border, and is contemporaneous in formation, constituting part of the same geological province, and about equally divided between mountain and plain. The mountains prevail as small topographic units, consisting of narrow ranges from five to ten miles in length, encompassed on all sides by plains, the mountains rising from five hundred to two thousand feet above their flat surroundings. On approaching the Rio Grande, the plains merge into a continuous range of rugged hills and mountains which follow the river almost without a break, along the northeast border of the States of Chihuahua and Coahuila. The axes of the range have a general northwest to southeast direction, this uniformity having been determined by the folding and faulting

which accompanied the elevation of the continent to its present position. The ranges show the upturned edges of the strata in a succession of exposures of the same geological formations, until the eastern border is approached, where later beds are encountered. The prevailing rocks are limestones and sandstones of sedimentary origin, probably corresponding to the Comanche Series of the Cretaceous. Sparsely distributed throughout are small areas of volcanic tuffs and massive eruptives.

The importance of this region with reference to mining, and the inducement it offers to prospectors, may be better appreciated by calling attention to the mining districts of Santa Eulalia, Naica, Sierra Mojada, Sierra Almoloya, and others within the same zone and situated in small ranges which exhibit the same topographic and geologic characteristics as those farther in the interior. Wherever established routes have made this field accessible important mines have invariably been discovered. The country in question is divided into two parts by the Conchos river, the settlements along the river-bottom having resulted in the prospecting of a strip 100 miles long by about 20 wide. Within this strip is the gold district of Guadalupe; the gold placers of Santo Domingo; the lead and zinc mines of Plomosas, Coyame, and Cuchillo Parado; the copper mines of Chorreras and Las Vigas; while across the Rio Grande a short distance from the mouth of the Conchos, is situated the Chanate range, where the Shafter district produces about half a million ounces of silver annually. Above Presidio del Norte, on the Mexican side, recent important discoveries of silver have been made; while below Presidio is the Terlingua quicksilver district. On the western border of the region, reached by the old stage routes, are situated Sierra Mojada, Naica, Santa Eulalia, and Terrazas. Mention should also be made of the recently discovered district of the Sierra de los Lamentos. The existence of such a number of important mining districts around the edges of this field surely justifies more attention to the interior than it has yet received. The accompanying map shows approximately the geology along the line of the Kansas City, Mexico & Orient railway, between the city of Chihuahua and the Rio Grande, and may be accepted as generally typical of the country under consideration. The principal ore-bearing formations are the Plomosas limestone, the Las Vigas sandstone, and the Aurora limestone. The latter is the same formation in which the ores of Sierra Mojada, Almoloya, Santa Eulalia, and other great silver-lead-zinc deposits of central Chihuahua are found. The Aurora lead mine and the Shafter silver mine are also within this formation. Below the Aurora limestone, and separated from it by a considerable thickness of gypseous shales and thin-bedded limestones (Cuchillo formation), are the copper sandstones of Las Vigas. In these rocks are found the mines of Las Vigas, Justicia, Santa Sofia, and others, which have produced and are still producing a goodly quantity of copper ore. These mines are not confined to one locality, but are situated on sandstone outcrops fully 30 miles apart. I have had occasion to travel many miles over these outcrops, and wherever the bedrock permitted examination of the bedding planes some copper sign could always be distinguished. This would seldom be more than a mere stain of green carbonate, but when followed it generally led to some workable deposit, as in the mines above mentioned. The character of ore in these sandstones is high-grade, consisting of fairly pure oxides, glance, and chalcopyrite, and carries as a rule from 4 to 10 oz. silver per ton. The Plomosas limestone yields copper, lead, and zinc, the latter being the principal product, consisting of carbonate which averages 50% metal.*

These three mineral-bearing formations underlie the entire region here considered, where they are exposed at frequent intervals in the scores of small ranges which constitute its principal topographical feature. Every one of these ranges merits attention from the prospector's standpoint, and offer better chances for the discovery of important mines than any part of the Republic that I am familiar with. Prospecting this field involves no greater difficulties than those encountered a few years ago in the desert portions of Nevada and Utah. The climate is somewhat similar, the midday heat being quite high, but generally tempered by a breeze, while the nights are always cool and comfortable. During the winter the plains are subject to cold winds, but it seldom snows. From September to May is the most favorable season for prospecting. The country cannot be recommended to the type of prospector who takes his pick, frying pan, and sack of grub on his back, trudging off on foot; but it does hold out exceptional inducements to energetic men who can afford an outfit of mules, or better still, a wagon, using the draft animals for riding and packing when necessary. In this way, and making a permanent camp at some spring as a centre, the country within a radius of 20 miles could be covered. At the farthest camp that could be made in the interior, the prospector would not be removed more than about four days from some base of supplies. Preparatory to the actual work, a couple of weeks might be spent profitably in an inspection of the mines tributary to the Conchos river, making himself familiar with the mode of ore-occurrence, and the relations of the enclosing rocks.

It must not be understood that the region spoken of is unknown to the natives. Their long acquaintance with the country and knowledge of the sources of water-supply enables them to travel across it in almost any direction, and there is generally some native settler, or at least a cattle camp in the vicinity of the principal springs. Consequently intelligent guides are not difficult to obtain.

The neglect of this district by prospectors may be explained on the assumption that the Sierra Madre and southern parts of the Republic, with their pleasant climate, abundance of timber and water, and the convenience of food supply, have diverted attention from this other promising field, in the same way that the Rocky Mountains and Sierra Nevada were thoroughly gone over before much serious attention was given to the arid region lying between them.

*For further details regarding the geology and mineral resources of this region, see article on 'Geology of Northern Mexico', by R. H. Burrows, in MINING AND SCIENTIFIC PRESS, August 28 and September 4, 1909.

Methods of Electrochemical Amalgamation.

By Elmer Ellsworth Carey.

*While the theory of electrochemical action has been known for many decades, it is only within the last few years that methods and machines for making a practical use of the theoretical knowledge have been devised. In 1859 United States letters patent were issued to Henry Brevoort, of San Francisco (No. 25,242), for an arrastre in which amalgamation was intensified by electrochemical means, and in 1862 a patent (34,881) was issued to J. C. Davis for an arrastre in which means were provided for galvanic action. On July 2, 1861, Frank Dibbern secured a patent on a barrel amalgamator in which he provided for 'local electrochemical action' by adding zinc or iron filings and a mercury salt to the water and pulp. His idea was that local galvanic couples would result, the mercury being deposited on the gold particles (cathodes) by electro-deposition. In 1867 Julio H. Rae was granted a patent for an electro-cyanidation process, which covers the essential points of the systems of today. In 1882 Breakell and Haycraft used an electrolytic cyanidation process in South Australia; in the United States patents for similar processes have been issued as follows: 290,295; 491,686; 684,672; 641,808; 364,372; 779,365; 863,934; 504,678; 668,283; 370,366; 363,411. These patents refer to devices in which the pulp is agitated in a tank having the bottom covered with mercury, the stirrers and mercury being electrically connected. Patents for sluices arranged for electrochemical amalgamation have been issued as follows: 492,711; 669,058; 548,265; 460,722; 307,081; 285,523; 386,030; 641,360; 590,524; 328,532; 757,557. A patent for a system of electrochemical amalgamation was issued to Sir William Crookes on November 3, 1891, No. 462,535. References to electrochemical amalgamation and cyanidation may be found in the following works. Cyanide Process, by E. B. Wilson; A Handbook of Practical Cyanide Operations, by Wm. H. Gage; Practical Notes on the Cyanide Process, by F. L. Bosqui; Electric Smelting, by W. Borchers; Cyaniding Gold and Silver Ores, by H. Forbes Julian and Edgar Smart.

Electrochemical amalgamation may be used in connection with (a) the standard mill plate, (b) mercury wells, or (c) the mercury bath (pan amalgamation). When the usual copper-plate is used, anodes are suspended above it close enough to come in contact with the passing flow of water and pulp, which acts as an electrolyte. The copper plate is connected as the cathode. In the paragraph above, relating to patents, the numbers of several patents granted for electrochemical sluices are mentioned. Electrolytic sluices with suspended anodes require more water than the usual mill-plate. Mercury may be supplied as in the usual practice, or it may be supplied to the water in the form of a solution of bichloride of mercury. A solution of common salt added to the water greatly increases the efficiency of the device. High-grade graphite anodes give the most satisfactory results; there is a grade of graphite made especially for anodes which is superior to the ordinary carbon. A current density of one-tenth to one-quarter ampere per square foot of cathode surface is ample.

Mercury wells such as are described in the second volume of R. H. Richards' work on Ore Dressing can be connected electrolytically and their efficiency greatly increased; some tests were made some years ago in South Africa with mercury wells in which the baffle-plates were connected as anodes, and I am informed that a similar construction is now being used in California. There are several methods of constructing electrochemical mercury wells and many experiments have shown that the electrolytic mercury well is an efficient gold saver; there is no fouling or flouring, and no scum or coating collects on the mercury. Electrolytic mercury wells will extract gold from slime and will recover gold that cannot be amalgamated by the usual methods.

When low-grade pyritic ore is crushed to 100-mesh or finer, practically all the gold is released as free gold; but only a small percentage of the assay-value can be recovered by the usual mill-plate. Gold when in a finely divided state quickly becomes coated with argillaceous, talcose, or sulphurous coverings, and will not amalgamate; very fine gold easily acquires coatings, gaseous or otherwise, which effectually prevent amalgamation. Gold in slime cannot be extracted by the usual mill-plate; particles of gold in placer deposits sometimes have rusty, silicious, or cuprous coatings which effectually preclude amalgamation. With electrochemical methods, these difficulties are overcome. In electrochemical amalgamation a few pounds of common salt should be added to every ton of ore or pulp; by electrolysis the chloride of sodium is reduced to nascent chlorine and nascent sodium. Bichloride of mercury is also added to the solution; this salt under electrolytic action evolves nascent chlorine and mercury. As a result of these reactions, an alloy of nascent sodium and mercury is formed; this alloy absorbs nascent hydrogen produced by the decomposition of the water, and the resulting compound, known as hydrogen-sodium amalgam, has a powerful affinity for gold; in fact no compound known has a more powerful amalgamating action. The water and solutions become charged with nascent chlorine and hydrogen; these gases destroy foul or greasy substances in the pulp; rusty or coated gold is cleaned, the gases mentioned reducing all oxides. Nascent hydrogen reduces oxides at normal temperature. As a result of this cleaning and reducing action, gold particles have been freed from substances that would prevent amalgamation, and amalgamation takes place at the first contact with the mercurial surface.

Those who wish a more detailed account of the chemical and electrochemical processes are referred to a paper on electrochemical amalgamation in the May 1909 issue of the *Electrochemical and Metallurgical Industry*; to *The Mining Journal* (London) for June 12, 1909; and also to Vol. I., page 205 of the *Proceedings* of the London Institution of Mining and Metallurgy.

*From *The Engineering Magazine*.

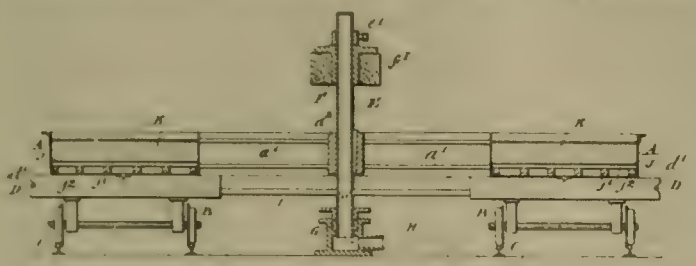
Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Vacuum Filtration.

The Editor:

Sir—In your issue of October 9, I note the letters of Edward Parrish and F. C. Frey, on 'Vacuum Filtration'. With the contention of Mr. Parrish that successful vacuum filtration now involves two distinct systems I entirely agree. The first he mentions is suction-adhesion of the solids on the filtering surface, and back-pressure at the exact period when it is desired to dispose of the residue. This I claim is embodied in my patent already referred to in the



MINING AND SCIENTIFIC PRESS of December 7, 1907, being a copy of United States Patent No. 619,211, February 1899. The other system Mr. Parrish refers to I also claim as my invention, and in support of the same I refer to the Victorian Patent granted to me on September 19, 1900, and patented in all the Australian States and in New Zealand. The patents in other countries were abandoned, as I failed to get financial support. I leave your subscribers to judge whether I am right in claiming to be the inventor of the process or method in dispute between Messrs. Burt, Parrish, and Caldecott, after reading the following extracts from the Victorian patent No. 17,559, above referred to: "The improved filtering apparatus * * * consists of a comparatively large annular trough or wheel *A* made with one or more compartments mounted upon a suitably constructed circular frame or platform carried by wheels *B* running upon a circular tramway *C*. Provision is made for rotating this frame by means of an endless driving rope *D* working within a groove d^1 formed for the purpose around the periphery of said frame. * * * The annular trough *A* is connected by spokes a^1 to a boss a^2 keyed upon a central vertical hollow pillar or shaft passing through and working within an overhead bearing. * * * The lower end of this hollow shaft *E* passes through a stuffing-box *G* in a pedestal-bearing from which a pipe *H* leads to a vacuum-pump, while radial suction-pipes lead from said hollow shaft to different points in the bottom of the annular trough. In this latter are arranged a number of battens j^1 and slats j^2 carrying a filter cloth *J* upon which rests a filter bed *K* of sand, which material I have found offers special facilities for the automatic removal of the slime as hereinafter described.* * * At any convenient distance from the slime-feeder I arrange a wash-water discharge pipe across the upper surface of the annular filter bed and provide said pipe with a number of holes or jets whereby a supply of wash water may be sprayed on to the surface of the slime, a deflector plate being used to ensure an even supply of water. * * * Means are provided for automatically removing the layer of slime from the surface of the filter-bed after it has been subjected to the operation of the filtering apparatus. These means comprise an inclined scraper pivotally supported at its rear end, and fitted at its forward end with an adjusting screw whereby the height of the lower forward edge of the scraper may be raised or lowered.* * * With a filtering apparatus such as that above described the slime will be fed on to the surface of the annular bed or filter-sand in an even and regular manner * * * and will be subjected to the action of the jets of water, * * * and the liquid contained in such slime, together with such wash-water, will be withdrawn by the atmospheric pressure upon the surface of the slime into the suction pipe *H* * * * for treatment in the ordinary manner. After the liquid has been removed in this way the layer of dry slime will be automatically removed from the surface of the filter-bed by the inclined adjustable scraper, * * * the height of sand on the filter-bed being removed by the delivery of sand from the sand-hopper."

Referring to my claim that I was the inventor of the first process mentioned by Mr. Parrish, namely, using a vacuum to cause the solids to adhere to the filtering medium, and at the desired period cutting out the vacuum and using back-pressure with the double object of disposing of residues and rendering the filtering medium again porous, I may mention that I have submitted my specification to two of the most capable men here, Professor Masson, of Melbourne University, and B. A. Smith, a leading consulting engineer. Both their reports uphold my contention.

After giving brains, time, and money to this, one naturally says, "What is the good of a patent? Is it simply a Government institution to put people at loggerheads and to encourage litigation?" I do not intend these remarks to apply to the patent office of any one country, as there has recently been an instance here (in the Commonwealth) of an important metallurgical patent, namely, the Potter process. After litigation extending over some years, and costing over £20,000, the Privy Council, the highest court of the British Empire, gave a verdict in favor of Potter, but the inventor himself is in his grave. The only thing Potter got out of his invention was worry and anxiety. So far my experience has been the same. Might I suggest for the consideration of international patents' committees that patents be granted with arbitration clauses where they overlap, but only for application in the case of the subsequent applicant introducing new and valuable matter. This would relieve many difficulties.

ASKIN NICHOLS.

Melbourne, Australia, January 6.

Regenerating Copper Cyanide Solution.

The Editor:

Sir—In his communication, in your issue of February 5, Isaac Anderson, commenting upon my experiments with acid regeneration of cyanide solutions, says that one "will get the same results day after day if the acid is not used in excess," and adds that I evidently used an excess of acid; apparently basing his assumption upon my statement that the hydrocyanic acid evolved raised a part of the precipitated simple cyanides to the surface of the solution. I assume, of course, that, by 'excess', Mr. Anderson means any amount of acid above that required to effect complete precipitation. The context, in his communication, preceding the statement quoted above leads me to believe also that the 'same results' refers rather to the recovery of the dissolved metals than to the regeneration of the cyanide content of the solution, the latter being the chief result desired from the tests which I made.

I did use an excess of acid, although it was comparatively slight, because my approximate methods of determining the essential proportions of acid and solution, and of measuring them, necessitated by the conditions under which I was working, did not permit of great accuracy, and, furthermore, my experi-

TABLE SHOWING REGENERATIVE EFFECTS OF VARYING AMOUNTS OF SULPHURIC ACID UPON CYANIDE SOLUTION CARRYING $K_2Cu_2Cy_4$ AND MINOR QUANTITIES OF OTHER DOUBLE CYANIDES.

No.	A.	B.	C.	D.	E.	F.	G.
1	0	2.8	3.0	...	...		
2	0.1	2.8	2.92	2.26	2.56	Slightly turbid.	Very light pp.; probably $CaSO_4$; slightly turbid.
3	0.2	2.4	2.92	2.28	2.4	Slightly turbid.	Very light pp.; probably $CaSO_4$; slightly turbid.
4	0.4	0.66	2.92	2.20	2.5	Turbid.	Small amount of fine-grained pp.; slightly turbid.
5	0.6*	0.60	2.92	1.84	2.36	More turbid.	Small amount of fine-grained pp.; slightly turbid.
6	1	0.40	2.88	0.62	1.4	Still more turbid.	Small amount of fine-grained pp.; slightly turbid.
7	2†	...	2.70	...	0.14	Small amount pp.	Small amount pp. solution, clearer than preceding.
8	3	...	6.76	...	0.14	Considerable fine pp.; some on surface solution.	Small amount pp.; slightly flocculent; clear solution.
9	4	...	7.75	...	1.60	More flocculent pp.; some on surface solution.	Flocculent pp.; little on surface; clear solution.
10	4.5	...	8.85	...	1.92	Flocculent pp.; some on surface of solution.	Flocculent pp.; some on surface; clear solution.
11	5‡	...	10.4	...	2.0	Flocculent pp.; more on surface of solution.	Flocculent pp.; some on surface; clear solution.
12	6	...	10.0	...	3.72	Flocculent pp.; more on surface of solution.	Flocculent pp.; more on surface; clear solution.
13	7	...	9.7	...	2.18	Flocculent pp.; more on surface of solution.	Flocculent pp.; more on surface; clear solution.
14	8	...	9.95	...	2.24	Flocculent pp.; more on surface of solution.	Flocculent pp.; more on surface; clear solution.
15	10	...	9.3	...	2.58	Flocculent pp.; more on surface of solution.	Flocculent pp.; more on surface; clear solution.
16	15	...	8.9	...	1.74	Flocculent pp.; more on surface of solution.	Flocculent pp.; still more on surface; clear solution.
17	20	...	8.9	...	2.2	Flocculent pp.; still more on surface of solution.	Flocculent pp.; still more on surface; clear solution.
18	30	...	8.6	...	2.4	Pp. very coarse and flocculent; much on surface.	Coarsely flocculent pp.; surface covered; clear solution.
19	50	...	8.8	...	2.78	Coarsely flocculent pp.; surface covered.	Coarsely flocculent pp.; about ½ on surface; clear solution.

Column A. Amount of acid in c.c. per litre of cyanide solution; H_2SO_4, sp. gr. 1.84 used.
Column B. Titration with $AgNO_3$. Pounds KCN per ton solution. Titrated immediately after adding acid.
Column C. Titration with $AgNO_3$. NaOH added to render solution alkaline.
Column D. Titration. Acidified solution allowed to stand 12 hours. Titrated without adding NaOH.
Column E. Titration. Acidified solution allowed to stand 12 hours. Titrated after addition of NaOH.
Column F. Remarks on physical appearance of column B solutions.
Column G. Remarks on physical appearance of column D solutions.
Columns B and D. Solutions filtered before titrating.
Columns C and E. Acid precipitate filtered from solution before addition of NaOH. Alkaline solution again filtered before titration.

*Solution acid after titration. †Solution acid before titration. ‡5 c.c. per litre to effect complete precipitation.

ments seemed to show that, while the addition of the proper amount of acid required to effect complete precipitation produced the best net results, when cost and regenerative effect were both considered an excess gave results nearer the maximum than could be secured with a corresponding insufficiency of acid. In fact, the chief disadvantage of an excess seemed to be the cost of the additional acid and lime, or of caustic soda, required.

Furthermore, in regard to the escape of hydrocyanic acid and the consequent rise of a part of the precipitate to the surface of the solution as an index to the presence of an excess of acid, it appeared to me that some hydrocyanic acid was given off before the precipitation was complete, and this does not seem to be contrary to theory if the chemical reactions which take place are similar to

$$K_2Cu_2Cy_4 + H_2SO_4 = K_2SO_4 + Cu_2Cy_2 + 2HCy.$$

To obtain some further evidence upon this point, as well as upon the relative effects of insufficiency and excess of acid upon the regeneration of the cyanide content of the solution, I have made a few additional tests, the results of which are set forth in the accompanying table. I found that the same results were obtained day after day in so far as the freedom of the resultant solution from dissolved metals was concerned, but, of course, the amount of cyanide and precipitate recovered naturally depended upon the amount of double cyanides in solution. At the plant where my experiments were made, a limited sump-capacity prevented the manipulation of the solution so as to obtain the possible maximum content of soluble double cyanides in the solution to be regenerated. The addition of wash-water, precipitation of copper in the zinc boxes, and loss of copper-bearing solution with the discharged tailing, seemed to keep the copper-content of the working solutions at 0.5%, or slightly less. A freshly regenerated solution, upon being used, would quickly take up copper to the amount of about 0.25%. The percentage of copper, with further use of the solution, would increase more slowly until the apparent normal balance of about 0.50% was reached. This was the approximate copper-content of the solutions used in my experiments. Just what relation this percentage bears to a saturated solution I do not know. Mr. Anderson states that 80% or more of the potassium or sodium cyanide, as the case may be, can be restored in a saturated solution, and the wording of his sentence seems to warrant the inference that he means that this result can be obtained by precipitation alone. If, as seems to be the concensus of opinion, the reaction for copper is approximately as above, and similar for other common metals, a recovery of but 50% of the cyanogen of the dissolved double cyanides is theoretically possible by precipitation alone. My experiments showed, however, that the recovery of a large proportion of the remaining 50% was possible by subsequent treatment of the precipitate. I trust that Mr. Anderson will not take offense at my criticisms, as the impelling motive for this communication is merely to gain information.

R. P. WHEELOCK.

Searchlight, Nevada, February 22.

The State Mineralogist Again.

The Editor.

SIR:—In November of 1909 a remarkable circular, ostensibly in the form of an interview, was sent broadcast by the California State Mining Bureau. It contains an attack on the United States Geological Survey on account of alleged delay in publishing the figures of the gold and silver production for 1908. It states in substance that the statistics in question were formerly issued by the Bureau of the Mint about July 1 each year, but that since this work was turned over to the Geological Survey the statistics are each year longer delayed. The State Mineralogist is uncertain whether this should be charged to incompetency or carelessness. While the circular is not signed, it was evidently written and distributed by L. E. Aubury, who still appears to be State Mineralogist of California. It would be charitable to suppose that the misstatements in the circular are due to ignorance. The assertion that the final figures of the production of gold and silver were always issued by the Bureau of the Mint about the first of July of each year is erroneous. The Bureau of the Mint has always given out these final figures in October or November. The statement that "about three years ago the Mint turned the work over to the Geological Survey" is again erroneous. The Director of the Mint, now as always, ascertains the gold and silver production from the statements of Mints and refineries. The Geological Survey, since 1904, ascertains the detailed production of each State, by counties and mining districts, through direct correspondence with the mine owners. Statisticians understand well that figures obtained from Mints and refineries will never quite agree with those obtained from the primary producers. The tabulation of the detailed statistics collected by the Survey is completed in the summer months, in July or August, but they are not published until opportunity has been afforded to compare them with the data of the Mint, as errors made in the returns of refining companies or producing mines can often be detected by such comparison. The Geological Survey has no authority over the Bureau of the Mint, and naturally waits until that Bureau is ready to compare and finally to issue the definite figures, which, as stated before, has always been done in October or November. The circular also contains some absurd statements in regard to the relative service to the public of the Geological Survey and the State Mining Bureau, but I do not think it necessary to occupy your valuable space with a discussion of these points.

WALDEMAR LINDGREN.

Washington, D. C., February 18.

The Katanga district, according to G. B. Beak, is widely mineralized and there is undoubtedly much good ground outside the concession. Abundant water-power is available. Besides the deposits of copper and tin, diamond pipes have been discovered on the Kundelungu and the West Lualaba. Quartz veins are present and payable gold probably will be found. For many years the district will be dependent on the Rhodesian railway system for transportation of supplies.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Creosoting timbers should be done at a temperature of about 160°F., and under a pressure upon the oil of from 100 to 120 lb. per square inch.

Micrometer measurements of precious-metal beads obtained in cupellation are liable to greater error in proportion as the ratio of silver to gold in the alloy increases.

Drill-holes in driving adits or levels of large section in ordinary hard crystalline rocks, should not exceed a total of 5, and may often be reduced as low as 3 ft., per cubic yard of rock excavated.

In pile driving, that the force applied must be greater than the resistance, is a primary principle. If, for instance, a 3000-lb. weight is placed on top of a pile, the pile goes down until the resistance equals 3000 lb. and then stops.

The Tennessee Copper Co. has returned a total of $2,275,000 in dividend on a capital of $5,000,000, par value $25 per share. The mine produced 14,000,000 lb. of copper in 1909 at a cost of 10.59c. per pound, and earned about $2.50 per share on its stock.

Coal production is estimated to amount annually to more than one thousand million tons, of which doubtless more than one-half is utilized in industrial operations. This means that between one and two million tons of coal has to be handled every day in the year, and that the ashes produced by its combustion have also to be handled, removed, and deposited elsewhere.

Shavings are used occasionally in boilers to reduce scale. The coloring matter and tannin combine with the calcium salts and precipitate them in a form which does not adhere to the plates, the woody fibre itself being beneficial in keeping the precipitate from forming a hard mass. On the other hand, the tannic acid corrodes the iron of the boiler, and it is a question which of the two dangers is greatest.

Water-packing is a term applied to a steam-point where one piece of metal slips within another, a few circular grooves being cut in one of the cylinders. The fit must be close, the idea being that the condensed steam in the rings or grooves forms a sort of packing. This system is used on engine indicators, and with some reducing valves of the piston type, where a tight steam-joint is desired and one cylinder must slip within the other.

Drilling hard diabase, having a specific gravity of 2.98, using a No. 34 slugger drill, with air at 90-lb. pressure, was found to average 1 ft. of hole per hour. The rock was very 'blocky', causing the drills to bind and stick badly. This was at Bergen Hill, New Jersey. The specific gravity of this trap rock ranges from 2.85 to 3.04, weighing 179 to 190 lb. per cubic foot. In normal trap the speed of drilling under like conditions is about 1 ft. in 20 to 25 minutes.

The jet condenser is the oldest type of apparatus for producing a vacuum by the condensation of steam, although the idea of a surface condenser was soon evolved for situations in which water containing salt and other substances had to be used, as in marine practice. When pure water is available, however, the immediate contact of the water with the steam still remains as a most effective means of condensation, and its applications are numerous.

Liquid air is produced commercially by the Claude process or by the Linde process at plants in various European countries. There is also quite a large one in this country using the Linde process, in Buffalo, New York. The chief product of these factories is compressed oxygen, and the principal applications of the oxygen are autogenous welding with the oxy-acetylene flame, cutting of metals with the oxy-oxy-acetylene flame, and the manufacture of artificial precious stones.

Powder-consumption in hard diabase in railway tunnel-driving at Bergen Hill, New Jersey, is reported to have been 2.9 lb. per cubic yard of excavation. The quantity used in making the advance at the main working faces was 2.5 lb., the excess being due to the 'trimming' shots on the sides, and blasting the channel for drains. At first 40% Forcite powder was used, then both 40 and 60%, and finally 60% dynamite exclusively. After passing through the diabase into the red sandstone the quantity of powder used increased materially.

Protection from rats in buildings whether in city or in country, is best afforded by the use of cement in construction. As the advantages of this material are coming to be generally understood, its use is rapidly extending to all kinds of buildings. Dwellings, dairies, barns, stables, chicken houses, ice houses, bridges, dams, silos, tanks, cisterns, root cellars, hotbeds, sidewalks, and curbs are now often made wholly of cement. The processes of mixing and laying this material require little skill or special knowledge, and workmen of ordinary intelligence can successfully follow the plain directions contained in handbooks of cement construction. Illustrated handbooks are often furnished free by cement manufacturers.

Lumber is the prevailing material of construction, and this is one cause of the great fire waste of the United States; there is another lying back of this—faulty construction and equipment. The list of causes of fires is headed by defective chimneys, flues, fireplaces, and heating and lighting apparatus—faults of construction and equipment. Matches, sparks, and explosions figure prominently in the list and are followed by incendiarism, electricity, and lightning. Nearly one-fourth of the fires are labeled 'unknown cause', which indicates forcibly the listless attitude not only of the general public toward this waste, but also of the men who are directly charged with protecting property against fire—the officials of municipalities and others.

Special Correspondence.

WESTERN AUSTRALIA.

Historical Summary.—Dividends in 1909.—Development Depth.—Metallurgical Methods.—Geological Survey.

The boom periods of the great Australian mining State, Western Australia, have passed, but there has been no desertion of mining towns nor any general stagnation. Instead the industry is being vigorously developed. It is now a fully established business, and the prospects for the future are brilliant. While it may be open to doubt whether the boom of late years was compensated by results the fact cannot be gainsaid that in the early stages of mining operations in the State, when camps sprang up like mushrooms, operators reaped a rich harvest. The development and productiveness of the mines have been as great as they were meteoric. The gold fever did not really develop until about 1894. It is true that the first return of 270 fine ounces was obtained in 1886, and that the industry was followed with additional vigor during the succeeding 8 years, but it was not until 1894 that production, on what might be termed a highly profitable scale, was carried on. Between 1894 and 1898 the output rose from 185,298 fine ounces to 939,490. After the latter period the million mark was reached. In 1903 the yield was 2,064,801 fine ounces, and although there have been numerous variations in the returns since, the figures have not been below a million ounces per year. The output for 1909 will show a considerable falling off in productiveness as compared with the past few years, and will be the lowest since 1899, in which year the world-famous Kalgoorlie field was opened. As an illustration of the progress of production the following figures are given:

Date.	Fine Ounces.	Value.
Prior to 1897	865,633	£3,686,971
1897	603,847	2,564,977
1898	939,490	3,990,699
1899	1,470,605	6,246,733
1900	1,414,311	6,007,616
1901	1,703,416	7,235,652
1902	1,871,038	7,947,663
1903	2,064,801	8,770,729
1904	1,983,230	8,424,226
1905	1,955,316	8,305,651
1906	1,794,545	7,692,744
1907	1,697,550	7,211,399
1908	1,648,505	7,037,579
1909 (11 months)	1,461,183	5,667,995
Total	21,473,470	£90,790,634

The dividends paid by the mining companies for the current year were:

	1909.	Total to Date.
Associated	£ 49,536	£ 691,449
Associated Northern	52,500	665,000
Black Range	32,625	130,437
Golden Horseshoe	165,000	2,925,000
Golden Ridge	27,812	61,409
Great Boulder Perseverance	70,000	1,426,250
Great Boulder Proprietary	262,500	3,169,300
Great Fingall	21,875	1,696,875
Hannan's Reward	1,748	1,748
Ivanhoe	240,000	2,348,750
Kalgurli	150,000	907,500
Lady Gladys	1,200	2,400
Lake View Consols	17,500	1,431,250
Mararoa	15,000	30,000
New North Boulder	2,100	2,100
Oroya Black Range	15,000	40,000
Oroya Brownhill	45,000	2,146,241
Sons of Gwalia	65,001	580,051
Sons of Gwalia South	12,000	24,500
South Kalgurli	20,000	85,000
	£1,266,397	£18,365,260

The decrease in the gold output is mainly due to the falling off of the yields from East Coolgardie where the mines have settled down to a regular output which provides continuous dividends for the shareholders. This is in accordance with the financial practice observed by the controlling companies.

Developments at the various mines during the year have revealed higher values in depth than previously exploited. The Great Boulder Proprietary has shown that the orebodies continue to at least 2600 ft., and that they maintain their average gold contents. This is the greatest depth in the district from which gold is being won. At 2600 ft. the lode is as wide and as strong as ever. Boring at 2400, 2500, and 2600 ft. has disclosed the continuity of the vein. At 2400 ft. it was 14 ft. wide, 3 ft. of this assaying 22 dwt. per ton; at 2500 ft. the vein was 14 ft. wide and assayed 10½ dwt. per ton, and at 2600 ft. 3 ft. of the vein assayed 11 oz. and 16 ft. gave 5 dwt. per ton.

The Ivanhoe shaft is down 2270 ft. At 1820 ft., where the vein averaged 46s. 3d. in the cross cut, for a width of nearly 50 ft., a fine shoot of ore has also been opened and the 2120-ft. is also looking well. The east lode, which is world famous, is the longest and most valuable on the Kalgoorlie field. It traverses the entire length of the Ivanhoe lease, and then extends several hundred feet north in the Great Boulder Proprietary ground and south for a greater distance in the Golden Horseshoe, where it is known as No. 3. The substantial increase in the percentage of extraction obtained from the treatment plant is one of the most noticeable features of the work at this great mine.

The Great Boulder Perseverance has devoted much attention to the deeper workings, and payable orebodies have been opened at 1750 and 1900 ft. Two new lodes have also been proved in the upper section of the mine, and are developing satisfactorily. The Perseverance, Lake View, and El Oro veins continue to be the most important bearers of payable ore in the property, and recent work on the old orebodies here yielded and continue to yield good results. Unfortunately the mine has just been visited by a disastrous fire which, besides doing about £400,000 worth of damage to the treatment plant, has caused a cessation of gold production for at least six months.

The principal factor in the present position of affairs on the Kalgoorlie belt appears to be a strenuous effort to maintain the grade of the ore going to mill, under the belief that this secures the greatest profit per ton treated. Large reserves of ore are being developed and considerable sums of money have been spent in this work. An analysis of the figures indicates a desire to maintain the reputation of the district for high-grade ore. The tonnage of ore falling just below the payable limit is not generally given; in fact the policy of the management is conservative in computing the values of ore reserves, and it is to these matters that attention should be directed, for in ore deposits of the character existing in Kalgoorlie it is nearly impossible to determine within, say 5 dwt. per ton, the value of a block of ore, say 150 by 150 ft., and it is this 5 dwt. that must often determine whether or not the block is to be counted in the declared ore reserves. In view of this it would be interesting to know how many blocks classed as payable have been proved to be non-payable, and vice versa.

Regarding the treatment methods, although during the last few years these have been improved in details, there has been no radical alteration of the plants. The efficiency and low costs of slime-treatment by the Cassel vacuum process have made it increasingly popular, and many mines have installed it. Considerable amounts of old tailing which would not pay to re-treat by filter-presses are being advantageously treated by this system. While the Kalgoorlie auriferous belt has contributed more than half of the gold produced in the State the geology of the district has never been properly studied. The reason is obvious. Kalgoorlie sprang up in a night, as it were. There was practically little searching needed to find the precious metal. It was got for the digging. When the baby propositions developed into healthy manhood a geological examination was deemed superfluous. Now, however, several of the mining companies, the Chamber of Mines, and the Government Geological Survey Department, have taken up that work. The result of

the labors of the geologists when made available should establish important facts pertaining to the ore deposits, which will tend toward diminishing the element of chance in prospecting and working the veins and lenses peculiar to this zone.

The position of mining in Western Australia must be regarded as being on a sounder footing than ever. While little outside capital has been introduced for some time, its steady development is almost wholly due to the exertions of the comparatively small number of the inhabitants themselves.

Western Australia possesses a great extent of ancient, pre-Cambrian rocks, covering an area of about 650,000 square miles, or about two-thirds of the superficial area of the State. Gold has been found at intervals over hundreds of miles but the auriferous areas are mostly confined to the ancient greenstones. When it is considered that hundreds of square miles of country are unfortunately covered by a peculiar kind of cement rock rendering prospecting troublesome, coupled with the small population of the State, it is difficult to predict what wealth lies beneath the surface. Moreover, as much of this region is not only unprospected but unexplored, there is undoubtedly a future for the prospector, the miner, and the investor.

JUNEAU, ALASKA.

Winter Work and Spring Plans. — Alaska Treadwell, Alaska Mexican, and Alaska United Reports.

Things are quiet around Juneau at the present time owing to the winter season. At present the mines in operation are the Treadwell group, the Alaska Treasure, Eagle River, and Gypsum Bay. Owing to lack of water-power the Perseverance, the Treadwell 300 mill, the Ebner, and the Alaska Juneau have been shut down since late in November. To this list may be added the Mills and De Groff mines on Chichagoff island, whose mills there have closed since the middle of December owing to lack of water-power. Work is being pushed rapidly at the Alaska Treasure mine on Douglas island. A cross-cut is being driven in from the beach a distance of 3300 ft. to tap the vein. A force of 50 men is employed working 8-hr. shifts. W. H. Priestley, Jr., is superintendent, succeeding D. J. Argall, who resigned late in November. The property of the Birner's Bay Milling & Mining Co. was sold at marshal's sale, the only bidder being the International Trust Co., of Boston; the bid was $800,000. This property has been in litigation for some years. On good authority it is stated that active work will be begun at Birner's Bay this spring. The opening of this rich property will be a source of great satisfaction to many. The Ebner mine, under the management of E. H. Tripp, is to be operated this spring by a new company. A larger mill is soon to be built, according to report. The Haltum group has been bonded by the Ebner. The Perseverance will open in the early spring as soon as its water-power is available, as will also the Alaska Juneau. In January an expert from Denver went to Pearl harbor, near Juneau, and examined John Peterson's mining claims. The outcome of the trip has not been made public, but it is known that a year ago Mr. Peterson bonded his property. The Mills and De Groff mines expect to resume operations some time in March. The Treadwell has built a dam at Sheep Creek, and is now putting in a pipe-line and building a power-plant. The electric power will be transmitted across the bay to Treadwell. With the Ebner, Alaska Treasure, and Birner's Bay mines added to the list of producers, this will undoubtedly be the banner year for the Juneau district. For the month ended January 15, the Alaska Treadwell reported 31,864 tons crushed with a total realizable value of $98,971, operating expenses of $78,136, and construction expense of $12,517. The yield per ton is given at $3.27 and the stock of broken ore increased 50,314 tons. The Alaska Mexican reported 18,312 tons crushed; $81,394 realizable value; operating expenses, $24,955; construction, $3699; yield per ton, $4.58; stock of broken ore decreased, 1209 tons. The Alaska United reported 32,898 tons crushed; $59,582 realizable value; $48,988 operating expense; $3869 construction expense, $1.92 yield per ton from the R. B. claim ore and $1.97 from the 700 claim. The stock of broken ore increased 1035 tons.

JOHANNESBURG, TRANSVAAL.

Big Movement in the Far East Rand.—Rumored Amalgamations. —New Electrical Association.—Cape Colony Labor Recruiting.—Mules Underground.—Coke for Gas Producers.

During the next year or two, there will be no division of the Rand more worthy of close attention than that to the east and south of the New Modderfontein, in the Far East Rand. The New Modderfontein itself is making splendid progress and stands among the 12 leading mines of the Rand. Costs have been reduced to 15s. 6d. per ton, milled. It is reported with seeming authenticity, that capital is to be raised to provide for a further extension of operations, for, although capable of milling today 50,000 tons per month, the mine—as pointed out by the chairman some time ago—can carry a much larger plant and has been scarcely touched in the eastern portion, adjoining the Modderfontein B company. This latter mine is said to be improving and to be showing in development a grade of ore far above the bore-hole results. Here, again, we may expect to see a big plant erected in the next two years. It is further officially announced that the Modderfontein Deep company is raising working funds by increasing its capital from £100,000 to £500,000. In addition to this new point of activity, the Government ground adjoining to the east, recently leased to Barnato Brothers, will soon be the scene of shaft-sinking operations. The Apex mines, whose shaft cut the reef last year, is developing, and the Van Ryn Deep has just reached the reef in its eastern shaft. The ground in this region is all held by strong houses. Four of these being concerned, healthy competition may lead to more rapid development than if the area were dominated by one firm. There are rumors afloat of big amalgamations in the East Rand (Leeuwpoort area) and the West Rand (south of the French Rand). As both schemes appear—according to the rumored details—deserving of keen censure from the mining point of view, discussion must be reserved till all the facts are available.

Rand Mine Laborers as They Enjoy Their Sunday Rest.

The newly formed South African Institute of Electrical Engineers held its inaugural meeting on January 13, under the chairmanship of its first president, C. W. Campbell. There was a large attendance and the new association received the good wishes of several representative bodies. Although the initial membership is satisfactory and there

is good promise of the production of valuable papers it cannot be said that the organization opens its career under wholly auspicious circumstances. There has been strong opposition to its formation and many of our leading electrical engineers have failed to identify themselves with the body. The reason is clear. Persistent efforts are being made to create one strong engineering society, with sections dealing with the various branches of the profession but with a common journal. That the electrical engineers would receive full consideration under the scheme has been promised, and it is contended that the formation of a new society at the present time may tend to weaken the movement for the amalgamation of the existing engineering associations. At the same time, the council of the new society does not appear to be opposed to the proposals for unification, but urge that they can obtain better recognition by adopting the present course. Hitherto, it may be observed, the electrical engineers have been served by the South African Association of Engineers, in whose proceedings have appeared some admirable electrical papers. This organization, however, deals as a rule with matters of general policy, with which the consulting man is more concerned than the routine electrician and it is the man of this status who is likely to support the new Institute. Just as the resident engineer on the mine is the backbone of the Transvaal Institute of Mechanical Engineers. The electrical engineer certainly demands far greater representation than he has hitherto obtained. Not long ago, his functions were limited to such duties as lighting, signaling, driving underground pumps, and operating minor units of mine equipment. Soon his functions will be universal, covering the operation of all main hoists and stamp-batteries.

The return of free labor recruiting a year or so ago led to the recurrence of many of the old abuses prevalent before the war, and recruiting organizations outside the Witwatersrand Native Labour Association, run on high moral principles, have not been signally successful in their results. Numerous complaints came from the Cape Colony of the dishonest methods of some agents, and it is, therefore, satisfactory that an enquiry has been made. While the Cape Government has introduced measures promising to hold the unscrupulous recruiter in check, the chances of more 'boys' coming forward have been improved. The Transvaal Government will be permitted to establish registry offices at various centres in the Colony, where registrars will control the dispatch of boys up to the mines. These officials will further examine the terms of the contracts under which the 'boys' have been recruited, seeing that they are thoroughly understood, and they will investigate any grievances expressed. Native messengers will also be sent around the country to make known the new protection afforded, and thus inspire confidence where none has, often with good cause, formerly prevailed. The shortage of native labor (which the optimists tell us will soon be over, largely because the December returns showed a gain after a succession of heavy wastages) has led to various schemes for economizing underground, and the Robinson Deep has adopted the employment of mules for mine tramming. This practice is almost novel to the Rand and is to be regarded with doubtful favor. As a general rule, the drifts are not sufficiently well laid out for mule transport, and there is rarely the opportunity of providing the beasts with well ventilated stalling accommodation. Further, if the company wishes to be clear of prosecutions, it must be extraordinarily careful in the choice of mule drivers, for the Kaffir would be a cruel master under these trying and ill-supervised conditions, and would not appreciate the necessity for care in the treatment of the animals, working and living in poor air. A good mule costing $200, the dangers of the innovation are obvious, but when it is a question of mules or nothing (a point of view that does not say much for the Robinson Deep's opinion of the unskilled white labor available for tramming), the factor of comparative economy is ruled out of the question. As an alternative scheme, the New Modderfontein is about to employ a petrol locomotive for underground haulage. This system is new to the Rand, and it is, therefore, satisfactory to find that it will be tried at a soundly run mine like the New Modderfontein, and not at one of those many properties which are so well managed that they can show a 10d per ton reduction in costs by the employment of any scheme introduced from quarters it is found desirable to please. If oil locomotives are as useful underground as the oil furnaces for drill-sharpening, there will be no cause for complaint. We are still hankering after an electric drill sharpener, to enable us to regulate the temperature with exactitude for the different classes of steel, but until this comes the oil furnace will continue to give satisfaction.

I must again give the *South African Mining Journal* a kindly hint as to the advisability of investigating the reasonable chances of accuracy in the reports it publishes in its editorial columns for syndicates. The 'facts' generally cannot be confirmed, but where the information is self-condemnatory it should not be printed without comments. In the *Journal's* issue of January 22 appears a report on the Vesta gold mine (a 'Black Reef' proposition) which is expected to start milling shortly. It is noted that "samples taken at various points give the following values—No. 1, 8 ft. from outcrop, 52 dwt. over 10 in.; No. 2, 60 ft. south, 54 dwt. over 12 in.; No. 3, 80 ft. south, 17 dwt. over 16 in.; No. 4, 81 ft. south, 105 dwt. over 12 in.; No. 5, 88 ft., 36 dwt. over 24 in.; No. 6, 170 ft., 24 dwt. over 17 in.; No. 7, 38 ft., 131.4 dwt. over 16 in. It will be observed that this represents 23.97 dwt. over a stoping width of 36 in., equivalent to a recovery value of £4 9s. 6d. per ton". Accepting the accuracy of this sampling, it will be seen that the average value of extraordinarily irregular sampling is taken to indicate the probable yield. Between samples called 1 and 2 (were there none between, and if so, of what value?) there is a distance of 52 ft., then comes a gap of 20, then three samples are taken within 8 ft. (no doubt a rich little pocket) following by the next 82 ft. away. Of course, the averaging of such returns is ridiculous for estimating probable yield, and especially for the patchy Black Reef, which will characteristically show an ounce sample between two 'traces' 10 ft. on either side. If the Vesta averages a yield of 6 dwt. it will be lucky.

F. W. Harbord, the British expert on iron and steel, studying the Transvaal iron resources for the Government, has completed his examination of the deposits, and is now going into the question of coking coal. It is doubtful if there is coal of the quality required to give a strong coke suitable for blast-furnace work. Mr. Harbord has stated, however, that our coal provides coke of high utility from the gas-producer point of view, and has suggested that there is room for useful developments in this direction, in the supply of cheap power for the operators of small units.

LONDON.

Cornish Tin Dumps. — Radium at Trenwith. — Wheal Kitty. — Cornish Geology.—Santa Gertrudis Flotation.

An interesting project has recently been undertaken in connection with the re-working of tailing heaps in Cornwall. A company called the Cornish Tailings Co. has been formed with a nominal capital of £40,000 for the purpose of purchasing accumulated dumps on the Carn Brea and Tincroft ground. So far the capital subscribed is £5000. The proposition to undertake the work came from Arthur Richards, a mining engineer of experience in various parts of the world, and the money has been put up by the Anglo-Australian group identified by the names of Baillieu and Lempriere. There is not room on the property to erect a treatment plant, so a wire-rope tramway is being built to convey the tailing to the old dressing-floors on the neighboring mine, Wheal Agar. It is estimated that the content of the dumps is from 7 to 9 lb. of black-tin per ton. The present price of black-tin is about 9d. per pound, so that the value of the dumps will average 6s. per ton. It is calculated that the dumps contain over a million tons of tailing. The question as to economical treatment requires narrow calculation. Transport, re-grinding, concentration, royalty, and profits will have to be figured closely, and the fluctuations in the market price of tin will have to be carefully followed. I think it is a scheme which stands a good chance of success; at any rate, the people connected with it have had ample

experience and are not likely to go into anything without being satisfied that the enterprise will win. A word of explanation should be given concerning the existence of such dumps. It is not through the superior wisdom of past managers of Carn Brea and Tincroft that these dumps are still in existence. They would have been dispersed along with the other tailing by being discharged into the Red river if there had been sufficient water-supply. The content is a trifle higher than has been discharged in the tailing during recent years, as the ore is now leaner than formerly. I reckon that the tailing discharged by the various mines into the Red river runs 5 to 6 lb. of black-tin per ton, and if the many streamers can make a profit by re-treating this tailing there is no reason why the present company should not do so also.

A few weeks ago I mentioned that the National Minerals Corporation had acquired the West Kitty at St. Agnes, Cornwall, and I traced some of the incomplete schemes belonging to that company. Since then the company has made an announcement relative to the St. Ives Consolidated Mines, which was formed a year ago to acquire a number of tin properties in the neighborhood of St. Ives as well as the Trenwith mine, which is notable for its production of pitchblende, and for its inferential content of radium. As I mentioned before, the directors have already established a laboratory in London where Sir William Ramsay is to produce radium. The latest announcement is that the Trenwith waters have been found to be radio-active, and that they are therefore suitable as a basis for the establishment of a 'spa.' No doubt we shall hear before long of the foundation of a sanitarium or a 'hydropathic', and the Great Western railway will boom the general curative powers of the town. St. Ives was once a busy centre of mining and fishing, but the pilchards deserted it soon after the decline in tin, and at the present time it has shrunk to a smaller estate. Efforts have been made to bring back prosperity by singing its praises as a watering place, but the accommodations are poor, and with the exception of an excellent golf-course there are no attractions. Besides, the dynamite manufactories on the opposite side of the bay form conspicuous landmarks that are not conducive to the peace of mind of invalid visitors. As regards the tin mining prospects at the St. Ives Consolidated mines, it is reported that many of the old workings, both shaft and adit, have been cleared, and a large central electric generating station has been erected. At first the power will be used for electric pumping with the object of unwatering below the adit.

While writing of West Kitty it is of interest to note that its neighbor, Wheal Kitty, is doing excellently. This mine was rescued from oblivion three and a half years ago by J. H. Collins, who found the necessary capital among his friends and re-opened the workings. The price paid for the property was £13,000 in shares, and work started with £8000 cash capital. Subsequently the capital was increased by another £5000, besides which, £5800 has been provided out of revenue for capital expenditure. During this time £3000 has also been distributed as dividend. The yearly output is rather over 12,000 tons, and the concentrate sold was 241 tons of black-tin during 1909. From this the income was £20,508. The economy of the management may be judged from the fact that the cost of directors' fees, management, secretary's salary, office, and general expenses was only £650 during the year. At various parts of the mine some excellent ore has been exposed, and in the southern portion near the boundary the lode is so promising that the adjoining Gooninnis property has been leased. Operations would proceed faster if the new main shaft were complete, and several of the shareholders have intimated their desire that the necessary capital should be at once subscribed. Without this Mr. Collins has had to proceed as best he could in the sinking of the shaft by applying some portions of each year's profits to that purpose.

Much amusement has been caused by the description of Cornish geology that appeared in a recent article on the Dolcoath mine in your Chicago contemporary. The writer says that the southwest extremity of England consists of a great expanse of old red sandstone. The reason for making such a queer statement is probably that the rocks are Devonian, and among this division is included the old red sandstone. The latter, however, only occurs in Scotland, as readers of Hugh Miller will know. Cornwall is composed of slate, and in Devonshire the Devonian series includes also some millstone grit, forming the scenery of Lorna Doone's country. In the Plymouth and Tavistock districts the rock is limestone. One of the geological features of Devonshire that confuses the visitor and the casual student is the existence of bright red cliffs on the coast south of Exeter. The observer immediately jumps to the conclusion that, as he is in Devonshire, the red rock must be Devonian, and therefore old red sandstone. It is, however, a different deposit, and belongs to the Permian. The writer in Chicago also says that "the sandstone at the junction with the outcrops of granite is covered with Killas, that is, hardened mud deposits derived from recent detritus of the granite." The word 'Killas' really means the slate in the vicinity of the granite, that has been contorted and metamorphosed by contact with the igneous intrusion. He also says that the "whole district is intersected by dikes of basalt running east and west, and curiously parallel." He presumably refers to the elvan dikes which consist of granite-porphyry. His geography is also at fault, for he places Camborne and the chief tin deposits in the north of Cornwall.

The successful issue of new shares by the Camp Bird company for the purpose of acquiring a controlling interest in the Santa Gertrúdis silver mine at Pachuca, Mexico, was one of the most important recent events in the London mining market. The company published a prospectus offering for subscription £500,000 of 6% debenture stock at 97½, and 280,000 £1 shares at £1 7s. 6d. The capital of the new Santa Gertrúdis Co. is £1,275,000, of which the Camp Bird will acquire by purchase 1,155,822 shares, £259,631 being provided out of the reserve fund, and the remainder out of the present issue. The Santa Gertrúdis Co. was formed to acquire the controlling or aviadora rights of the silver mine of that name in Pachuca, and the purchase price is ₱9,000,000, or £922,131. After this price is paid the company will have a working capital of about £150,000, which will be spent in further development in depth, and in the erection of a modern mill and cyanide plant to treat 160,000 tons per annum. The mine was discovered in 1876, and has been worked successfully by a local company, although the methods of treatment were out-of-date and expensive, the patio process being used. The adjoining mines, La Blanca and Barron, working on the same vein, have also been successful. The Santa Gertrúdis vein is large and persistent. It consists of friable quartz, and the valuable mineral is sulphide of silver, which contains some gold. There are practically no base metals present, so that cyaniding will give high extractions. The country rock is andesite. The vein varies from 10 to 30 ft. wide, and has been developed for more than a mile in length. The main ore-shoot has averaged 2500 ft., extending through the three mines. Within the Santa Gertrúdis ground is another smaller orebody, and the indications are that this will join the main orebody in depth. The main shoot has been worked down to the 1000-ft. level. The average content of the ore now available for stoping is 32 oz. silver, and ¾ dwt. gold, and the average value is about $20 gold per ton. The mine has been carefully sampled, and it is reported that 308,043 tons of 'positive' ore exists that will yield $2,565,055 gold profit and 218,240 tons of probable ore that will yield $2,714,906. The cost of treatment by a modern plant will be about $11 gold per ton. The petrological examination of the vein and country rock shows nothing to indicate any change in depth. The examination of the property was undertaken by W. J. Cox, manager of the Camp Bird. E. E. Chase, of Denver, did the sampling, F. J. Pope made the geological report, G. Doveton advised on metallurgy, E. E. McIntyre, of the Guanajuato Development Co., reported on the cost of mining, and R. J. Frecheville, one of the directors of the Camp Bird company, has visited the property and given his views. The issue of these shares and debentures was underwritten, partly by L. Hirsch & Co., and partly by the Canadian Agency, Ltd., one of Chaplin, Milne, Grenfell & Co.'s companies.

MEXICO.

Zacatecas Custom Mill.—San Roberto Mine.—Palmilla Mill.—Oil Concentration at Santa Barbara.—Largest Filter Plant.

The State of Zacatecas is now engaged in custom milling having a fifth interest in the custom concentrating and cyaniding plant recently built just north of the Zacatecas capital, and there is promise that the money invested with the object of encouraging mining in the old Zacatecas district will bring substantial returns to the State. The plant was recently placed in commission, a number of trial runs have been made with satisfactory results, and the machinery will be soon adjusted for steady operation. The response of the mining men of the district has been so general that the management of the plant has been compelled to decline ores until such time as additional storage facilities can be provided. The equipment of the custom plant consists of a 9 by 14-in. Blake crusher, two 5-ft. Bryan mills, one Card and two Wilfley tables, a tube mill, 5 by 14 ft., six Risdon Johnson tables, four Pachuca tanks, a Butters filter, and zinc boxes, the whole having a capacity of 60 to 75 tons per diem. There is already talk of doubling this capacity. The facilities for handling custom ores will be materially increased during the present year, as plans are being made for custom work at three other reduction plants in the Zacatecas district. Theodore Van Wagenen and the Cape Copper Co., of London, have surrendered an option on the

Zacatecas.

San Roberto mine in the Zacatecas district, and the property is again in the hands of the owners, J. A. Petit and C. A. Bently, who will continue development. Shipments of high-grade ore have been made from the San Roberto during the past several months, the ore yielding unusually high gold values. The Zacatecas Syndicate, Ltd., controlled by the Goerz interests of London, is working night and day shifts on a 3-compartment shaft on property acquired last year near the Villa de Guadalupe, in the Zacatecas district. This is the second shaft started, and soon work on a third will be commenced. An option on the Santa Rosa mine in the Concepcion del Oro district of Zacatecas has been taken by the Exploration Co., Ltd., of London, and extensive development is planned. The control of the mine is held by the Victor Clement estate. Milling soon will be resumed by the reorganized San Carlos Gold Mine, Ltd., of London, in the Mezquital del Oro district of Zacatecas. The 50-stamp mill and cyanide plant are being placed in shape for operation. The ore reserves are estimated at 120,000 tons.

The first 250-ton unit of the 1000-ton plant of the Palmilla Milling Co. (Alvarado Consolidated), now under construction in the Parral district of Chihuahua, will be completed not later than next September. The equipment ordered for the plant consists of three 9 by 15-in. Blake crushers, six 10-stamp batteries, 12 concentrating tables, 3 tube-mills, 5 by 22 ft., 24 vanners, 6 Pachuca tanks, filter-press, and the usual zinc boxes. A power plant of three 300-hp. compound engines, and three 250-kw. alternating current generators, will be installed. The reduction plant was designed by Bernard MacDonald, of Guanajuato, and will be one of the most complete in Mexico. The American Smelters Securities Co. has completed a zinc mill at its Tecolotes y Anevas mines at Santa Barbara, and if it proves successful the capacity will be doubled. The Tecolotes reduction works are now handling nearly 700 tons daily. The Arizona Parral Mining Co. has been organized to operate the properties of the American Zinc Extraction Co. in the Parral district. A plant for the Elmore process of oil concentration was recently installed. The second annual report of the Rio Plata Mining Co., operating the Santa Barbara silver mines near Guazapares, shows an income of $214,905 for the year ended November 30, 1909, and profits of $97,766. The company paid a dividend of 1½% in December, and it is expected to pay a similar dividend each quarter.

The Cometa mine in the El Oro district of the State of Mexico, immediately adjoining the property of the Mexico Mines of El Oro, has been taken under option by the Exploration Co., Ltd., of London, which controls the Mexico Mines and the El Oro Mining & Railway Co. The option has three years to run, and if it be determined that the main vein of the Mexico Mines continues into the Cometa, as is believed, the property will be purchased. The Mexico Mines development has uncovered valuable orebodies within 400 ft. of the Cometa line. The January production of the great Dos Estrellas mine was P766,673, and the expenses P324,989, leaving a profit for the month of P441,683. A 100-ton Butters filter-plant is nearing completion at the Dos Estrellas mill. This is the largest filter-plant in Mexico.

GOLDFIELD, NEVADA.

February Report of Goldfield Con.—Heavy Production. — Active Development.

The preliminary report of operations of the Goldfield Consolidated for February, 1910, shows tonnages of ore produced as follows: from the Combination mine, 6034 dry tons, assaying 0.86 oz. gold; from the Mohawk, 7370 tons, 0.86 oz.; Red Top, 5988 tons, 1.57 oz.; Clermont, 4474 tons, 3.20 oz.; making a total of 23,866 tons, assaying on an average 1.49 oz. gold per ton. The approximate value produced was: from the Combination, $109,034; from the Mohawk, $131,010; from the Red Top, $194,322; and from the Clermont, $295,554, making a total of $729,920. The loss in tailing was $45,692, and the estimated recovery $684,291, the percentage extracted being, therefore, 93.74%, and the average net production per ton $30.59. The total costs, including losses, were $244,422, or $10.24 per ton, leaving a profit per ton of $20.34, making a total of $485,498, the percentage of net earnings to gross recovery being 66.5. The costs are distributed as follows: bullion tax and marketing, $14,000; general administrative expenses, including corporation and legal expense, damages, taxes, etc., $13,000; mining, $95,569; transportation, $3424; milling and cyaniding, $55,800; marketing concentrate, $17,000. The total cost as outgo was, therefore, $198,795, which, with the tailing-loss of $45,629, makes $244,422. The mine produced ore of more uniform grade and at lower cost than in January. The mill treated a larger tonnage with a better extraction, and the company realized larger daily profits and a higher percentage of profit on the ore mined. The advance at the various mines was as follows: Combination, 419 ft.; Mohawk, 795; Clermont, 1135; Red Top, 1050, making a total of 3399 ft. The advance was less than in January, but the results were more fortunate. The development proved the following approximate amounts: Clermont, between the 900 and 1000-ft. levels, 17,000 tons, assaying $20 per ton; above and below the 750-ft. level, 14,000 tons, $44; above the 600-ft. level, 18,700 tons, $10; for the Red Top, above the 330-ft. level, 2000 tons, $14; giving a total of 51,700 tons, assaying $22 per ton. This ore is duly developed on two sides, and some of it only on one side. It cannot, therefore, be called more than partly developed ore, and any estimate, either of tonnage or values, may go astray. It seems fair to say, however, that the developments for January and February have been, by a considerable margin, in excess of extraction, both in tonnage and in value. The 1000-ft. level of the Clermont is developing favorably. About February 18 a small seam of good ore appeared. It assayed from $10 to $1000 per ton for a few rounds, but was too small to make the drift profitable. About February 25

the streak began to show improvement both in size and value, and for the last two days of the month the car-samples showed good ore, 40 tons averaging $33 per ton. There is reason to hope that this ore-shoot may prove better on the 1000-ft. level than on the 900. A development that cannot be other than important is the discovery, in the last two days of February, of the continuation of the Mohawk ore-shoot on the 750-ft. level of the Clermont. The vein is 8 ft. thick where intersected in a cross-cut southwest of the large Clermont orebody. The samples taken from the face assay from $20 to $30, but the car-samples taken thus far show an average of only $9. The latter ore must have been mixed with a good deal of waste.

NEW YORK.

Copper Mines and Metal. — Cobalt.—Goldfield Con. Love Feast.

The quarterly report of the Nevada Consolidated Copper Co. has just been received. It shows production for the last quarter of 1909 to be 12,969,761 lb. of copper produced from ore averaging 2%. The Cumberland Ely is still closed, while, as yet, there has been no production from the Ruth. The payment of the first dividend of 37½c. was made during the period covered by the report and a similar dividend has been declared for the current quarter. A wire from C. B. Lakenan, of the Nevada Con., gives the February production as 7700 tons of carbonate and 4,600,000 lb. of blister copper. The ore milled during the month was 165,000 wet tons, averaging 2.3% copper. Copper costs, Mr. Lakenan figures, at 7.24c. per lb. It is evident that Nevada Con., for the present, is to retain its identity. There has been a little talk of a possible campaign to be made by Utah Copper people to get the control in the open market. This is an absurdity. While Nevada Con. enjoys a fairly active market, it is, in reality, closely held and the amount of floating stock is relatively so small that any attempt to accumulate shares would be apparent at once. The Utah Copper Co.'s output for January is reported at 4,700,000 lb. of copper. Some of the shareholders are subscribing for the new stock under their rights in order that they may receive the April dividend, which, it is officially announced, will be 75c. per share. Utah Copper shares in the open market have been selling either under or so near the subscription price that there has been no market whatever for the rights. The decline in North Butte was accentuated this week by the cutting of the dividend from $1 to 50c. In most of the other Butte issues there have been advances, especially in Amalgamated and in Anaconda, which have been in process of accumulation for merger purposes. The appraisal of the various Butte properties by B. B. Thayer, president of the Anaconda, and his corps of assistants is to be an interesting piece of work. Up to the present time there has been no official announcement of just what properties are to be included in the new Anaconda, though it appears certain that Butte Coalition is to go in and equally certain that North Butte is to be left out. While there has been little outward evidence of negotiation, it is understood that the Anaconda, after absorbing the various properties now in view, will be, and is now in the market for any and all of the younger proved properties in Butte. These include East Butte, Butte & Superior, Butte & Ballaklava, and Tuolumne. The last named is especially needed by the new merger as it could be worked simply as an extension of the North Butte, and it would be possible to sink the apex trouble between the two companies in the merger. There has been a vast amount of copper ore extracted from Butte Hill in the years gone by and the revamped Anaconda will need something more than empty stopes with which to make a record that will atone for Amalgamated. The lessened production of the Butte mines for February aided somewhat the favorable anticipations in regard to the Copper Producers Association's figures covering February's production and consumption. Were it not for the preparations everywhere for record breaking production, copper metal ought to strengthen rapidly. European visible supply as of March 1, 1910, is reported at 113,460 tons as against 114,100 tons on February 15, 1910, while the reduction, in itself, is not large enough to be important, its significance lies in that there was any reduction at all, in view of the recent heavy exports from this side. A sale of 5,000,000 lb. of Lake copper, for export, was reported today, at 14c. per lb. Electrolytic for May delivery is selling at 13¾c. The improved statistical position of copper has resulted in an increased demand and a much brisker market. The American Smelting & Refining Company is said to have withdrawn all offerings for the present.

The flotation of the North Indiana, a Michigan copper property in which Charles S. Herzig and W. Murdoch Wiley were interested, has been withdrawn and the same parties have taken up the flotation of a piece of ground at Houghton, Michigan, to be known as the South Quincy. The village of West Houghton is situated on a part of the property, which it is proposed to develop.

Cobalt is looking forward to a year of large accomplishment. The hydro-electric plant, which is to deliver power from the Montreal river, is just completed, and as current is made available each mine is expected to push development which has been held back waiting for power. Cheaper power is expected to make profitable large quantities of ore, which hitherto could not be handled at a profit, and, in this way, will go far to make for the permanence of Cobalt. Kerr Lake is paying a dividend of 50c. per share. Crown Reserve reports a production for 1909 of 4,034,325 oz. of silver from 3092 tons of ore. Gross value of bullion produced was $2,080,156, net profit was $1,664,015. The management claims for the Crown Reserve a production equivalent to one-sixth of the total output of the Cobalt camp, and states that there is much more ore in sight in the mine now than there was a year ago.

George Wingfield entertained the Goldfield Consolidated directors at a 'love feast' at the Waldorf this week. Among those present was Charles Hayden, the Boston broker, who last spring was invited to resign from the board. Hayden sold his own stock and took his own friends out a year ago believing that the value of the ore would not extend from the dacite into the latite formation. Now, that development has proved that the veins carry high gold values in the underlying latite formation, Hayden has 'made up' with former fellow directors, and Boston is said to be again buying the stock.

LEAD, SOUTH DAKOTA.

Guarding the Homestake Plant.— New Laborers. — Resumption of Mines and Mills.

All the trains in and out of the Black Hills now carry detectives, so-called 'Pinkertons', and each daily quota of new arrivals of men for the Homestake mine is convoyed by these guards. Many union men are leaving. These are mostly foreigners, with some old-timers and their families. With the exception of a few individual brawls and fist fights there has been no trouble, and the union seems to be whipped to a point of bewilderment. Mr. Kirwan and others of the Western Federation of Miners are still directing their forces, but all their moves seem to have been anticipated and checkmated by the Homestake management. The property is well guarded, two detective agencies having charge of that work, and the guards have practically a military organization, whereby all outlying pipe-lines, power-lines, mills, and property of every kind, is patrolled and watched continuously, the guards being increased at night. There are some noted fighters among these guards, such as Mr. Bartell, the bodyguard of Orchard during the Boise trial, and many men who have gone through the Western Federation fights in Colorado, Nevada, and Idaho. Unless vigilance is relaxed, it would seem difficult to damage any of the property. Of course some fanatic might do injury from a distance to a chief or to T. J. Grier. Naturally, all these men are under a great tension. Mr. Grier goes about as usual, often accompanied by his wife, and generally followed by a guard at a distance. At night a searchlight from the roof of Ellison hoist plays over the town and works, making it possible to distinguish men as far as the Highland hoist.

Mill street is always crowded, mostly with new men looking for work. These new arrivals, who are nearly all

American miners from the Kansas, Wisconsin and Missouri lead and zinc fields tax the capacity of the town for housing and feeding. Both sides occasionally display their strength at a funeral. The Union could muster about 1200 men, mostly Slavonians, Finns and Swedes.

On February 22 there were about 2300 men on the pay roll, and the new men were coming in faster than they could be used in the mine. It is necessary to break in the men to the Homestake mining methods. To avoid accidents, the management wants to go slowly. On February 24 the following mills were at work: Amicus, 240 stamps; Star, 200 stamps; Homestake, 200 stamps; and Mineral Point, 100 stamps, making a total of 740 stamps dropping on ore. Cyanide No. 2 and the Mineral Point mill were started on February 23 of this month. The Pocahontas, the sixth mill, started on March 3, thus making the full 1000 stamps, and the mines and entire plant have thus resumed on a non-union basis.

SALT LAKE, UTAH.

Utah Metals.—Chino, Ray, and Gila Merger.—Chief Consolidated.—Jackling and the Guggenheims.

The Utah Metals tunnel will eventually be one of the longest and largest in Utah. From its portal in Middle canyon it has been widened for a distance of 2000 ft. for the purpose of placing a double track. It is 8 by 10 ft. for this distance, and will be driven through the mountain to the Carr Fork side of the range in Bingham, which will give it a length of 11,000 ft. The drain ditch is being enlarged below the tunnel so that it can carry from 1500 to 2000 gal. of water per minute. Heavier timbers are being installed, and a 35-lb. rail laid, with the track having a 24-in. gauge. A 6-in. galvanized vent pipe and large compressor are being placed in position, while a large generator is to be installed for the power-plant, which is generated by the water flowing from the tunnel. After the face of the tunnel has been reached the management expects to make 400 ft. per month. The Jordan lime will be intersected within 3000 ft., at a depth of more than 2000 ft. from the surface. This deposit has been mined by the United States company in its territory, and $18,000,000 worth of silver-lead ore extracted. Some cross-cuts will be run from the tunnel-level, and the management expects to intercept at least six distinct fissure-veins.

It is generally understood that there will be a merger of the Chino, Ray Consolidated, and Gila copper properties within a short time. These are controlled by the same interests that own the Utah Copper. The Ray has 46,000,000 tons of copper ore, of an average thickness of 120 ft., and the general average throughout the mine is 2¼%. The Gila adjoins the Ray, and has more than 14,000,000 tons of copper ore averaging 2½%. The average thickness of this ore is greater than at the Ray. A 5000-ton reduction plant is now being installed on these properties, which will treat the ore from both mines. The widening of the railroad from Kelvin to Ray has been completed, and all the material for the mill will be on the ground within a short time. Chino has been said to have the thickest known orebodies in the world. At places the drill has penetrated a commercial grade of copper ore more than 500 ft. thick. Some of the orebodies in this property, which range from a few feet to 65 and 70 in thickness, contain an average grade of ore higher than 11%. In all there has been more than 14,000,000 tons of ore proved which averages almost 3% copper. The controlling interests in all of these estates have expressed a desire to place their holdings with one company, which will eliminate the expense of separate organization and management.

D. C. Jackling, vice-president and general manager of the Utah Copper, has just employed Louis S. Cates, formerly mine-manager of the Boston Consolidated, as assistant to R. C. Gemmel, who is first assistant to Mr. Jackling. Mr. Gemmel has recently inspected the Chino, Ray, and Gila properties, and Mr. Cates will next visit them and familiarize himself with the conditions. The object is said to be primarily for the purpose of relieving Mr. Jackling of so much of the field work, in order that he may devote more of his time to the Eastern end of the business. In this connection it is known that the Guggenheim interests desire to have all their mining and smelting business placed in the hands of a man with a large capacity for managing operations. They have expressed a desire to have Mr. Jackling take control of all their interests in this country, Mexico and Alaska. He has not consented to do so while having all the business of the Jackling-MacNeill interests on hand, but it is understood that they have shown a disposition to increase his forces in the Utah territory in order that he could give his personal attention to a larger field.

BUTTE, MONTANA.

Labor Troubles Settled.—Litigation.—Guggenheims Buying Zinc.

The mines and smelters are once more running at about their normal capacity and the jurisdictional trouble between the Western Federation of Miners and the International Engineers has passed into history. For a time it looked as if the trouble might assume serious proportions. The Amalgamated Copper Co., through John D. Ryan, the president, made it plain when the trouble started that the company would stand by a contract which existed between the company and the miners. On the eve of a big mass meeting Mr. Ryan published a lengthy review of the whole situation, and declared that the mines were going to be operated if men were not in the city to do the work, they would be brought in. This settled the whole affair. The mass meeting did little except talk, and in 24 hours the engineers began to apply for their jobs, and all talk of a sympathetic strike was over. Mr. Ryan in his statement declared that the company would live up absolutely to the terms of the contract with the miners so long as that organization could furnish men. The statement further declared that the company under no circumstances would discharge any man at present in its employ, and men leaving its employment might not expect to regain work. In concluding, the statement said: "The company proposes to run its mines, mills, and smelters and wishes to say to its employees who are members of other international unions that a careful and calm consideration should be given this entire controversy before any sympathetic walkout is ordered." Between the lines of the statement is the warning to all organizations that no further disputes or trouble will be tolerated, and it is believed this is intended to mean miners and smeltermen as well as all others.

A case of some interest in the mining world has been filed in the United States Court, the title being Levi M. Strong against the Berlin and North Butte Mining companies, W. D. Thornton, and A. J. Davis. Strong alleges that the defendants have 5000 shares of stock in the Berlin company which belong to him and he wants the court to issue an order giving him the stock. It appears Adam Gassert sold to Strong 10,000 shares of the stock, and in proceedings which finally were settled in the United States Supreme Court, Gassert recovered 5000 shares of the 10,000 originally sold to Strong. Now Strong alleges that after Gassert instituted the case against him to recover the stock, Thornton, in behalf of the North Butte Mining Co., entered into a contract with him whereby the mining company agreed to purchase from him the entire block of 10,000 shares, paying down $50,000 of the purchase price and agreeing to pay the remainder in $25,000 monthly installments. The agreement, it is stated, was that the stock was to be deposited with Andrew J. Davis and held until the full amount of the purchase price was paid. Strong asks that all contracts with the defendants be forfeited and terminated and that on his payment of $50,000 the 5000 shares of stock still in the hands of Andrew J. Davis be decreed to be his property. The Guggenheims are making an effort to secure interests in this State, and particularly in this district. S. D. Nicholson, Julius Rodman, and Mr. Plumb have been in the city for some time endeavoring to secure options on zinc properties especially. There is a report that they have secured an option on the Southern Cross mine for $850,000. The report is denied by the representative of the H. L. Frank estate, controlling a majority of the property. Mr. Plumb is known to have made a thorough inspection of the Southern Cross property.

General Mining News.

ALASKA.

An explosion of a powder magazine on the 1100-ft. level in the Alaska Mexican mine, on Douglas Island, near Juneau, March 3, resulted in the death of 29 men. The man in charge of the powder was killed and the cause of the accident has not been learned.——Ludwig Johnson, working on ground belonging to James Funchion, at Fairbanks, has found rich gravel near the upper end of No. 9 Below near the mouth of Deep creek. At this point it is 50 ft. to bedrock. Previously little pay-gravel had been found farther down Fairbanks creek than No. 5 Below.——Work is active along Chatanika and Cleary creeks. Max Altman has a considerable dump out on Cleary, and is increasing it. The four Riley shafts on No. 5 Below are down to bedrock. The Ballard is working, and the Berg dump is growing.——Gustard and Powell have dumps out on No. 11. On the Chatanika flats three young men, working No. 5, have made a discovery of pay-dirt. Alexander & Morrison's old ground is being worked by Mr. Webster. Sam Wise is opening up his ground, Watson is working five or six men, and Pearson has started work.

ARIZONA.

COCHISE COUNTY.

Production of copper at the Douglas smelters for the month of February was less than in January, but was at about the monthly average for the past six months. The exact figures are: Copper Queen, 8,940,000 lb.; Calumet & Arizona, 4,000,000 lb. The Copper Queen operates seven to

Map of Arizona.

eight furnaces, according to the quality of ore. In January nearly 10,000,000 lb. was produced. At the Calumet & Arizona four of the six furnaces are in blast and the average product for the past six months has been nearly 4,500,000 lb. Both smelters have had furnaces idle for two years. The Copper Queen has ten 500-ton furnaces, while the Calumet & Arizona has two 500-ton and four 300-ton furnaces. Two of the small furnaces are idle.——The entire output of ore from the Copper Queen mines is now being hoisted through one shaft, the Sacramento, and the big hoisting engine is handling the output easily. The ore is being hoisted at the rate of three tons per minute. Most of the ore is delivered to the Sacramento through the 400 and 1400-ft. levels, and the last connection with the Sacramento was made at the 1400-ft. from the Lowell. The power used for transporting the ore cars to the Sacramento is electric and the cars have roller-bearings. Some trouble has been experienced with the motors, but larger ones have been put in use on the 400 and 1400-ft. levels, and the company plans to build two locomotives especially adapted for the heavy work. A new compressor will be installed at the Copper Queen power house and will be ready for use about May 1.——The Calumet & Arizona Mining Co. has spent $1,000,000 in the development of outside properties. Development of rich sulphide ores in the lower levels of the Oliver shaft gives reasonable basis for hope that similar ores also will be found at greater depth in the Irish Mag shaft. Good ore is now being found 1000 ft. deeper than it was believed to have existed ten years ago.——At the Cole shaft of the Superior & Pittsburg company, the new orebody found on the 1000-ft. level has been thoroughly prospected and has proved to be a good sized body of rich oxide ore. The work on the bottom levels at the Cole continues to look encouraging. At the Hoatson, the 1300-ft. drift is being pushed through to the Briggs shaft. A new head-frame is being designed for this shaft. It will be ready in about four months. At the Junction shaft the 150-ft. level has been pushed toward the Hoatson at the rate of about nine feet per day for over a month. The sulphide orebody south of the shaft is practically proved now on three levels. At the Briggs shaft the 1200-ft. level is being cut, sinking being stopped while this is under way. As soon as the station is cut, sinking will be resumed.

GILA COUNTY.

(Special Correspondence).—At the Superior & Boston mine, stoping without the use of timbers has just been begun above the sixth level, in the western part of the workings. The drift being driven along the Iron Ledge fault on the sixth level, to reopen the Great Eastern lode, has advanced 100 ft. The sinking of the McGaw shaft, now in progress, has reached a point 52 ft. below the sixth level. On this level, a 1000-gal. Prescott pump is being installed. Both raises put up on the Great Eastern lode from the sixth level drift have passed continuously through 9% copper ore to the intermediate level 9 ft. above. J. D. Wanvig, the superintendent, is employing over 100 men. ——The drift north from the Telfair shaft of the Arizona-Michigan property, on the 500-ft. level, measures 488 ft., and is in quartzite, with practically no mineralization. The south cross-cut, 533 ft. long, has passed through 10 ft. of soft, faulted ground, containing a little iron, but no copper. It is expected that the directors, at a meeting at Houghton within a few days, will decide to have an air-compressor and machine-drills installed at the Telfair shaft. N. A. Nelson, the superintendent, is employing 20 men on development.——The Williams shaft of the National Mining Exploration Co. is being sunk in quartzite at a depth of 612 ft. Previously, diabase, limestone, quartzite, and black shale were sunk through by the shaft in the order named. H. W. Woodward is in charge.——The churn-drills on the property of the Miami Copper Co. are finding ore on the Captain claim, where the fourth hole is now being put down. During the last week in February, 911 ft. of driving, cross-cutting, and raising was completed on and above the 420-ft. level of the mine. The Miami Copper Co. is expending approximately $25,000 monthly in underground development.——The drift on which driving was recently begun, following the Black Hawk lode on the seventh level of the Arizona Commercial mine, has passed through 20 ft. of 7% copper ore, and since running out of this material, has been in ground running between 2½ and 3½% copper and containing, also, considerable iron. J. W. Bennie, the general manager, is visiting the property.——A churn-drill, already ordered for use on the Live Oak property, is expected to be on the ground and in operation by April 5. The average grade of ore opened by the four drifts and two raises now being driven has been 2½% for the past week. A report just made to the stockholders of the Live Oak Development Co. gives the following information: Receipts from founding of company to December 31, 1909, $192,240; disbursements, $163,746; balance of cash on hand, January 1, 1910, $28,494; net value

of tonnage developed to date, $1,875,000, tonnage blocked out monthly for past three months, 250,000 tons; past expenditures from $3500 to $4000 a month. A call of $2 per share, payable April 1, 1910, will be made on Live Oak stock.

Globe, March 4.

GRAHAM COUNTY.

The Shannon Arizona Railroad Company has completed its road from Clifton to Metcalf and is hauling ore over it. For the present there will be no passenger service.

MARICOPA COUNTY.

A decision has been rendered by Judge Edward Kent in the case entitled P. T. Hurley, plaintiff, United States of America, intervenor, against Charles F. Abbott and 4800 others, defendants, in a friendly suit instituted in 1905 for the purpose of ascertaining and the establishment by judicial decree, of the rights of all land owners to use water from the Salt river for irrigation. The suit was designed to wipe the slate of all complexities and prevent further litigation. —Ore assaying from $700 to $800 per ton is reported from the Vulture mine near Wickenburg. The Vulture is controlled by Canadian capitalists and is under the direction of W. Spencer Hutchinson. For the past two years the old mill only has been operated, 20 of the old stamps having been repaired and put in working order. A new mill with 20 stamps, each weighing 1500 lb., is being erected. The Vulture mine was discovered by Henry Wickenburg in the early '50s, and up to the time it was tied up by litigation, in the neighborhood of $20,000,000 was taken from it.

MOHAVE COUNTY.

The Bi-Metal mine, three miles south from Kingman, will erect a 40-stamp mill. The batteries will be similar to those of the Gold Road mill, but in other respects the plant will be different. The fine grinding will be done by Huntingtons instead of tube-mills, and since the ore is free-milling, cyanidation is unnecessary. There will be 32 ft. of plates below the stamps and 32 more below the Huntingtons. Pierce amalgamating traps will be used. The Bi-Metal, which has been under development for the past two years, has been thoroughly prospected by three shafts and numerous open-cuts. The result of this development is a body of ore estimated at 2,600,000 tons, assaying $4.16 in gold. The actual saving on all mill heads to date on plates has been about $3, or 72%. With the increased length of plates and better grinding the new mill is expected to make an extraction of about 84%, or about $3.50 per ton.——Several miles south of the Bi-Metal, in the same district, work is being started on the Gold Butte and Fay Bonanza properties. Lewis Lusk, of Spokane, one of the principal owners, has been examining the prospects. The entire bottom of a 40-ft. shaft on the Butte assays $8, while 10 in. of the vein on the Fay Bonanza runs $108. Samples taken across 20 ft. on the surface averaged $14.——The Rainbow mine has found good ore on the 225-ft. level, 175 ft. north from the main shaft, where two branches of the vein unite forming 4 ft. of good ore between well defined walls. Ten inches of the vein assay from $40 to $80 and the balance is milling ore. The breast is now midway between the south ore-shoot, which is developed to a depth of 240 ft., with ore blocked out for a length of 150 ft., and the Windsail shoot, from which the former owners shipped much high-grade ore.——The Pilgrim mine, 12 miles west from Chloride, owned by William O'Day, is being examined by engineers representing Spurr & Cox, of New York. The Pilgrim is in the same range as the Gold Road mine and has ore of a similar character. It averages about $8 in free-milling gold.——The Venture company, of Duluth, which has been in active operation at Globe as the Cactus Development Co., for some time, is the latest of the new companies to enter Mohave county. John B. Hamilton and Frank Meyers, representing the Easterners, are sampling a number of properties in the different districts of the county, and have already bonded the Oneida group in Lorena Flats, belonging to O. D. Gaddis. The Oneida properties adjoin Stockton Hill mines, on a number of which the United States Smelting, Refining & Mining Co. is extensively developing.

PIMA COUNTY.

Objecting to an order commanding all the employees of the company to trade at the company's store and board at the company's boarding house, employees of the Chesterfield Copper Co. have walked out on a general strike. The Chesterfield mines are situated about six miles from Twin Buttes. They comprise 15 properties adjoining the Esperanza claims. C. T. Roberts was appointed general manager of the properties recently. The company employs between 10 and 15 men.——An important discovery was recently made in the Esperanza mine on the 300 ft. level. The entire face of the drift is in high grade silver and lead ore containing also gold and copper. A car shipment returned a net profit of over $1800. The Chesterfield and Esperanza are contiguous properties and can be well managed under one head, that being the present intention of the two companies. This plan will undoubtedly prove advantageous to both. Three shifts have been run on the Chesterfield in good ore. The main working shaft is now down over 300 feet.

YAVAPAI COUNTY.

The Yavapai Bullion Mining Co., owning placers in the Copper Basin district, is planning to build a three-mile pipe-line. The survey has been completed, and the pipe will arrive in a short time. W. S. Bradford, the engineer in charge, states that tests of the ground have been made at many points. The company has acquired title to 1120 claims.

YUMA COUNTY.

The railroad from Bouse to Swansea has been finished and work on the smelter of the Clara Consolidated is being rushed to completion.

CALIFORNIA.

CALAVERAS COUNTY.

The Calaveras Copper Co. has taken over from the Union Copper Co. the famous old copper mines at Copperopolis. The present 300-ton concentrator will be doubled, and a blast-furnace, of 250 tons capacity, will be installed. In addition to the reverberatory furnace now in the plant, this will give a total daily capacity of 400 tons. Two stands of convertors will also be provided. A supply of ore sufficient for two years, said to average 4% copper, is available. The new company has a capitalization of $1,000,000, divided into $5 shares. Of this amount $600,000 are issued and pooled, and $400,000 remain in the treasury. Charles M. Hayden is president, J. Newton Cole is secretary-treasurer, and J. H. Trerise is manager. The Eastern agent is Theodore Lurman, 87 Ames Bdg., Boston, Massachusetts. It is expected to begin operations in the autumn.

LOS ANGELES COUNTY.

Delegates and visitors in Los Angeles during convention week of the American Mining Congress, from September 26 to October 1, will be given the opportunity of inspecting mining and oil machinery of all kinds, models of some of the famous mines of the Southwest, and a comprehensive collection of ores and oil samples. The Sierra Madre Club, which has charge of local arrangements, has decided on such an exposition. A central down-town location will be secured and a small admission fee charged to cover expenses. The Chamber of Mines will be asked to take charge of the mineral collection. Preliminary plans for the Congress are gradually taking shape and answers to requests for co-operation from outside points are coming in. E. D. Johnston, president of the San Diego Chamber of Mines, has been elected to represent that organization on the advisory committee.——Pending legislation to regulate the issuance of assay certificates, the committee of the Chamber of Mines having this matter in charge has been authorized to take immediate steps to investigate the methods of assayers in Los Angeles and vicinity, claiming 'secret porcesses'. The Chamber of Mines also passed resolutions supplementing its previous recommendations as to the necessity for the creation of a Bureau of Mines, and also instructed the secretary to urge upon the California Representatives and members of the House Committee on Mines and Mining the passage of Mr. Flint's bill providing for

the establishment and maintenance of a Federal assay office in Los Angeles.

NEVADA COUNTY.

Splendid progress is being made in erecting the great head-frame at the Mountaineer mine. As soon as it is finished the work of sinking from the surface to connect with the lower levels of the partly completed vertical shaft will begin. The Mountaineer is in good ore and will be equipped to sink over 2000 ft. vertically.——The 10-stamp mill at the Pittsburg mine is running again, and fine ore from the drifts on the 1000-ft. level is being stoped.——At a depth of 400 ft. the Nassau shaft has struck the old workings of the Eureka mine. The Nassau was formerly the Dana. It is situated near the Idaho-Maryland and the Golden Gate.

SHASTA COUNTY.

(Special Correspondence).—The Mammoth Copper Co. has resumed work on the bag-house with 60 men. Steel work and equipment for the plant is on the way from the East. The management hopes to have the plant completed in June.——The Balaklala Copper Co. is experimenting with the Cottrell fume-controlling device. F. G. Cottrell is in charge of the experimental work.——The remodeled furnace at the Bully Hill plant is in commission. The new jackets are of electric-welded steel, in place of the riveted point designs formerly in use. The improved furnace was designed by the engineering staff of the company and built by the Allis-Chalmers Co. A Kilker matte-dumping device has also been installed.——The working force at the Evening Star has been increased and arrangements are under way for a markedly enlarged production. The property was recently purchased by German capitalists.——The Midas is pushing developments in the lower levels. The monthly production approximates $50,000.——The Milkmaid, under new management, is working a large force of men and maintaining an excellent output. New machinery is being installed.——The Black Tom Mining Co. has been granted 30 days in which to meet the indebtedness against the Niagara mine, in the French Gulch section. Judgment against the company for $3200 was recently given in the Superior Court.——The second payment on the $115,000 purchase price of the Evening Star mine was made at Whitehouse February 26. There is a 5-ft. vein of good ore in the shaft. The working force has been doubled since the new management took hold less than a month ago.

Redding, March 5.

SIERRA COUNTY.

A discovery of rich ore was made at the Standard mine, in Sailor ravine, last week by Jason Frye and Robert Blevins. The find was made in the lowest level in the lower adit, some 180 ft. from the surface. The vein will average over 2 ft. in width. Two shots blasted down 600 lb. of sulphides and several hundred pounds of rich specimen rock. A conservative estimate places the amount obtained so far at $5000.——J. S. Johnson, general superintendent and president of the Neocene Placer Mining Co., which has the largest hydraulic mine in the world at Scales, states that work will soon be resumed. The mine is near the Plumas county line, and has been idle for many years on account of the anti-débris legislation. Since the Neocene company purchased the property last season, extensive improvements have been made by installing a large concrete dam to impound the tailings. Cuts and adits have been run into the deep ground to enable the monitors to pipe the gravel, and thousands of feet of flumes have been put in to carry the débris to the dam.

SISKIYOU COUNTY.

Joe Davidson and Ben Hall made a rich discovery in their claim in Portuguese gulch March 1. They found a vein about a foot wide, from which they have taken out a quantity of specimen quartz.

TRINITY COUNTY.

(Special Correspondence).—The Poverty-Slide hydraulic mine, at Trinity Center, has begun sluicing and the wash on Coffee creek will start up on March 10.——The outstanding debts of the Bonanza King are being paid up by the California Trust Savings Bank and the mine will start as soon as the weather permits.——The Headlight is excavating for the foundation of its 40-stamp mill.——The Strode mine, one mile northeast of Carrville, has been sold to New York and Los Angeles capitalists, the deal being negotiated by W. H. Cleary of the latter city, one of the purchasers. The price is said to be $12,000, and possession will be given on March 15. The new company will extend the lower tunnel 8000 ft., enlarge the milling plant, and develop a large low-grade free-milling vein hitherto untouched.

Carrville, March 1.

The Trinity River Dredging Co., a Chico corporation, has made its final payment on 900 acres of dredging ground along the river above Lewiston. The dredge is to be built in the spring as soon as material can be hauled to the ground. The company has bought the water-right, pipeline, and bridge formerly owned by the Fairview Mining Co., which was abandoned two years ago. The 1000 inches of water will be used to develop power for operating a sawmill that is to cut the lumber for building the dredge, and will later operate the dredge itself. The Fairview company spent thousands of dollars on the pipe-line and suspension bridge across Stuart's Fork.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—The engine room on the adit-level of the East Griffith mine is being retimbered and enlarged. Electric power and machine-drills are to be installed.——The Grand Trunk adit has been driven 160 ft., and for the last 15 ft. a streak of $55 gold-silver ore, that is from 4 to 6 in. wide, has been followed.——Shipments are to be started from the Homestake property, on Lincoln mountain, during the coming month. A streak of ore is showing in the heading that is from 10 to 16 in. wide and worth 23 oz. in gold per ton.

Georgetown, March 3.

(Special Correspondence).—At the Princess Alice property at Alice, large bodies of mill ore are exposed and the 50-ton mill will be started as soon as water is available.——Max Boehmer, president of the Druid Hill Gold Mining Co., was in town last week to look over the holdings he represents. He stated that the Adduddel lateral in the Newhouse tunnel will be extended 400 ft., and a station is made from which a raise will be driven 1500 feet.

Idaho Springs, March 4.

GILPIN COUNTY.

(Special Correspondence).—A 6-in. streak of ore has been uncovered on the 800-ft. level of the Pittsburg mine that assays 130.41 oz. gold and 17.6 oz. silver per ton, with 4.8% copper.——The shaft on the Ready Cash mine is to be sunk another 100 ft., making the total depth 250. A pool of local business men is financing the work. The vein is an extension of the Eureka, one of the high-grade producers of this district.——At the S. S. M. property, in the Wide Awake district, a streak of ore has just been found 100 ft. from the entrance of the adit that is worth 208.6 oz. in gold per ton.——It is reported that the Adduddel and Frontenac properties have been merged by H. P. Lowe. English capital has been interested.——The Champion group is to operate under lease.

Central City, March 4.

LAKE COUNTY.

Leadville has had heavy snow but improvements continue to be made. The head-frame and other surface improvements recently installed on the Colonel Sellers property have been completed and are now being used. Ore is hoisted regularly. Sinking the new Colonel Sellers shaft is progressing. It is likely that the Belgian and Frenchman properties, on Iron hill, will soon be operated. These claims have never been fully developed. They contain 14 acres of patented ground on the summit and east slope of Iron hill, and directly in the trend of the largest ore-shoot in the Leadville district—the great Iron-Silver ore-shoot, which has been developed from a point 2500 ft. west of the property line up to the Belgian-Frenchman claims. Other mines east of these claims have taken up the same ore-shoot, indicating that the mineral passes through this prop-

erty. The vein on the Iron Silver property averages 200 ft. in width and 60 ft. in thickness. At a depth of 140 ft. from the surface in the Belgian property a body of high-grade lead ore has been discovered, which during the former operations produced about $12,000 worth of ore. Another body bearing silver and lead with fair values in gold has produced nearly $60,000 worth of mineral.

HUMBOLDT COUNTY.

Stratton Estate mines, near the American Eagles, are doing well. Returns have been received by Geiglein & Sons, operating on block 239, from the initial shipment. The ore returned $50 per ton. It was mined in sinking the shaft, now down 30 ft. At the surface lessees found rich float and commenced saving ore before out of the wash. The same vein is under development by Cotton & Brown, lessees, on block 228. The shaft is down about 20 ft., and between 20 and 25 tons of ore is lying on an ore-plat awaiting shipment. Tim Moynahan is breaking ore, worth about $25 per ton, in a new shaft sunk by him on block 251, now down about 30 ft. The February output of the Strong mine, on Battle mountain, is placed at 47 cars of ore, ranging in value from $40 to $225 per ton.——Operations have been resumed on block 29, of the Mary McKinney Mining Co.'s Gold Hill estate—originally owned by the Anaconda Gold Mining Co. The lease on this ground is held by J. H. White and associates, of Colorado Springs. A. J. Bunch has been placed in charge as superintendent, and the lease is to be operated through the Grace Greenwood shaft.——At the E. Porter Gold King mine, on Gold hill, work was begun March 1 by John Sharpe for the owner, though certain ground will be reserved for leasing purposes.——The initial shipment for the Rexall Gold Mining Co., owning and operating the Spicer mine and territory adjacent thereto, was loaded out from the main shaft last week. The shipment, made up of coarse quartz and screenings, about 27 tons in all, is estimated at about 2 oz. gold per ton. The ore was taken out in a drift, at the 900-ft. level of the Spicer shaft, on the main vein, at its junction with a new lead, now known as the Grace vein. The company will shortly start construction work on a modern and up-to-date mill.

NEVADA.

STOREY COUNTY.

It was formally announced this week that plans for organizing a great holding company to control and operate

Ward Shaft, Centre of the New Work.

the Comstock mines had been completed. While the mere announcement did not of itself create much of a surprise, for there have been rumors of its formation for several weeks, the names of those back of the plan caused a decided surprise. The committee in charge represents a majority of the shareholders of the Comstock mines, including the Alta, Alpha, Andes, Belcher, Bullion, Best and Belcher, Consolidated-Virginia, Crown Point, Chollar, Consolidated Imperial, Challenge, Caledonia, Confidence, Exchequer, Gould and Curry, Hale and Norcross, Justice, Julia, Kentuck, Lady Washington, Mexican, New York, Ophir, Overman, Potosi, Savage, Sierra Nevada, Segregated Belcher, Union Consolidated, Utah, and Yellow Jacket. It includes Franklin Leonard, Jr., chairman, treasurer of the Comstock Tunnel Co. Adolph Lewisohn, president General Development Co., New York. Ernst Thalmann of Ladenburg, Thalmann & Co., New York. A. L. Scheuer of Probst, Wetchat & Co., New York. Charles A. Ellis, Boston. D. F. Shaw, of Shaw Brothers, San Francisco. W. C. Ralston, San Francisco. James McNab, of McNab & Smith, San Francisco, and J. Parke Channing, of New York. The formation of the holding company not only enables the development of new orebodies, but it simplifies the management of the various corporations. In place of stock jobbery and inharmonious action, the work of development will proceed under one general head, and it will be performed in the most economical manner. It is primarily a combination of vast capital for exploiting the lower levels of the Comstock Lode, in the belief that the unexplored ground contains rich orebodies, which only remain to be developed to prove their great extent and richness. The capital stock of the new holding corporation will be probably between $6,000,000 and $10,000,000. It will be underwritten and amply secured. The individual companies will continue to exist, each with its own officers and boards of directors; but the control of their affairs and the actual work of development at the mines will be vested in the holding company. In the working of the mines the direction of affairs will be under the control of Mr. Channing as consulting engineer.

NYE COUNTY.

(Special Correspondence).—The first clean-up of the Tonopah Extension mill resulted in seven bars of bullion, valued at approximately $7000. The company is treating the ore stored on the dumps.——Tonopah, of Nevada, is maintaining approximate shipments of 3350 tons of ore per week, mainly from the Red Plume, Silver Top, and Valley View veins.——The orebody found on the 1100-ft. level of the Belmont has been opened for 250 ft. west of the fault, and shows a width of from 8 to 16 ft. With the exception of a small streak of waste in its centre, the vein is of milling grade. On the 1150-ft. level there is 3 ft. of milling ore.——The working force at the Tonopah Liberty has been increased and considerable ore has been opened. T. S. Carrahan, the manager, expects that a milling plant will be erected this summer.——Robert T. Christian has been placed in charge of operations for the Nevada Copper Co., operating east of Sodaville.——The north cross-cut from the 765-ft. level of the Montana Tonopah has entered the lode porphyry at a point 2700 ft. from the shaft. The porphyry is outside the proved ore-zone and was found after driving through a belt of rhyolite.——A. C. Eisen has resigned from the directorate of the Mayflower Con., and the new board of directors will at once take charge of the property. The mine, mill, and estate have been leased to the Mayflower Leasing Co. for a term of four years, upon a basis of 50% royalty of the net profits of the leasing company. Mayflower stockholders are given the preference in subscribing for stock in the leasing company. This has been incorporated for 100,000 shares, par value, $1. Stockholders will be offered 40,000 shares.

Tonopah, March 3.

WASHINGTON.

FERRY COUNTY.

Reports submitted at the annual meeting of the New Republic Mining Co. show a past production of $100,000. Much dead work has been necessary to put the mine in shape. New machinery has been installed and ore broken or in transit is considered of sufficient value to cover the present indebtedness of $6000. R. J. Howard, W. B. Parker, F. B. Babcock, M. J. Burns, John De Young, F. Kingbaum, A. Babcock, O. B. Hollis, and John Fullenweider were elected directors.

OKANOGAN COUNTY.

The Lucky Knock Mining Co. is planning to erect a 40-ton smelter for treating antimony ore. A recent shipment of 19 tons was made through Ledoux & Co., in New York. The orebody has been penetrated for 14 feet.

KITTITAS COUNTY.

An avalanche is reported to have wiped out 12 of the 16 buildings at the Skookum mine, four miles from Mount Stuart. One man was killed.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

W. S. Noyes has returned from Oregon.

R. V. Neily is at Prieta, Chihuahua, Mexico.

Bernard MacDonald is now at Parral, Chihuahua, Mexico.

Henry Bollweg is at the Washington mine, Cumpas, Sonora.

J. H. Trerise was in San Francisco. He has returned to Copperopolis, California.

A. E. Drucker will sail from San Francisco for Korea on the *Tenyo Maru* March 15.

H. W. Du Bois passed through San Francisco on his way from Arizona to British Columbia.

Joseph Donnelly is now general mine superintendent for the Goldfield Consolidated Mines Co., at Goldfield, Nevada.

Hallet R. Robbins has been appointed managing engineer for the Victory Mining Co. at the Ironsides gold mine near Boise, Idaho.

Hal. McLaughlin has been appointed general manager for the Central Chili Copper Co.'s smelter and mines in the province of Coquimbo, Chile.

Robert H. Richards read papers on 'Developments in Ore Dressing Machinery' at the Pittsburg meeting of the American Institute of Mining Engineers and the Toronto meeting of the Canadian Mining Institute.

Dwight J. Lawton, formerly connected with the Bourne syndicate, and later expert in the United States General Land Office, has resigned to take charge of the old Plumas Eureka mine in Plumas county, California, for New York capitalists.

Societies and Universities.

The American Electrochemical Society will hold its next meeting at Pittsburg, April 28, 29, and 30.

Cornell University has this year more than 5000 students, of which number 1724 are registered in engineering.

The Geological Society of London this year awarded the Wollaston medal to W. B. Scott, and the Murchison medal to A. P. Coleman.

The University of Wisconsin has established two engineering fellowships and is equipping a metallurgical laboratory.

Dividends.

The Round Mountain Mining Co. will pay a dividend of 4c. per share, May 25, to stockholders of record March 20.

Review of February Copper.

By Mishia E. Appelbaum.*

From February 1 to 24 the copper business was at a standstill, and the market gradually sagged from 13⅞ to 13½c. delivered in 30 days, when sales to domestic consumers, aggregating about 30,000,000 lb. were made. These sales had little effect on the market, but at the end of the month, when it was found that for the first time in over a year the visible supply in Europe showed a decrease, in addition to the 43,000,000 lb. decrease in this country in January, most of the selling pressure disappeared, and producers confidently held for higher prices. There is no doubt that if the copper which is being shipped to Europe is going into the hands of consumers, and if the visible supply on this side continues to decrease, higher metal prices will be recorded. In spite of the general slackening in business, the metal manufacturers are still working full force, and as I do not share the opinion, prevailing in some quarters, that the country is facing a business reaction, I confidently expect the metal to reach higher levels, with but very slight depressions.

*President of the New York Metal Selling Company.

Market Reports.

LOCAL METAL PRICES.

San Francisco, March 10.

Antimony	12—12¾c	Quicksilver (flask)	49½—50⅛
Electrolytic Copper	16¼—16½c	Spelter	7—7¼c
Pig Lead	4.95—5.00c	Tin	36—37½c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Mar. 3	13 37	4.55	5.75	50¾
" 4	13.37	4.55	5.75	50¾
" 5	13.37	4.55	5.75	50¾
" 6	Sunday.	No market.		
" 7	13.44	4.54	5.75	50⅞
" 8	13.44	4.54	5 75	50⅞
" 9	13.44	4 54	5.75	50¾

ANGLO-AMERICAN SHARES.

Cabled from London.

	Mar. 2. £ s. d.	Mar. 10. £ s. d.
Camp Bird	1 7 0 ex. div.	1 7 [illegible]
El Oro	1 8 6	1 8 9
Esperanza	2 15 0	2 17 6
Dolores	1 8 9	1 8 9
Oroville Dredging	0 10 0	0 10 0
Mexico Mines	8 2 6	8 6 3
Tomboy	0 17 6	0 17 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, March 9.		Closing prices, March 9.
Adventure	9	Mohawk	64¼
Allouez	55	North Butte	42
Arizona Commercial	37¼	Old Dominion	46
Calumet & Arizona	75	Osceola	167
Calumet & Hecla	630	Quincy	89
Con. Mercur	13	Shannon	15½
Copper Range	77½	Superior & Boston	14¾
Daly West	8	Superior & Pittsburg	14
East Butte	11¼	Tamarack	69
Granby	87	Trinity	8⅜
Greene-Cananea, ctf	10½	Utah Con	34
Isle Royale	21½	Victoria	4¼
Lake	7⅞	Winona	11
Mass Copper	6¼	Wolverine	147

(By courtesy of J. C. Wilson, Mills Building.)

SOUTHERN NEVADA STOCKS.

San Francisco, March 10.

Atlanta	$ 16	Mayflower	$ 3
Belmont	2.00	Midway	27
Booth	16	Montana Tonopah	86
Columbia Mtn	6	Nevada Hills	50
Combination Fraction	33	Pittsburg Silver Peak	75
Daisy	6	Rawhide Coalition	21
Fairview Eagle	12	Rawhide Queen	20
Florence	2.32	Round Mountain	53
Goldfield Con	8.30	Silver Pick	10
Gold Kewenas	7	St. Ives	17
Great Bend	3	Tonopah Extension	70
Jim Butler	12	Tonopah of Nevada	7.25
Jumbo Extension	38	West End	39

(By courtesy of the San Francisco Stock & Exchange Board.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, March 9.		Closing prices, March 9.
Amalgamated Copper	82⅛	Miami Copper	24⅜
A. S. & R. Co.	88¼	Mines Co. of America	⅛
Boston Copper	20⅜	Montgomery-Shoshone	⅞
B. C. Copper Co.	7⅛	Nevada Con.	24¾
Butte Coalition	26¾	Nevada Utah	1¼
Cumberland-Ely	7¼	Nipissing	10⅜
Davis-Daly	3⅛	Ohio Copper	4¾
Dolores	6½	Ray Central	3½
El Rayo	2½	Ray Con	23¾
Ely Central	1½	South Utah	2¾
First National	4½	Superior & Pittsburg	13¾
Giroux	9⅞	Tenn. Copper	35⅜
Guanajuato Con	1⅝	Trinity	8¾
Inspiration	8¾	Tuolumne Copper	3¾
Kerr Lake	8⅜	United Copper	8⅜
La Rose	4½	Utah Copper	51⅝
Mason Valley	1⅞	Yukon Gold	4⅝

COMPANY REPORTS.

BRITISH COLUMBIA COPPER CO., LTD.

The report of this company, operating mines and a smelter, which also does custom work, at Greenwood, B. C., shows matters to be in satisfactory condition despite loss of three months time, due to a strike at the Crows' Nest Pass coal mines. The company now owns 132,556 shares of the capital stock of the New Dominion Copper Co., Ltd., corresponding to 53% of the total. During the year the smelter handled 373,336 tons made up of 3949 of converter slag, 6964 of custom ore, and 362,423 of ore from the company's mines. Of this latter the Mother Lode yielded 337,989, the Oro Denoro, 13,384, and the Napoleon 11,950. The yield was, fine copper, 6,325,000 lb.; gold, 18,244 oz.; silver, 64,234 oz. The yield in copper per ton of the company ore was 17.7 lb., and of gold and silver $1.93. The price realized for the copper is given as 13.08c. and the cost, after crediting the value of the gold and silver, 9.829c. The cost per ton of ore, including all charges from ore in place to sale of metals, was $2.68, according to J. E. McAllister, general manager.

RIO PLATA MINING CO.

This company operates mines in Chihuahua, Mexico, and maintains executive offices at New York. The company sends to its stockholders monthly reports, of which that for January 1910 is abstracted below, the figures being given in U. S. currency. Net returns on shipments, $14,030; stamp mill, operated in part all the month, equal to 29.93 days at full capacity, crushed 1706 tons of dry ore, containing 93,872 oz. silver, gross, and produced 36 tons concentrate; cyanide plant, operated to about three-fifths of its capacity, treated 1276 tons of tailing, containing 38,142 oz. silver, gross; tailing stored in pond during month contained 19,695 oz. silver; expended on mine development, $1400; recovered in concentrate, 36,035 oz. silver; recovered in shipping ore, 2676 oz. silver; recovered in bullion (by cyanide), 32,453 oz. silver; total silver recovered, 71,164 oz.; value of silver recovered, $33,510; operating expenses, 13,463; operating profit (exclusive of stored tailing), $20,046.

In the second annual report covering the year ended November 30, 1909, the president, H. W. Miller, summarizes important developments as including: (1) The paying off in full, in the month of May, of all indebtedness on the mine. Funds for this were derived mainly from the sales of the product of the mine, and disbursements for the same amounted to $109,013. (2) Completing the plant and improvements as follows: cyanide plant; auxiliary steam-power plant; increased water-power plant; two tube-mills; electric-power plant; and other necessary equipment. Total disbursements for these purposes during the year amounted to $105,607.

The general manager, D. W. Shanks, states that there was mined during the year 14,580 tons of ore, averaging 63.8 oz. of silver, containing 930,638 oz. from which was sorted 35.1 tons shipping ore, assaying 1135.3 oz., containing 39,851 oz., and sent to the mill 14,545 tons averaging 61.21 oz. The cost of mining was $1.89 per ton; this covering labor, timbers, explosives, hoisting, and tramming. Milling operations for the year are summarized as follows: Delivered to the mill, 14,545 tons of ore; average assay value, 61.21 oz. of silver; total contents, 890,787 oz. of silver; recovered in concentrate, 360,776 oz. of silver; tailing from concentrate, 14,212 tons; contents, 530,011 oz. of silver; average value, 37.3 oz. per ton; treated by cyanide, 2143 tons tailing; contents, 70,031 oz. of silver; recovered, 61,361 oz. of silver; extraction, 87.6%; leaving for storage, 12,069 tons tailing; contents, 459,980 oz. of silver; average value, 38.1 oz. per ton; total tailing stored in pond to December 1, 1909, 26,685 tons; contents, 1,105,098 oz. of silver; average value, 41.03 oz. per ton; cost per ounce of silver recovered, 27.5c.; cost per ton of ore handled, $8.181.

It will be noted that the recovery by concentration for the year ended November 30, 1909, was 40.4% of the total value, while for the fiscal year 1908 it was 52.8%. This is accounted for by the appearance in the upper level of barium sulphate, the specific gravity of which is so nearly that of silver sulphide as to make it impossible to exclude a considerable portion of it from the concentrate. While the recovery was thus reduced, the contents of the tailing, from practically the same tonnage as that milled in 1908, was nearly the same. This lower extraction operated to increase the cost per ounce, but if the charges against cyaniding included in 1909, but not incurred in 1908, be deducted, the cost per ton remains virtually the same: $7.11 in 1908 and $7.18 in 1909. Barium sulphate does not affect the extraction in cyaniding, so that values not recovered by by concentration are saved later in the cyanide plant. In designing the plant 85% was given as the probable recovery in the cyanide plant; the average has been 87.6, and for November was 90 per cent.

Publications Received.

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

A PRIMER ON EXPLOSIVES FOR COAL MINERS. By Charles E. Munroe and Clarence Hall. Bulletin 423, United States Geological Survey. Washington, D. C., 1909.

Although specifically addressed to coal miners, this little book is of almost equal application to blasting in metal mines and in open rock-excavation. Furthermore, it is well to state that the senior author of the primer may be called America's Berthelot, the greatest authority on explosives in this country, than whom no man can speak with greater understanding of these treacherous materials, both on the theoretical and practical side. The work is extremely elementary, free from technicalities, and addressed in plain language to the plain men who are concerned in the actual use of these assistants of the miner and quarryman. Therefore the treatise opens with an account of combustion, leading logically to the explanation of this process when sustained by oxygen liberated in contact with certain substances, independently of aid from atmospheric oxygen, which is the principle of explosive mixtures. Incidentally a classification of explosives is attempted, but the line of demarkation is not sharply established. Mr. Munroe divides them into low and high explosives—perhaps the most useful classification—but the attempt to limit these classes by composition fails as soon as examination of the modifications of 'high' explosives is made. The saltpetre explosives, which undergo merely rapid combustion, as contrasted with the nitroglycerin class, whose normal habit of dissociation is practically instantaneous detonation, do not comprise all 'low' explosives by any means, as he himself shows later on. The tendency has been quite distinctly to depart from saltpetre explosives in an effort to secure slow-acting rending effects by means of modified nitroglycerin or nitro-cotton mixtures, together with various nitro-substitution compounds. The description of the latter type of explosive seems to us to have been rather too briefly given in relation to its growing importance. While these nitrated coal-tar products are, as stated in this primer, generally susceptible to injurious change from absorption of moisture, some of them are remarkably water-proof, and may be used to envelop and protect the more hygroscopic compounds, producing an explosive possessed of resistance to water, either in storage or in wet blast-holes, equal to that of the gelatin dynamites. Their lessened sensitiveness to shock, moreover, commends them on the side of safety. It is quite noticeable that the authors refrain from expression of opinion concerning the merits of different makes of explosives, contenting themselves with statements of proved and well known facts, which is as it should be in a Government publication that must avoid anything likely to work to the detriment of the manufacturer, but it appears in many cases that more details might have properly have been given. The subject of 'chlorate powders' is dismissed rather summarily, with a warning as to their sensitiveness, but with rather too brief an account of 'stabilizers' through which it is hoped to produce safe mixtures capable of being locally manufactured, thus avoiding both the peril and the high cost of transportation. One of the chief advantages of such a primer as this lies in its explanation of the nature and behavior of explosives. Mere rules for safety are not

enough; the user may forget the rule when the reason for it is unknown, but if he comprehends the nature of the substance with which he deals he can be his own guide to rational use. In this respect the book as a whole is excellent, but the case mentioned above, in connection with chlorate of potash powders, constitutes an omission, all the more serious because these are being brought to the attention of people in this country as a result of the partial success obtained with them in Europe within the last few years.

The instructions regarding the handling and care of explosives are excellent, but we regret that a more explicit description of the phenomena of freezing of the nitroglycerin mixtures was not given, nor any caution as to the conditions under which even frozen dynamites are dangerous. A note of warning is sounded, which cannot be too strenuously insisted upon, regarding the powders in which the freezing point is lowered by the admixture of ammonium nitrate and other substances. Storage in the dark is counselled, which is well. Although explosives are made with a degree of care seen in few articles of manufacture, so that spontaneous decomposition is extremely rare nowadays, nevertheless the action of light promotes chemical change, disturbing the delicately balanced chemical equilibrium of the mixture. An explosive is like a glass ball poised on the top of a spire; it is in equilibrium, but unstable; a drop of moisture too much on one side suffices to precipitate it through a violently destructive process to a new but permanent equilibrium. Commendation is due for the emphasis laid upon the need of dry-storage. In calling attention to the fact that excessive dryness also has its disadvantages it might have been well to inveigh against the common practice of storing explosives in tunnels. Even in the dryer parts of the desert regions of the Southwest a moisture-content of from 7 to 12% is found in the rocks at a short distance from the surface, and this leads to a moist magazine as the mouth of the tunnel is tightly closed by a door.

It is because of our admiration for this work that we are disposed to examine it so minutely. It is a treatise that should be in the hands of every man who uses explosives. It is the only work now in print, suitable for the non-technical man, and it is authoritative and able. We are merely pointing out what seem to us omissions, caused evidently by the desire to keep within narrow limits of space. The report is too condensed. We think the Geological Survey might well have given the authors freer rein while the work was in the doing. Our only distinct difference of opinion with the teachings of the book is in regard to storage magazines. We cannot see by what process of reasoning brick or stone structures can be recommended for this purpose. They absorb and retain moisture to a greater extent than surfaced and painted weather-boarding; they become hotter, and render ventilation more difficult in a hot country; and, if an explosion occurs, every brick and stone in the structure becomes a dangerous missile, with a destructive range dependent upon the quantity of explosive in storage at the time. A frame magazine with double hollow walls, one filled with broken glass and one with dry sand, is both vermin and bullet-proof, and a sand or earth-wall, properly maintained as a surrounding barrier, serves both for fire-protection and as a deflector to circumscribe the area of danger in case of an explosion, while the magazine itself is merely reduced to splinters by it.

We have not touched upon the questions of fuse, squibs, and detonators, electric and fuse-firing of charges, and the preparation of primers, which are all adequately discussed; nor have we been able to review the special pages devoted to the use of explosives in gassy mines. The latter is extensively presented, together with a description of the admirable work which has been going on for two years under the guidance of J. A. Holmes at the experimental testing laboratory of the U. S. Geological Survey at Pittsburg, Pennsylvania. The conditions under which explosives ignite dangerous mixtures of coal-dust or gas, and air, are set forth, and the methods employed at the testing works for determining the safety of blasting powders. This is accompanied by a list of the permitted explosives.

THE ELEMENTS OF MACHINE DESIGN. Part I. By W. Cathorne Unwin. New edition. Pp. 532, ill., index. Longmans, Green & Co., New York, 1909. Price $2.50.

For thirty-three years Unwin's treatise on machine design has been a standard, familiar to engineering students, and to practical workers in the shops, throughout the world. While not elaborately illustrated, it gives a clear exposition of principles that makes the way easy to the solution of the problems arising in everyday work. The new edition is in fact a new book in appearance and in content. It has been wholly re-written, greatly enlarged, and contains many new and useful features.

GEOLOGY AND WATER RESOURCES OF THE NORTHERN PORTION OF THE BLACK HILLS AND ADJACENT REGIONS IN SOUTH DAKOTA AND WYOMING. By N. H. Darton. U. S. Geol. Surv. Prof. Pap. 65. Pp. 105, ill., maps, index. Washington, 1909.

WINTER SCHOOL OF MINES—ANNOUNCEMENT. Quart. Bull. State College, Vol. 2, No. 3. Pp. 10. Pullman, Washington, 1909.

A brief announcement of short courses for the benefit of coal and metal miners given January 4 to March 30.

MINE PRODUCTION OF GOLD, SILVER, COPPER, LEAD, AND ZINC IN THE WESTERN STATES AND TERRITORIES IN 1908. By A. H. Brooks, C. N. Gerry, V. C. Heikes, C. W. Henderson, H. D. McCaskey, Chester Naramore, and C. G. Yale. U. S. Geol. Surv., Min. Res. U. S. Pp. 314. Washington, 1910.

INVESTIGATIONS OF COAL FIELDS IN INDIANA, NORTH DAKOTA, AND MONTANA IN 1908. By G. H. Ashley, C. D. Smith, R. W. Richards, L. J. Pepperberg, and C. H. Wegemann. U. S. Geol. Surv., Bull. 381-A. Pp. 110, maps. Washington, 1909.

QUALITY OF SURFACE WATERS IN THE UNITED STATES. Part I. Analyses of Waters East of the One Hundredth Meridian. By R. B. Dole. U. S. Geol. Surv., Water-Supply Paper, 236. Pp. 123. Washington, 1909.

GEOLOGY OF THE WHANGAROA SUB-DIVISION, HOKIANGA DIVISION. By J. M. Bell and E. de C. Clarke. New Zealand Geol. Surv. Bull. 8, N. S. Pp. 115, ill., maps, index. Wellington, 1909.

The Prospector.

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

E. S. A., San Antonio, Texas: A specimen of calc-tufa.

J. A. F., West Point, California: A specimen of black tourmaline.

H. O. Y., Bowman, California: No. 1, pyrrhotite in hornstone; No. 2, massive tremolite.

H. W., Burrough, California: Quartz with sulphide of iron.

R. W., Winnemucca, Nevada: A metamorphic rock with cubes of pyrite; the geological age cannot be determined from the specimen.

J. P. L., Battle Mountain, Nevada: The brown sulphide is pyrrhotite and the greasy brownish silicate is garnet; some chalcopyrite is present.

J. P. C., Goldfield, Nevada: No. 1, altered rhyolite; No. 2, rhyolite with cubes of pyrite; No. 3, altered rhyolite; No. 4, volcanic tuff. The base of these specimens has altered to clay.

J. S., Bearmouth, Montana: No. 1, tetrahedrite in barite with a little secondary malachite and azurite; No. 2, tetrahedrite and chrysocolla. The green color is due to copper.

O. S. G., Porterville, California: No. 1, yellowish green serpentine; No. 2, oxidized pyrite.

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EDITORIAL.

NIGHT LETTERS by telegraph is an innovation which will be appreciated by the public. Fifty-word messages (in plain English only) will henceforth be transmitted at night for the same sum as ten-word messages at other hours.

THE PRESIDENT of the Philadelphia Rapid Transit Company finally consented to meet the president of the Amalgamated Association of Street & Electric Railway Employees. So long as the strike merely entailed inconvenience to the public, occasional rioting, and some loss of life, the company refused to arbitrate. It is said that its change of attitude was due to the refusal of members of the Stock Exchange longer to support the stock of the company. Such incidents make more anarchists than dozens of Emma Goldmans.

ANNOUNCEMENT of the isolation of a considerable quantity of the rare metal polonium, by that gifted experimenter Mme. Curie, is of supreme interest for the scientific world. Polonium is even more energetically radio-active than radium, and its transformation occurs at an enormously rapid rate. The study of its transmutation offers an opportunity to work out important physico-chemical laws. The polonium obtained by Mme. Curie was extracted from pitch-blende, and it is stated that in a period of 140 days one half of the total quantity isolated disappeared as a result of its transmutation into other substances.

WARFARE seems to be the lot of the Anaconda Copper Company as long as it persists in performing the work of smelting copper, for which it was organized. The old smoke-suit has been granted a re-hearing, and now comes Uncle Sam with a brand-new Pandora's box of troubles, threatening injunction to save the National Forests. Dispatches from Washington mention the possibility of solving the smoke problem by making the fume into sulphuric acid to be used in converting raw phosphate to the soluble form. This is all possible, but it would involve an enormous outlay of capital and continuing losses in operation. Incidentally, Uncle Sam himself has withdrawn all phosphate land from entry, temporarily at least, discouraging such an enterprise.

CYANIDATION of sulphides is a matter of such great importance that the article on the treatment of concentrate by Mr. A. E. Drucker, published in this issue, will attract wide attention. The statements of Mr. Drucker acquire the greater weight because the method which he has finally adopted for installation at the works of the Oriental Consolidated

Mining Company in Korea is the fruit of lengthy experiments, and of observation of cyanide practice in all parts of the world. Mr. Drucker has recently studied gold milling in Australia, India, South Africa, and the United States. This should equip him for superior electicism. The result is shown in the extraction of 92 per cent of the precious metal from the concentrate at a cost of less than $3 per ton of original ore milled, including all-sliming and air-agitation.

WHEN the Osceola mine in the Lake Superior copper district was turned over to the Calumet & Hecla Mining Company by virtue of the decision permitting the latter to own and vote stock in the former concern, the market quotations of Osceola shares immediately rose. This showed in an unmistakable manner the preference of the public for Calumet & Hecla management. While operated as a Bigelow property good results were obtained, and in 1906 a dividend of $10 per share was paid, due in part to the phenomenal average price of 18.89 cents per pound realized for the year's output of copper. With the exception of that year the dividends earned varied from $2 to $7; but in 1909, on 13.30-cent copper, the Osceola has paid a dividend of $10 per share, justifying public confidence in the superior ability of the Calumet & Hecla staff to operate efficiently a Michigan copper property. The average copper content of the ore stamped was only 16.9 pounds per ton, and the cost of production was forced down to 9.03 cents per pound.

CONSTRUCTION IN BOND for export is the basis on which the Fore River Shipbuilding Company, of Quincy, Massachusetts, has been able to underbid its over-sea rivals, and obtain the contract for two battleships for the Argentine Republic. Whenever one looks into the binnacle of the shipping industry, though the arrow points due north, the compass is found to be compensated against local attractions. The business, in none of its branches, ever seems to be conducted in the frank and open manner which admits of free competition. Even the building of ships in bond is not alone sufficient to yield an advantage so great as to enable the American to bid on each 'dreadnaught' $900,000 less than the lowest English offer. By this method the cheap foreign market for Pittsburg steel is transplanted under hot-house conditions to the fringe of our own protected country. While an American firm gets the contract, and more American laborers are employed, a large quantity of the structural material will be the product of foreign cheap labor, which should burn the fingers of the union workmen on Massachusetts Bay. The matter is full of perplexities for every class of theorist.

THE SENATE COMMITTEE on Mines and Mining has unanimously reported the bill for creating a Bureau of Mines at Washington. We are glad to note that the House bill is amended by providing for a Director at $6000 per year in place of a Commissioner at $5000. It is also provided that the Director shall be a man equipped by training and experience for the office, and in every possible way it is assured that the Bureau will be a scientific organization with a scientific man at its head. Any pretense of authority to inspect mines or supervise metallurgical plants is expressly disclaimed. All this is excellent, though the last merely puts into the act a recognition of facts which Congress itself could not have changed if it would. However, there has been such persistent misunderstanding of the purpose and functions of the proposed bureau that it is, perhaps, just as well to be even over specific. Omitting, however, the words, in defining the functions of the Bureau "to foster, promote, and develop the mining industries of the United States," is, we think, conservatism run wild. The phrase is common in the organic acts of various similar government bureaus, and we are quite unable to see where it is wrong "to foster, promote, and develop the mining industries of the United States" while right to do all these things in the case of agriculture and manufacturing.

Natomas Consolidated.

The Hirsch Syndicate, Limited, of London, has exercised its option to underwrite $5,000,000 of the bonds of the Natomas Consolidated of California. This will produce a favorable impression. The Natomas Consolidated represents the combined interests of the Feather River Development Company of Oroville, and the Natomas Development Company and the Folsom Development Company of Folsom, which were consolidated on January 1, 1909. The holdings of this concern consist in the main of 7000 acres of tested gold gravel deposits, 60,000 acres of valley land along the Sacramento and American rivers, ten operating gold dredges, eight of which are working at Folsom, and two at Oroville, and two rock-crushing plants at Folsom of 2000 and 1500 tons capacity respectively. Among the dredges is one having buckets of 13½ cubic feet capacity, which has become justly celebrated. This dredge handled an average of 8397 cubic yards of gravel per diem, or 251,910 cubic yards per month, during 1909. The delays in operation on this great dredge are reputed to have been less than 16 per cent throughout the year. Various estimates of cost have been unofficially stated, ranging from 2½ to 4 cents per cubic yard. Unfortunately the company has adopted a policy of secrecy that has aroused scepticism as to its achievements. Frank publication of data would undoubtedly remove the cause of considerable hostile criticism. The fact that the Hirsch Syndicate has assumed the responsibility of underwriting a $5,000,000 bond issue on the strength of a favorable report by so distinguished a mining engineer as Mr. Charles M. Rolker, would indicate that the company has no skeleton of operating troubles locked in its private office. The bonds are for a term of 20 years, bearing 6 per cent interest, and both principal and interest are payable in San Francisco, New York, or London. The denomination of the bonds is $500 and $1000. The capital stock of the corporation is $25,000,000 in $100 shares, approximately $11,500,000 having been issued. The stock is not listed on the Exchanges, but curb quotations range from $20 to $25. When the consolidation was effected, bonds

were authorized to a total amount of $20,000,000 divided into two classes $10,000,000 of Class A constituting a first mortgage on certain properties and a second mortgage on others. The remaining $10,000,000 Class B were the reverse of the former namely a first mortgage on the property pledged as second mortgage under the Class A bonds, and vice versa. Of these bonds $1,000,000 worth were sold for cash the total amount issued, partly in payment for properties and for other purposes, being $5,261,000 Class A, and $2,500,000 Class B.

The money realized by this bond issue will be available within thirty days, and it is said that five additional dredges will be built at once. The valley lands will also be developed, and the prospects are that the colonization enterprise will surpass the gold mining operations as a producer of revenue. These low-lying lands, now subject to annual overflow, are of extraordinary richness. Building of levees has resulted in reclaiming large areas in the lower Sacramento and San Joaquin valleys, and such lands are in great demand. The Natomas Consolidated will become a factor of increasing importance in the development of the resources of California.

Individualism or Collectivism.

Speaking of the common miscarriages of justice in America, Judge Curtis H. Lindley gave expression to some advanced thought in a recent address on 'Reform in Our Legal Procedure' before the Commonwealth Club of San José, California. He remarked that "exaggerated respect for the individual as the 'isolated centre of the universe', which has come down to us with its seventeenth century coloring, is the cause of most of our troubles. Ever since the beginnings of legal instruction in America the neophyte has been saturated with the Blackstonian postulate which subordinated and circumscribed the social group to the strict narrow standard of the individual. The ancient dogma of the common law that 'the public good is in nothing more essentially interested than in the protection of every individual's private rights', placed the individual above society."

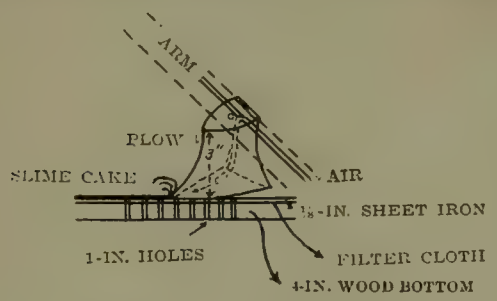
This is capable of a wider application than that involved in the 'adjective law', as the machinery of justice is called. It is important as showing the tendency of legal opinion. The conceptions of the leading lawyers exert their influence upon the judges through pleadings at the bar, and get written as case-law, thus establishing the course of social evolution. The crystallization of custom into law, whether of the legislature or of the bench, largely determines a people's attitude toward the great problems of life, and the customary thought of the age finds no surer index than the utterances of so distinguished a barrister as Judge Lindley.

We have pointed out in previous editorials that the decisions of the Western courts during recent years have been notable for the emphasis laid upon one and the other extreme of this question of individualistic right. The matter is somewhat complicated by the mingling of diverse legal principles where the common law and the civil code have come into conflict in the Southwest. The view of the people in the territory absorbed from Mexico has been greatly influenced by the laws and customs originally prevailing and which in many respects were peculiarly adapted to the physical conditions there existing. It was only a few days ago that Chief Justice Kent, of Arizona, in deciding the famous Salt River valley case (Hurley v. Abbott), rejected the common law doctrine of riparian rights so far as they interfere with the use of water for irrigation. Furthermore, Judge Kent recognized individual claims to consideration, to the extent of fixing the status of every piece of land in the valley, involving more than four thousand defendants. The decision is in line with the deference shown to the individual in the case of Arizona Copper Company, Limited, v. Gillespie. This is the most recent deliverance from the bench in line with the precedent established in California in the débris case (Woodruff v. North Bloomfield Gravel Mining Company), and in Utah (McCleery v. Highland Boy Mining Company), where the judge affirmed that "public policy is more concerned in the protection of individual rights than in the profits to inure to individuals by the invasion of those rights." Some famous cases on the other side have been the Mountain Copper in California, the Bunker Hill & Sullivan in Idaho, and especially the Anaconda smoke-case in Montana. The decisions in the Anaconda and the Arizona Copper cases represent the most recent expressions of judicial opinion on opposite sides of this question. The Arizona case has been appealed to the Supreme Court of the United States, and the Anaconda dispute is to be reviewed in the ninth circuit of the Federal Court. The outcome of these important cases will go far to determine the future trend of social evolution in the West. Just now it is toward relaxation of the old common law zeal in protecting the man as an independent agent, while the rights of society are elevated. It is a matter of units; the molecular rather than the atomic social unit is attracting attention in the effort to better regulate the body politic. We cannot help looking upon the pioneer miner and homesteader, hewing success out of hard conditions by individual brawn and heroism, as a type the loss of which involves a loss of inspiration. The protection of the individual means the protection of this kind of initiative and wholesome endeavor. It was a class characteristic of the pioneer days, which has almost been swept into the limbo of the past. The social structure of today is built on the foundation laid by men of that class. It may be time to put away the old style along with the top-boots and the patriarchal beards of the Argonauts. Judge Lindley has shown, not only his personal viewpoint, but that of a growing number of thinkers in the West. The application of his doctrine to criminal law need not concern us here; it would lead to swifter and perhaps more even justice. The question that lies near to us is what the effect will be in the struggle between the small operator and the corporations that are daily growing more powerful through gigantic combinations. The way of evolution is the way of necessity, and whatever one or another may think or say, that which means in the end the greatest good to the greatest number will triumph.

Cyanidation of Concentrate.

Written for the MINING AND SCIENTIFIC PRESS
By A. E. DRUCKER.

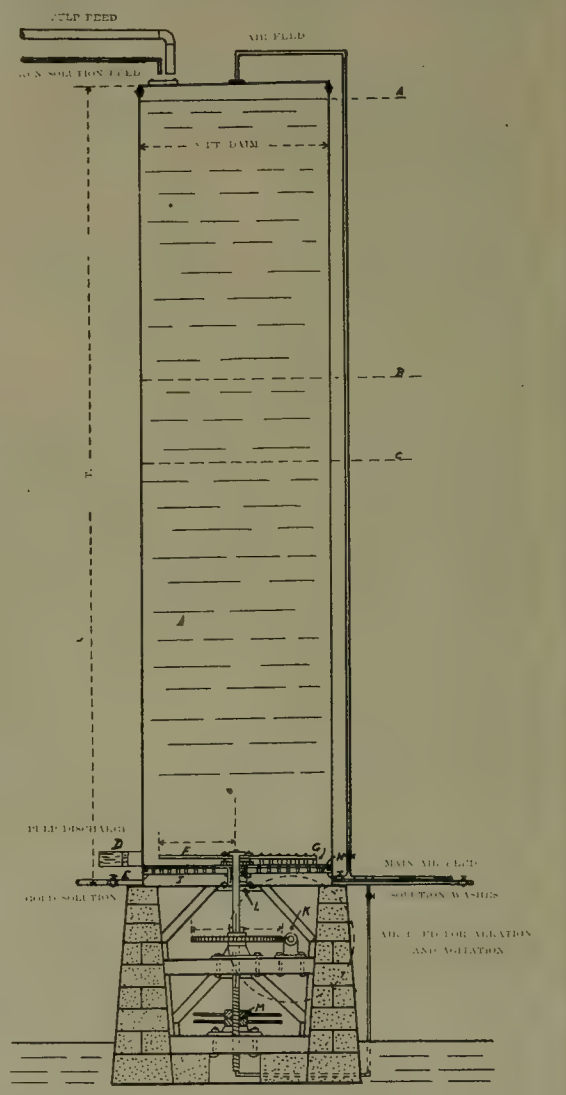
After about three years of experimental work in Korea with the Oriental Con. M. Co., in connection with the treatment of sulphide slime, and also after an 18 months tour and study of cyaniding methods in India, New Zealand, Australia, South Africa, and the United States of America, I have come to the conclusion that the combined air-agitator and continuous leaching vat as shown in the drawings accompanying this article is the most economical and efficient system of any in use at the present time for the treatment of a high-grade slime containing gold and silver. This agitator is the result of selecting the good points of other styles I have seen in various places. What I claim as being original is the arrangement and device for keeping the bottom filter free from slime-cake, thereby allowing the gold-bearing solution to leach through the slime and to pass the filter to the zinc-boxes, while at the same time the pulp is being aerated and air-agitated. This agitator is par-



ticularly adapted to the cyanide treatment of gold and silver-bearing sulphide slime, and in fact to any other high-grade slime where it is desirable to get the highest possible extraction in the shortest time.

These agitators may be made in three sizes: 15 by 6 ft. diam., 10 tons capacity; 25 by 7 ft. diam.; 20 tons capacity; and 35 by 8 ft. diam., 40 tons capacity, all dry weight. These are the figures given for a clean sulphide slime. The consistence of the sulphide slime under treatment is about 1 to 1 by weight. All details of construction of this combined agitator and leaching vat will be found in the drawing. There are four arms *F* at right angles to each other, revolving at about 6 rev. per min., and to these are attached 26 cast-iron double plow-shoes *G* equally spaced. The shoes on opposite arms are arranged to work in between, so as to keep the whole filter-bottom free from slime-cake.

The cloth filter is well braced about 6 in. from the bottom, and can neither bulge one way nor the other under pressure or vacuum. This filter-bottom consists of 3-in. pine boards *H*, bored with 1-in. holes, and placed as closely together as possible. In addition to these holes the top of the 3-in. boards are grooved so as to get the full benefit of the filtering area when the cloth is placed above and calked to the sides of the vat by means of a rope. As a protection to the filter-cloth a ⅛-in. sheet-iron cover, bored also with 1-in. holes to correspond to the 1-in. holes below in the wood bottom, is placed on top of the cloth and secured. The filter-cloth is between, and the inch holes above should coincide with those below, as is shown in the drawing. The plows *G* attached to the arms *F* can be easily raised or lowered 2 or 3 ft. by means of the lower threaded end of the vertical driving-shaft. This is important if it should be desired to stop the agitator while the pulp remains in the vat. These plows are driven by means of the worm-gear *K* beneath the vat. On stopping, the arms are raised, say 2½ ft., and the slime allowed to settle. On starting again, the plows are set in motion and gradually lowered through the settled slime until



the points just begin to touch the filter. There it is made secure by means of a clamp wheel *M* on the threaded end of the vertical driving-shaft. The plows revolving close to the filter prevent any slime-cake from forming, thereby allowing continuous leaching from above of the gold solutions into the compartment *I* beneath the filter, and thence to clarifying presses or sand-tanks, through which the clear solution passes to zinc-boxes.

There is no trouble in lowering the arms when plow-shaped shoes are attached. I have never found any other form of shoe that would successfully work down on this heavy thick sulphide slime after it was

once allowed to settle, especially the last layer of slightly coarser material next to the filter, which packs like cement.

An agitator of this type is particularly adapted to the treatment of heavy sulphide slime. There is always a small amount of fine concentrate that is bound to escape into an agitator from the classifiers, even though all is ground to pass a 200-mesh screen. With a sulphide, the coarser portion passing a 200-mesh screen will give serious trouble to any other form of agitator upon allowing the charge to settle, on account of being unable to work down on a cemented sulphide.

Compressed air for aerating, agitating, and softening of cake is introduced through the hollow vertical driving shaft, and from the top is conveyed by means of small pipes to the points of each plow as shown. At the end of each air-jet within the plow a rubber nipple is attached, so that when air is being forced through the nipple expands and allows the air to do its work. When the air is turned off the nipple contracts, preventing any slime from entering the pipes and clogging them. The air-connection at the bottom of the hollow shaft is made by means of a swivel and rubber hose, so as to allow a vertical movement upward or downward of the arms to which the plows are attached.

The object of forcing air beneath the cutting-points of the plows is to somewhat soften the cake, thereby helping the plows in their work. At the same time this air is being well distributed at the bottom of the vat, and bubbles up through the charge, keeping the pulp well agitated and preventing settlement of the slime. Everything seems to be actually boiling. Aeration and agitation are perfect at every point of the vat. Each agitator has a friction-clutch beneath the vat for starting or stopping the plows. With four of these vats placed in a row one main horizontal line-shaft *K* drives all, a friction-clutch being needed for each vat.

The vertical driving shaft to which the arms are attached passes up through a stuffing-box *i* in the bottom of the vat, so as to prevent leakage of solution pulp at the entrance of the shaft. This packing box is placed so that it can be readily tightened from beneath the vat when required. After removing the first strong cyanide solution down to about 30% moisture by means of pressure-filtering, all subsequent barren cyanide washes, if necessary, are to be forced up through the vertical driving shaft, and out through the pipes on the arms to the points of each plow. By this means the wash is added at the bottom of the vat and works itself upward through the thick pulp, giving a perfect mixing and wash. After sufficient wash-solution has been added it is turned off, but the arms are caused to rotate, while pressure-filtering is resorted to for driving the solution through the filter to the zinc-boxes. When this operation is complete there remains about 30% moisture within the thick pulp. This slime is forced into a filter-press where it is given a weak wash, and the 3-in. cakes finally discharged as residue with about 10% moisture.

With a 40-ton vat (8 by 35 ft.) treating clean sulphide slime and requiring a 4-day treatment the following power is necessary:

40-TON CHARGE.

	Horse power
For driving short arms (intermittent power)	1
Air agitation (15 cu. ft. air per min. at 20 lb. pressure, intermittent power)	11/2
Total intermittent power	21/2
Continuous power	2
Continuous power per ton treated	**0.05**

The operations can be divided as follows after all-slimming the sulphide within a tube-mill in cyanide solution, taking for example a 4-day treatment:

1. Collecting a full charge in agitator (undergoing an air-agitation and leaching while filling) .. 24 hours
2. Air-agitation and continuous leaching (cyanide solution carrying gold and silver, continuously flowing to the zinc-boxes; pulp finally pressure filtered down to 30% moisture before washing) 36 hours
3. Intermediate barren cyanide wash (mixing and finally pressure filtering down to 30% moisture before sending to filter-press) ..... 12 hours
4. Filter-pressing, weak wash, discharging..... 24 hours

Total ..... 4 days

ANALYSIS OF SULPHIDE SLIME TREATED IN KOREA.

No. 1 Sulphide.

	Per cent.
Iron pyrite (FeS_2)	56
Galena (PbS)	36
Sphalerite (ZnS)	6
Arsenopyrite (FeAsS)	2
	100

No. 2 Sulphide.

Arsenopyrite	72
Marcasite	27
Galena } Sphalerite }	1
Copper pyrites .....traces	
	100

The No. 1 sulphide carries from $40 to $50 in gold. Only a fraction of an ounce of silver is present in this sulphide. An actual extraction in bullion of 92 to 94% was obtained by my combined agitator and leaching-vat at the experimental plant in Korea during 1908. The old method of leaching No. 1 sulphide (without all-sliming in tube-mill) for 18 days in shallow vats, with strong cyanide solutions, gave an extraction of 84%. No. 2 sulphide carries from $20 to $30 in gold. A 16-day leach in shallow vats (without all-sliming) gives an actual gold extraction of about 70 to 75%. Upon all-sliming this sulphide in a tube-mill, and finally treating in my combined agitator and leaching-vat, the extraction was increased to 92% with only a 4-day treatment. Costs depend upon conditions, and these vary greatly in different parts of the world. In Korea our expensive item is power, while labor is cheap and efficient. A comparison between old and new methods of treating sulphides in Korea per ton of clean sulphide treated (1200 tons per month), shows: (1) Old method, 18-day leaching in shallow vats, estimated at $2.17 to $2.37; new method, all-sliming and tall air-agitators, estimated at $2.75 to $3 per ton of ore milled or concentrated (20,000 tons per month). (2) Old method, 13 to 14c. (taken from company report); new method, 16 to 17c. (estimated).

In a great many places (Australia, America,

Mexico, and New Zealand), the ore is concentrated before cyaniding, and the sulphide concentrate shipped to the nearest smelter for reduction, the owners being content with high smelter and transportation charges. Besides, the smelters do not completely extract the precious metal. If one realize 95% of the true assay value he is lucky, after taking into consideration the percentage of moisture and improper sampling. Why ship concentrate to smelters that can be successfully treated by the cyanide process? The majority of gold and silver-bearing sulphides can be treated on the spot at a far better profit than by shipping to the smelters.

Most sulphides (concentrate) offer little trouble to a successful cyanide treatment provided the following points are observed: (1) To be treated fresh and re-ground in a tube-mill with strong cyanide solution (0.15 to 0.20% KCN) so that the resulting product going to the agitator will all pass a 200-mesh screen. (2) To be air-agitated and aerated in the combined agitator and leaching vat shown in the drawing. Treatment from 20 to 36 hours. (3) It is a very important point to continuously leach at the same time the pulp is being air-agitated, so that at the end of the 20 to 36-hour treatment practically the bulk of the gold and silver has been deposited in the zinc-boxes. This method gives excellent results. It not only cuts down on the time of treatment to a large extent, but also avoids the numerous washes formerly required with the old methods of agitation in one solution. (4) Keep an eye on the protective alkalinity of the cyanide solutions. Do not attempt to use cyanide solutions testing only 0.05 to 0.15% KCN and expect to get good results in a 20 to 36-hour agitation. About 0.25% in free KCN I find suitable for most sulphides. Use KCN in preference to NaCN, when air-agitation is employed. KCN gives the best results at a less consumption of cyanide. (5) Do not allow the strong cyanide solution to become so foul as to become inactive. This is one of the serious troubles in treating sulphides. A newly made solution, free from reducing agents, will give the best extraction, and have the greatest dissolving power, but as it becomes older and takes up various foreign substances, which act as reducing agents, robbing the solution of its oxygen, the extraction gradually falls. The cheapest and most effective way of maintaining the extraction and overcoming this reducing action is by a thorough aeration while agitating the pulp with cyanide solution. In treating concentrate (sulphide) it is not a bad plan to make a new strong solution every six months.

The relation between volatile matter and efficiency in coals used in house-heating boilers is of particular interest to people using coal from the central part of the country, as in Indiana, Illinois, and Iowa, as these coals contain much volatile matter. The volatile content of the coals tested recently by the United States Geological Survey ranged from 18 to 44%, and as the volatile matter increases the efficiency decreases, for much of the volatile passes out of the stack unconsumed. The efficiency is 60% with coal containing the least volatile matter, but is reduced to 47% for coal having the greatest amount.

STANDARDIZATION OF ASSAY TERMS.

The Committee for standardization of bullion and assay values, of which G. T. Holloway is chairman, has reported to the Institution of Mining and Metallurgy, and the matter is now being discussed. The Committee was formed for the purpose of recommending rules which should, as far as possible, be followed by assayers, metallurgists, and mining men, in reporting the results of assays and tests of which assays form an essential part, so that ambiguity should be avoided and the possibility of misinterpretation or misuse of reports minimized. Reports of assay results, extraction tests, metallurgical and ore dressing trials, are sometimes so worded as to permit a wrong interpretation, and the Committee urges the necessity for definite statements as to the nature and condition of the sample as assayed, and, where advisable, an indication of the method of assay. Thus, in the case of such metals as copper, tin, lead, antimony, etc., where both 'wet' and 'dry' methods of assay are in use, results should be reported as obtained by 'fire' assay or by 'wet' assay, with further details as to method, if judged advisable. Similarly, a statement should be made as to whether the sample was assayed in the condition in which it was received, was 'air-dried', or dried at—°C. In reporting that an assay for such a constituent as tin, arsenic, tungstic acid, etc., corresponds to so much 'black tin', 'white arsenic', 'wolfram' or other recognized salable product, the report should give the assay result for such constituent, together with a definite statement as to the figures used in calculating such salable product. Thus, an assay showing 1% of metallic tin might be reported as 1% of metallic tin, equivalent, if all could be extracted as such, to 1.5% of 'black-tin' containing 66.6% of metallic tin.

The Committee submits the following recommendations for adoption by the Institution: (1) Assay reports shall state the exact condition of the sample as to dryness when assayed. (2) Assay values of gold and silver ores and products shall be represented in pennyweights and decimals or in ounces and decimals, and not in ounces, pennyweights, and grains. They shall be expressed in terms of fine gold and fine silver respectively, not as 'bullion'. (3) Assay values of alluvials shall be reported in grains and decimals of a grain of 'fine' gold, or in pence (at 2d. per grain of 'fine' gold), or cents per cubic yard. It is recommended that, in the absence of specific information, one cubic yard of ordinary alluvial, excluding boulders, be taken as equivalent to 3000 lb. (1½ short tons). (4) In reporting assay values of cyanide and other solutions, the results shall be given in parts by weight in a stated volume of the solution. (In the case of cyanide solutions, the use of the 'fluid ton of 32 cubic feet' is recommended. It closely approximates to 2000 lb. and is in common use.) (5) When it is necessary to state or estimate the money value of an ore, etc. (other than of gold), it shall be accompanied by the assay value, and the basis on which the former has been calculated from the latter shall be stated. (6) Laboratory sieving tests shall be made with the I. M. M. Standard sieves, or else the widths of the apertures shall be stated.

Reopening the Mexican Mine, Comstock Lode.

Written for the Mining and Scientific Press
By William Symmes

Although the Mexican mine contains the deepest workings on the Comstock Lode, it has never produced enough ore to be worth mentioning. The only ore milled from the present Mexican area consisted of 308 tons, assaying $13 per ton. This was taken from a stringer on the 2700-ft. level in 1883. In 1884 the Mexican 3100-ft. winze was sunk to the 3300-ft. level, and three diamond-drill holes were driven out. The results being disappointing, all work in the lower levels at the north end was discontinued, and from that time until recently, no work has been done in the mine below the Sutro tunnel level, at a depth of 1600 ft. In 1906 a drift 215 ft. long was driven north from the Mexican-Ophir line on the 2000-ft. level, but this yielded no results, and for a couple of years there was not a miner engaged in the Mexican workings.

In July 1908 a drift was started north on the

Fig. 1. Union Hoist, Virginia City.

Fig. 2. Consolidated Virginia Mine.

2200-ft. level, on which the Ophir was working a body of good ore only 70 ft. from the Mexican line. When in 215 ft., this drift picked up a small vein of quartz (now known as the 'west vein'), from 2 to 5 ft. wide, and assaying from $5 to $30 per ton. The ore-shoot thus exposed, however, was only a few sets long. In the spring of 1909 I was placed in charge, with the usual instructions to find a body of pay-ore in the shortest possible time.

The conditions for mining, however, were unusually bad. The company then had a one-third interest in the Union shaft, which has a modern plant, but the territory it was desirable to explore was not connected therewith. The only access was by way of the C. & C. shaft, and the Con.-Virginia and Ophir workings. Waste had to be trammed to the shaft, and timbers brought in through nearly 2000 ft. of drifts, 500 ft. of which was through the 2350-ft. Con.-Virginia 'snow-sheds', where the thermometer showed the exhilarating (?) temperature of 122 to 132°F. The mine was lacking in equipment. The rock-temperature in the Mexican drift was 107°F., and the air for ventilation, which was furnished by the Ophir management from their own insufficient supply, was 103°F., and the current was scarcely strong enough to make a candle flicker. The compressed air supply which came all the way from the shaft through a 2-in. pipe, and did yeoman's service on the way, had an unaccommodating habit of periodically dropping to 45 lb. Under the circumstances I could not muster much enthusiasm for 'following the ore'. A vision of balmy adits, fresh air, and other precursors of efficiency, presented itself as an overpowering attraction.

For many months, therefore, the Mexican did only 'dead work'. A south drift from the Union shaft workings on the 2000-ft. level was driven to a connection with the Ophir workings. A natural draft of air thus circulated along that level and up the Ophir incline, which is the up-cast for the north end mines. A blower was installed on the 2000-ft. level, and a relay blower on the 2200-ft. and these delivered air to the Mexican 2200-ft. drift through a maximum of 1200 ft. of 15-in. pipe. By this means a fair supply of air was obtained. A 2-compartment raise was then driven to the 2000-ft. level, at about the centre of the Mexican territory, and was connected with the drift from the Union shaft. The raise (or winze, as it is now called), thus became a down-cast, and the Mexican and Ophir now have an abundance of cool dry air, circulating naturally through their 2200-ft. drifts. Although the immediate objective work was upon the 2300, 2400, and 2500-ft. levels, the 2000-ft. level was chosen for access to the ore-zone, instead of some deeper level, for the reason that the former has been for a considerable time drained of all hot water and is now cool. Thus the 1850 ft. of tramming is made easier, and the air-supply reaches the ore-zone with a minimum addition of heat and moisture, which would not be the case were connection with the Union shaft made at a lower horizon, near the water level. The present temperature at the station of the Mexican 2000-ft. winze registers 87°F. The wet-bulb temperature is 73°, showing only 53% saturation. The amount of air passing through the drift in January, 1910, was 22,000 cu. ft. per minute.

On the 2000-ft. winze-station was placed a No. 6 Sturtevant multivane fan, direct-connected to a 20-hp. motor, with a speed of 1120 rev. per min. It is rated at 13,500 cu. ft. per minute against a 2-in. water-gauge, with a consumption of 22 brake horse-power, 11,060 cu. ft. against 4-in. pressure, taking 19.5 brake horse-power, and 8500 cu. ft. against a 5-in. water-gauge, with a consumption of 16 brake horse-power. A 20-in. trunk-line pipe runs down the winze, with 15-in. branches on the different levels.

The 2400-ft. station is thus kept down to 90°F. By a simple arrangement of gate-valves the fan is made to suck air after blasting and to deliver the smoke into a drift that connects with the Ophir up-cast. On the same station was installed a double-drum electric hoist, driven by a 30-hp. A. C. motor, with a maximum hoisting speed of 450 ft. per minute. In putting through the raise, progress was limited by inability to handle more than a certain amount of waste. Therefore the Mexican winze is constructed with only two compartments. The single cage is balanced by a counterweight in the compartment used as a pipe and ladder-way. The maximum load when hoisting a car with 1800 lb. from the 2400-ft. station is 1700 lb., and when hoisting the counterweight and lowering the empty cage it is 1630. Waugh stoping drills were used in raising, with Waugh 'sinkers' for plugging. In driving and sinking Sergeant 2½ and 3-in. machines are used. The Waugh 'sinkers' are not regularly used for sinking, as they cannot keep the holes sufficiently clear in the stiff clay that is encountered.

The results of this preliminary work at once became apparent. Previously the 'pass' system had been necessary. In the hotter and more humid headings on the Comstock, the men work a 'pass' at the face and then go out to the cooling-station to cool off; but since obtaining the Mexican air-connection with the Union shaft the 'pass' system has been abolished, and all miners in the Mexican mine now put in a full shift at the face. The labor-cost of driving immediately dropped to 46% of what it had been under the previous management for the entire mine, and to less than 40% for the drifts connected with the Mexican winze. The labor-cost in the winze drifts for the past three months has averaged $5.50 per foot, the wages of all men underground being $4 per day. Most of the rock was a fairly hard diabase, but some was soft vein-matter and required timbering. The cost of driving is considerably increased by hoisting in the winze and shaft, tramming 1850 ft. on the 2000-ft. level, and by fixed expense, which features are now receiving attention. Apart from the general pumping expense, in which the mine shares, there is no reason why work may not soon be conducted as economically as in other places which have similar rock, and where equal wages are paid.

The principal orebodies at the north end of the Comstock Lode (excepting on the outcrop) have not been found in the main 'vein', but in branch fissures which extend from the Comstock vein-matter upward into the hanging wall. This formation is

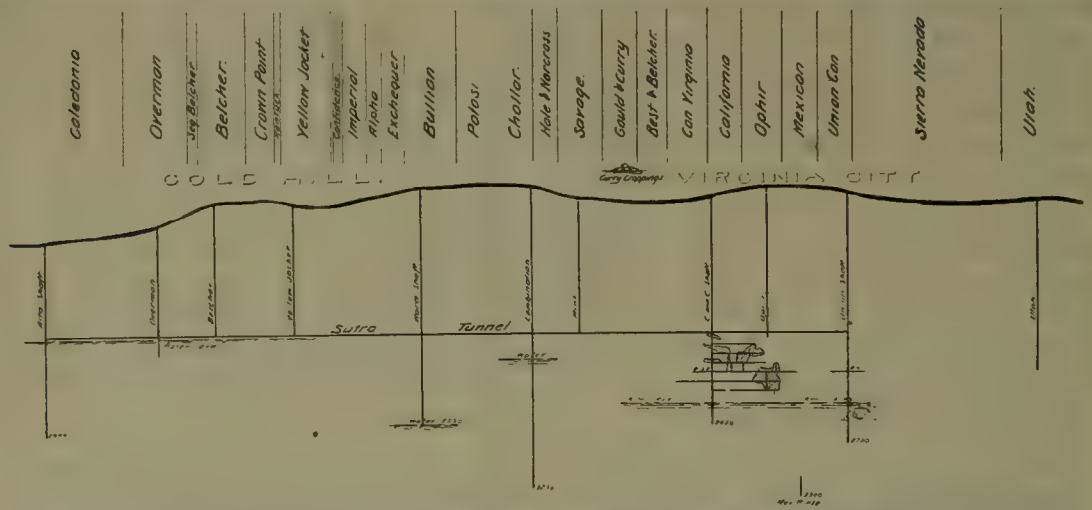


Fig. 3. The Comstock Lode Showing Water Level in 1909 and Ore Extracted Since 1890.

shown in Fig. 4, which gives a composite cross-section, east and west, through the Con.-Virginia and Ophir. The time honored method of prospecting on the Comstock has been to drive lateral drifts and

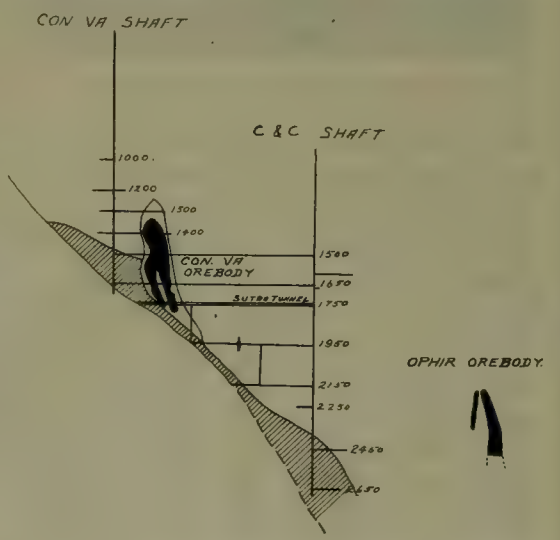


Fig 4. Cross-Section of Lode.

cross-cuts at random through the main 'vein' and hanging wall, and then to follow any promising stringers that were thus found. At the north end there is a belt in the hanging wall more than 800 ft. wide, sufficiently decomposed in places to have been classed by the old-time miners as vein-matter, and as this belt contains a million stringers it will be seen that the old method was a task of some magnitude. Drifts were formerly driven on all sides of

the orebody lately worked in the Ophir without suspicion of its presence 250 ft. above.

Becker states:[1] "Openings of the type of that which contained the Con.-Virginia and California

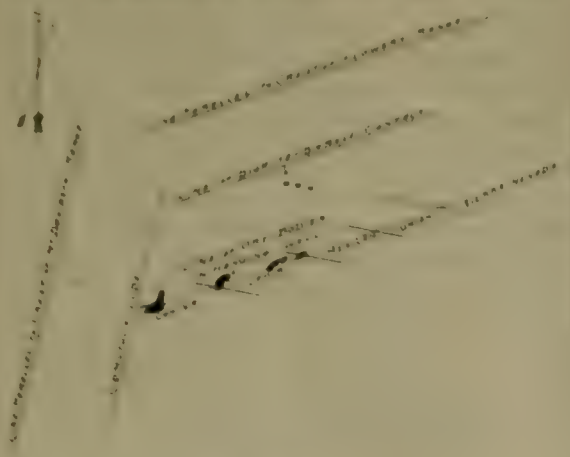


Fig. 5.

bonanzas may occur at any point on the vein, and wholly without warning from above, as was the case with that body." He believed that the orebodies occurred near points of non-conformity of the hanging and foot-walls of the lode. Church,[2] who examined the Con.-Virginia bonanza some years previous to Becker, was of the opinion that the Con.-Virginia ore was in the main Comstock vein-matter. In 1905 John A. Reid[3] made a study of certain portions of the Comstock district, giving most of his attention to the cross faults which he found on the surface. Unfortunately he was not allowed more than a momentary inspection of the deeper mine-workings. He proposed that the ore-bearing gashes that extended from the main vein-matter into the hanging wall should be known as 'rifts'. He stated that other rifts might be found by driving exploratory drifts farther east and at greater depth, but was able to offer no more satisfactory advice.

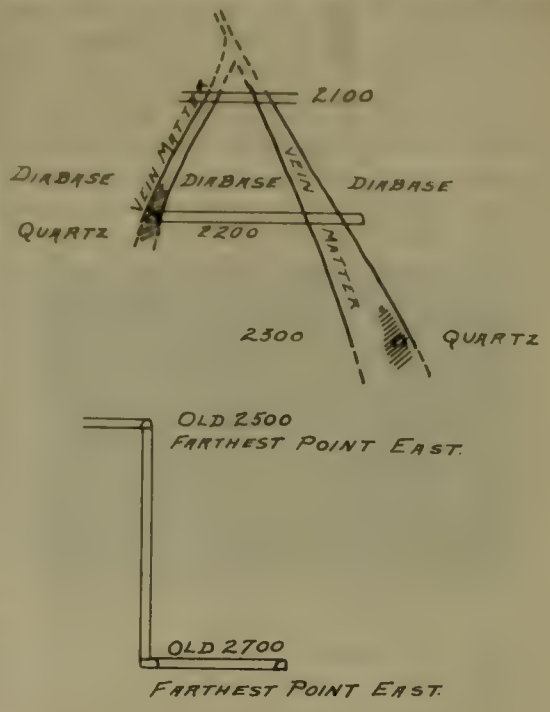


Fig. 6. East-West Cross-Section, near Mexican-Ophir Line

Fig. 7.

[1] 'Geology of the Comstock Lode and the Washoe District'. By Geo. F. Becker. Washington, 1882; p. 287.

[2] 'The Comstock Lode—Its Formation and History'. By John A. Church. John Wiley & Sons, New York. 1879. P. 121.

[3] 'The Structure and Genesis of the Comstock Lode'. By John A. Reid. Univ. of Cal. Publications, Vol. 4, No. 10; pp. 177-199. The University Press, Berkeley. 1905.

In 1909 I began an investigation of the structural geology of the north end with a view to obtaining data for guidance in a search for ore in the Mexican

ground. I found that the hanging wall was sheared in two principal directions and that the orebodies had been deposited in rifts in the hanging wall along the zone of intersection of these shear-planes. One series contains shearing parallel to the contact of the diabase of the hanging wall, with the diorite of the Mount Davidson range on the west, that is, parallel with the main Comstock Lode; and the other series contains shearing parallel to the contact of the hanging wall diabase with the diorite of the Flowery range on the north, along which contact lies the east fork of the Comstock vein-matter (Fig. 5). The ore has been deposited in rifts made by these two shearing movements. A series of intermediate shearing also exists, bisecting the angles made by the other two, and bringing 'feeders' into them. I projected the plane of the intersection of the Davidson and Flowery shear-zones into the Mexican ground and found it to lead to the east of all the old workings. Accordingly last August I persuaded the Ophir management to join with the Mexican in driving an east cross-cut from the Ophir northeast drift on the 2300-ft. level, the cross-cut following the boundary line between the two properties. The Ophir joined reluctantly, because it was the opinion of its superintendent and foreman, who had spent their lives on the Lode, and are experts in the 'stringer method' of prospecting, that no ore could be found in that

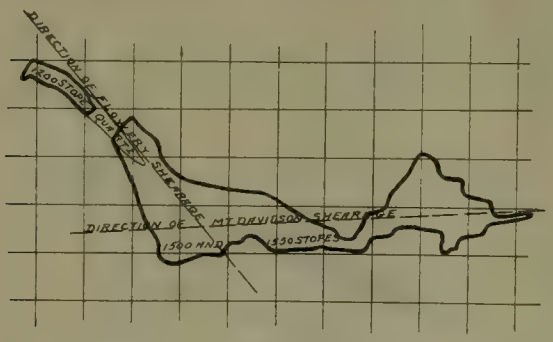


Fig. 8

direction. The joint east cross-cut, however, exposed the junction of the shear-zones, and with it a 10-ft. vein of quartz. The Ophir drove southwest along this 'east vein' and has stoped ore for a length of 60 ft. The 'sets' averaged from $18 to $58 in value, but the ore extended above the 2300-ft. level for only four sets. The Mexican started northeast through ore that averaged as high as $65, but when the drift had been advanced only 20 ft. the quartz suddenly gave way to clay and porphyry. The vein-matter has now been explored for a distance of 250 ft. northeast from the Mexican line. It is composed mostly of clay and decomposed diabase, with bunches and veinlets of crushed quartz of low assay value. A few small bunches, however, gave good assays, some as high as $120. It may be noted, in passing, that the 1100-ft. level of the Con.-Virginia, which tapped the upper tip of the 'big bonanza', went through a similar soft leached zone, and had to be closely timbered.

The ore extracted by the Ophir and Mexican from the 'east vein' is identical in mineralogical composition with the other orebodies of the north end. Exploration has also shown the structural formation to be the same. The 'west vein' in the Mexican lies in the Mount Davidson shear-zone, a little north of its junction with the Flowery range zone. It is a spur from the 'east vein' and dips to the west, while the latter dips to the east. It is shown in cross-section in Fig. 6. On the 2100-ft. level it contains only clay and bunches of crushed quartz of no value. On the 2200-ft. level, however, it shows a firm clean-cut lens of quartz for about 70 ft., with clay and crushed quartz of no value between the vein-walls at either extremity of the lense. The quartz averages from $10 to $30 in assay value. The exploration of this vein, on the 2300-ft. level, is now about to begin.

The east vein does not lie along a single shear-

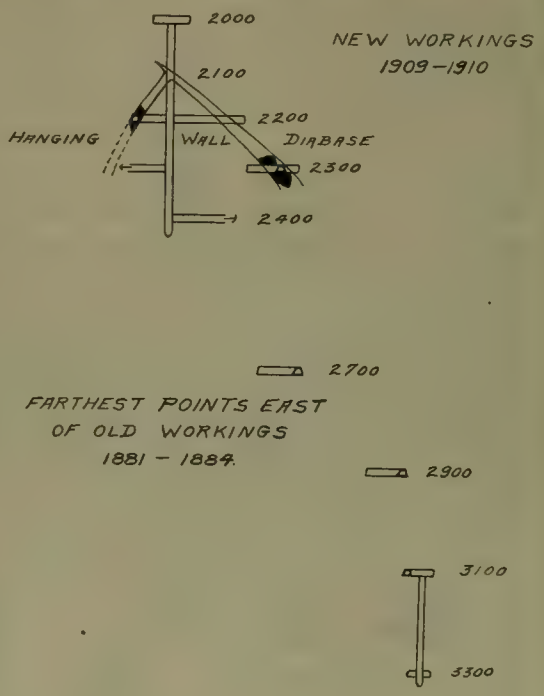


Fig. 9.

zone, like the west vein (Fig. 7). At the south, in the Ophir, the quartz follows the Flowery shearing, which is the only one that is there well defined; but in the Mexican ground there is a combination of shear-planes, and the quartz is found mainly in the intermediate sheared area, at and near the junctions with the Flowery shear-planes. In the Con.-Virginia, Ophir, and Mexican, the formation appears to be identical. Valuable deposits of quartz appear to originate along these three shear-zones only. In the larger orebodies, where the hanging wall has been considerably shattered, and the three shear-zones above mentioned are intermeshed with numerous minor shear-planes, jointings, and east and west faults, the wall-rock between the principal shear-zones has to a large extent been replaced by quartz. A vertical section through the Con.-Virginia bonanza would show a zig-zag outline, due to the shearing having different hades. In Fig. 8 the direction of the two principal shear-zones, as found in the Mexican, are superimposed upon a plan of the Con.-Virginia bonanza. It may be noted that in the latter, as in the present Ophir-Mexican orebody, on the

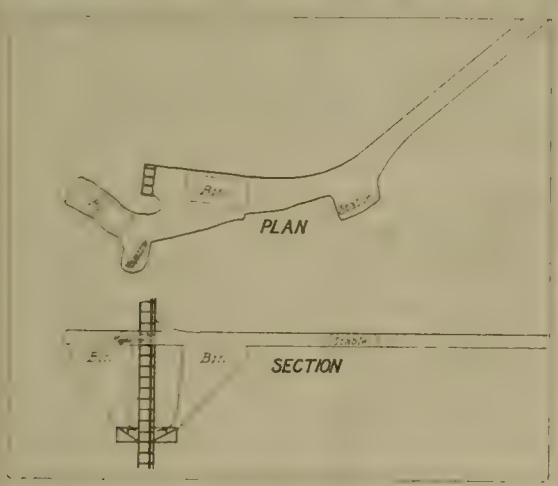
upper levels the ore appears at the south end, and in the Flowery shear zone only.

The structural geology of the Comstock is complicated and has never received an amount of study commensurate with its importance. The north end has already reaped some benefit from such work, and I believe that the middle and Gold Hill areas can also obtain similar benefits. The pumps at the C & C shaft are now lowering the water level at the north end below the 2300-ft. level of the Mexican and Ophir, where it has stood for several years. Both of these mines have sunk their winzes to the 2400-ft. level, and are now cross-cutting toward the east vein. Whether or not they find ore there will merely determine the size of the one particular ore-body that has lately been stoped on the 2300-ft. level. The important fact has already been demonstrated that good ore can and does exist to the east of all former workings in this part of the Lode (Fig. 6); and it would also appear that exploration on the Comstock, by following stringers, is an antiquated method that must now give way to quicker, surer, and more scientific work.

EXPLOSION AT MEXICAN MINE, ALASKA.

Written for the MINING AND SCIENTIFIC PRESS
By ROBERT A. KINZIE.

At 11:30 on the night of March 2, 1910, a powder magazine on the 1100-ft. level of the Mexican mine, of the Alaska Treadwell Gold Mining Co., Douglas Island, Alaska, exploded, killing 37 men and injuring 9. The accompanying sketch shows the position of the mine-magazine. A description of the method



used in handling powder is all the information that can be given in regard to the explosion. Powder is delivered to the mine-magazines, one of which is provided on each level, once every 24 hours. Sufficient powder is delivered to supply the night and day shifts. In the case of this magazine the amount is between 20 and 30 boxes. This magazine furnished powder for the 1100-ft. level only.

The magazine in question consisted of a chamber, cut out of the rock for this purpose, and boarded up in the front. A partition divided the magazine into two rooms, and each room had a door. The door has an open grating through which the interior of the magazine can readily be seen from the outside. These doors are always kept locked, except at 'powder time', when a stope boss is in the magazine to pass out powder to the miners who call there for it.

The magazine is lighted by an incandescent 16 candle-power light, which is situated a short distance inside the door, no wiring crossing the stored powder. There is no heat brought into the magazine, as all powder is always thawed before being delivered to the separate mine magazines. The situation of the magazine near and beyond the shaft excludes the possibility of any men being cut off from escape in case

Magazine Marked by X X at 1100-Ft. Level.

of accident. A rescuing party was at the scene of the explosion within 35 minutes after it occurred, and no one was overcome by gas, showing that the ventilation was good, and thus serving as an argument for the advantage of placing the magazine near a shaft.

The explosion occurred just at the time the shift was waiting to go to the surface for midnight supper. Had it occurred at any other time, few, if any, would have been killed.

The men on the 990-ft. station, 110 ft. above, report two explosions; the first one put out their lights, but was of no great violence. They lighted their candles and had started for another shaft, when the second explosion of great violence occurred, knocking them over, seriously injuring one, and slightly injuring three others. The explosion consisted of a shock, followed by concussion.

The skip-chute men who were loading the skips from chutes 45 ft. below the station were uninjured, and the men on the 1200 and 1300-ft. stations were uninjured. The explosion knocked out the posts of the station-set, which, with lagging and other timbers, formed a mass of débris, closing the shaft. Among the débris were recovered 22 bodies, and five injured men.

As ore was being hoisted from the 1100-ft. level the doors were down, closing the hoisting compartment below the skip-chutes. One body was found on these doors. The man-cage compartment was open, and eight bodies were recovered from below in this compartment of the shaft.

The stable, a light board shed, was entirely demolished, and here two bodies were recovered. The stable contained two horses, one of which was killed, while the other was uninjured.

Two bodies were recovered along the drift between the station and the shaft, and the fragments of at least one body were found in a corner of the magazine. I have absolutely no clew to the cause of the explosion and cannot account for it.

Relation Between Mineral and Chemical Industries.—I.

By George T. Holloway.

*In their highest state of purity, minerals are definite chemical compounds—chemicals as truly as the manufactured products—but made by natural processes. It is, in fact, now possible to manufacture a large number of 'minerals' by artificial means, such products being often so true to nature as to almost defy detection, and many being of commercial importance. It is true that, in nature, replacements are numerous, the composition of certain minerals being frequently varied and complicated by a partial substitution of one element for another without interfering with their crystalline habit, but the same applies to manufactured chemicals, as is well instanced in the case of the alums. Minerals also so commonly occur in admixture that, although the component minerals may be, and frequently are, chemically pure substances, they require to be separated in order that their respective commercial values may be realized. In the case of the majority of metalliferous minerals, mechanical 'dressing' or a preliminary metallurgical or chemical treatment is a necessity.

In the hope of being able to avoid the mere stringing together of a series of isolated facts, and to correlate such details as can be given in the time at my disposal, it is my intention to trace the formation of certain typical minerals from their primary igneous source, the molten magma or its solidified representatives, whose molecules, through natural agencies, have ultimately become rearranged into the forms familiar to the mineralogist.

In the production of mineral substances, the action of nature differs in no way from that of the chemist or metallurgist, but she has the advantage that her supply of raw material is unlimited, that her resources as to fuel, fluxes, and labor are unbounded, and that such details as time and balance-sheets are matters of indifference. Heat, water, air, and time are the principal factors through which her work is accomplished.

Our knowledge as to the composition of the earth is mainly confined to the examination of a thickness of the crust extending for less than fifteen miles from the top of the highest mountain to the lowest depths of the sea (but practically only of definite value for quite a small proportion even of this thin layer), out of the 4000 miles separating us from the centre of the earth. It is true that volcanic disturbances afford some clue to the conditions existing at greater depths, but the composition of the ejected material differs in no way, except in physical condition, from the deposits with which the mining man has to deal.

The fact that the density of the earth is about 5.5 (a little higher than that of magnetite) while the average density of the crust works out at rather over 2.6 (about the same as that of quartz, which is a distinctly light mineral), shows that the composition of the interior must be largely different, either generally or locally, from that of the crust.

Many attempts to estimate the relative proportions of the principal elementary constituents of the earth's crust have been made, the latest being that of F. W. Clarke, who in 1900 published figures based on analyses of 830 samples of the older crystalline rocks throughout the world and ignoring water and air. In 1898 and 1899, Professor J. H. L. Vogt, of Christiania, Norway, published an estimate, in which the rocks, air, and sea are included together.

The figures of Clarke and Vogt are as follows:

	Clarke, per cent.	Vogt, per cent.
Oxygen	47.02	50.00
Silicon	28.06	26.00
Hydrogen	0.17	0.90
Carbon	0.12	0.20
Phosphorus	0.09	0.08
Sulphur	0.07	0.06
Chlorine	0.01	0.17
Fluorine	0.01	0.03
Nitrogen	...	0.02
Aluminum	8.16	7.45
Iron	4.64	4.20
Calcium	3.50	3.25
Magnesium	2.62	2.35
Potassium	2.35	2.35
Sodium	2.63	2.40
Titanium	0.41	0.30
Manganese	0.07	0.07
Other elements	0.07	0.17
	100.00	100.00

It is interesting to note the great preponderance of non-metals over metals, the former constituting about 75% of the total, while aluminum, which by the mineralogist may almost be considered a non-metal, accounts for at least one-third of the remaining 25. The principal elements occur as oxides and the proportions in which such oxides exist have been calculated by Clarke as follows:

	Per cent.
Silica (SiO_2)	59.71
Alumina (Al_2O_3)	15.41
Ferric oxide (Fe_2O_3)	2.63
Ferrous oxide (FeO)	3.52
Lime (CaO)	4.90
Magnesia (MgO)	4.36
Potash (K_2O)	2.80
Soda (Na_2O)	3.55
Water (H_2O)	1.52
Titanic acid (TiO_2)	0.60
Phosphoric acid (P_2O_5)	0.22
	99.22

It will be observed that, with few exceptions, none of the ordinary metals of commerce are included in the above estimates, the proportions being far too small for individual mention. Even lead, with its annual production of about 1,000,000 tons, copper, with about 762,000 tons, zinc and tin, with their respective annual productions of over 724,000 and 108,000 tons, are all included among 'other elements', as also are the precious metals. It may be mentioned here that all figures throughout this paper are in tons of 2240 lb. Notwithstanding the fact that gold is almost as widely distributed as water and is the most sought after of all the metals, the 21,000,000 or 22,000,000 troy ounces of 'fine' gold extracted an-

*Abstract from Bulletin of the Institution of Mining & Metallurgy.

nually and valued at from £80,000,000 to £90,000,000, is in fact one of the least important of nature's products, when quantity is considered. It is probably produced at a loss, allowing for the expenditure on the unproductive enterprises of the gold-seeker. The ore from which this gold is obtained averages throughout the world under one-third of an ounce of precious metal, or, say, one part in 98,000, and amounts to well over 60,000,000 tons.

Apart from metalliferous veins which have filled fissures in the earth's crust from below, the primary source of most minerals is the fused or igneous matter which, by rapid cooling at the earth's surface, has yielded lava or the natural glasses, the latter being known as obsidian in the case of highly silicious matter, and by other names when more basic in composition. This fluid or semi-fluid igneous matter has often been acted upon by steam and other gases or vapors, and has thus given rise to vesicular and hair-like forms of lava, the former of which is known as pumice. When such igneous matters have been slowly cooled under pressure, as is the case with the deeper seated masses, such highly crystalline rocks as granite, syenite, diorite, and the like, or such semi-crystalline rocks as rhyolite, trachyte, andesite, and basalt have resulted, according to the rate of cooling. As with furnace slags, so in nature, rapid cooling tends to produce glassy products, and slower cooling the more stony or crystalline varieties.

Taken in mass, the natural glasses, having been produced from the same molten mass or magma, have the same composition as the corresponding semi or highly crystalline rock. During the slow cooling to which the latter have been subjected, however, aided often by the action of volcanic gases, steam, and other agencies, whose powers under the conditions existent are scarcely comparable with any of which we have actual experience, the minerals to which they owe their crystalline structure have separated. The more basic usually crystallize from the magma first, the order of separation being one of decreasing basicity, the quartz, which may be regarded as the excess of the acid constituent, silica, or that unused by the bases, crystallizing last of all, and commonly enclosing many of those minerals which were first formed. The partial solidification of a rock magma therefore usually results in the increased acidity of the remaining fluid portion, so that the composition of rock magmas may vary between highly acid and highly basic, and in classifying the igneous rocks, a transition from the vitreous to the crystalline state must be recognized, and a variation in chemical composition from highly acid to highly basic.

A concise classification of the igneous rocks is difficult, but for general purposes a tabulated statement such as Table I is convenient.

For my present purpose, it will be convenient to consider the crystalline igneous rocks as a whole, and Table II is intended to indicate the more important of the numerous products to which these rocks eventually give rise.

The most potent factors which result in the decomposition of rocks are air and moisture, aided by frost and the action of plants. Total submersion of a rock or mineral in water may, and commonly does, serve as a preventive to atmospheric action, but moist air has a power which few silicates and still fewer of the non-oxidized metalliferous minerals can resist.

The action of the organic acids produced from decaying vegetation and even the mechanical power of the roots of living plants, are also powerful disruptive and decomposing forces. These acids act as direct solvents, and they and other agents produced by the decomposition of plants are commonly powerful reducing agents, so that the insoluble peroxides in rocks and minerals become reduced to protoxides which pass into solution in combination with the organic acids or with carbonic acid. By this abstraction, red rocks are bleached, and the coherence of even compact stones is weakened until they crumble down to soil. The ferruginous solutions thus produced may, by oxidation, deposit their iron elsewhere.

At the depths and temperatures at which the rocks themselves were formed, silica is the most powerful of all acids. Practically non-volatile at temperatures at which most other acids evaporate or are decomposed, silica destroys or prevents the formation of compounds other than silicates until the affinities of the bases in the magma have become satisfied by it, any excess of silica separating out as quartz. A homely illustration is afforded by one of the most common of analytical processes—the fusion of silica or silicious matters with sodium carbonate. If quartz, the densest and most inert form of silica, be thus treated, carbonic acid is expelled with the formation of sodium silicate or 'water-glass'. If the latter be dissolved in water and treated with car-

TABLE I.

IGNEOUS ROCKS.

Silica.	Acid. 80-65%.	Intermediate. 65-60%.	Intermediate. 60-55%.	Basic. 55-45%.	Ultra-Basic. Less than 45%.
Vitreous.	Pumice. Obsidian. Pitchstone.	Trachytic pitchstone.	Andesitic glass.	Tachylyte.	—
Hemi-crystalline.	Rhyolite. Quartz-felsite.	Trachyte.	Andesite.	Basalt. Dolerite.	—
Holo-crystalline.	Granite. (Pegmatite).	Syenite.	Diorite.	Gabbro.	Picrite. Peridotite.
Essential Minerals.	Quartz. Feldspar. Mica.	Feldspar. Hornblende.	Feldspar. Hornblende.	Feldspar. Augite.	Basic ferro-magnesian minerals (olivine, etc.).

bonic acid, carbonate of soda is re-formed, while the bulk of the silica is precipitated as gelatinous silicic acid (H_4SiO_4).

The action of carbonic acid in the natural decomposition of feldspars and of many other silicates of which the rocks are composed, is exactly similar, but the action is so slow that other factors intervene and the direct and complete decomposition explainable by formulae is thus often replaced by most complicated reactions resulting in the production of an immense variety of products, including clays, zeolites, and other minerals. But for the diluted condition of the attacking acid, the extremely dense nature of the crystalline silicates and the smallness of surface exposed to chemical action, decomposition would be effected far more rapidly than is actually the case.

So far as granite and many other igneous rocks are concerned, the chief decomposable constituent is the feldspar. There are many varieties of feldspar, the term being applied to a group of double, triple, or even more complicated silicates of aluminum and bases such as potash, soda, lime, or magnesia. These compounds occur in varying degrees of purity, and commonly merge one into the other, the potash variety, orthoclase, typical of granite, generally having a portion of the potash replaced by soda, lime, or magnesia, while the soda feldspar, albite, and the lime feldspar, anorthite, generally contain some bases other than the soda or lime which are their essential bases.

During the degradation of granite another of the principal constituents, the quartz, is also commonly transported (although to a less distance, on account of its coarseness) and ultimately reappears in such well known deposits as pebbles, gravel, and sand, containing also a large variety of other weather-resisting minerals which formed part of the original rock.

Such pebbly deposits, whether formed originally from granites or other rocks may, by the addition of clayey material or by the deposition of iron oxide, silica, carbonate of lime, etc., by percolating solutions, become eventually consolidated into conglomerate or pudding stone.

Should the percolating solutions be mineralized to any extent, or should the deposits become mineralized by any other means, commercially valuable products may be formed.

The well known 'banket' gold ore of the Transvaal affords an excellent example of this kind, immense beds of rounded quartz pebbles of varying dimensions having become compacted into hard rock. In this case the cementing material is mainly silica of a somewhat ferruginous character, the iron being oxidized above water-level but pyritic at depth. The origin of this material has been, and still is, the subject of much discussion, many interesting theories having been propounded to account for its formation and mineralization. It has been found that no gold exists in the pebbles themselves, all metal values being contained in the matrix or cementing material. The whole value of this, the most important group of gold-producing deposits, depends therefore on the secondary minerals through whose agency the gold was concentrated. Although throughout the Transvaal the ore non-treated averages under a third of an ounce per ton, the amount of fine gold produced there in 1908 was 7,054,621 oz., worth nearly £29,000,000, over one-third of the world's output.

As regards the soluble products from the decomposition of the igneous rocks, it is scarcely necessary to point out that many substances which are commonly considered insoluble, dissolve to a sufficient extent under conditions existent in nature, to produce most important commercial results.

Silica, in the form in which it is produced by the decomposition of silicates, dissolves in alkaline or practically neutral solutions. The deposition of silica from such solutions has resulted in the formation of flints, agates, jaspers, opals, and all varieties of chalcedony; of the petrified forests of Arizona and elsewhere, in which it has replaced the woody fibre of trees; and of the silicious terraces of New Zealand in the formation of which the silica has deposited from hot solutions almost as quickly, and in much the same manner, as carbonate of lime deposits from a 'petrifying spring'.

Vegetable and animal organisms also collect their tithe from dissolved silica and the enormous beds of kieselguhr or diatomaceous earth which are mined to the extent of thousands of tons annually for use as an abrasive, as a non-conductor, and as an absorbent in chemical industries, particularly in the manufacture of dynamite, consist of the outer shells or skeletons of fossilized minute infusoria, vegetable organisms which are remarkable for collecting silica to protect their tissue instead of the carbonate of lime which foraminifera and shellfish absorb, or the phosphate of lime which animals secrete.

The enormous use of quartz and other forms of silica in glass-making and for many other purposes, scarcely requires mention here. Quartz is one of the few minerals obtainable in quantity in a state of almost absolute purity, and reference may be made to its increasing use as the only source of silica glass, for the production of such important electric-furnace

TABLE II.

IGNEOUS ROCKS.

Quartz.	Feldspars.			Mica, Hornblende, Augite, and Olivine.	Accessory Minerals.
Sandstone. Quartzite.	Clay. Shale. Slate.	Dissolved silica. Chalcedony, opal, vein-quartz, etc.	Carbonates, sulphates, fluorides, borates, etc.	Asbestos, serpentine, chlorite, talc and other magnesian minerals, calcite, dolomite, etc., magnetite, chromite, etc., iron oxides, chromite, etc.	Tourmaline, apatite, fluorspar, garnets, zircons, topaz, pyrites, cassiterite, titaniferous and 'rare metal' minerals.

products as elementary silicon and alloys of silicon with iron and copper, and of carborundum, alundum, and silundum three carbides of silicon used as abrasives and for other purposes.

The solution of lime in carbonic acid during the decomposition of rocks and its reappearance as beds of limestone, marble, Mexican onyx, and other ornamental varieties, or as stalactitic deposits, or, after serving to build up the skeletons of foraminifera, corals, shellfish, etc., as chalk, and the like, is too well known to require more than passing mention, but it is worth while to point out that carbonate of lime, which has been collected from solution by such organisms, is thereby purified with formation of deposits of great purity.

Local or complete change of deposits of carbonate of lime has commonly occurred through infiltration of solutions containing sulphates, phosphates, and the like. This has resulted in the production of gypsum and other varieties of sulphate of lime, and of rock phosphate, the former minerals being used for ornamental purposes and in the production of plaster of paris, and the latter in the manufacture of chemical fertilizers. Some idea of the importance of these secondary mineral deposits, which are not of course all derived in this direct manner from carbonate of lime, may be gained from the fact that nearly 4,000,000 tons of gypsum is annually mined and that apatite and phosphate rock for manufacturing fertilizers, is mined to the extent of about 4,500,000 tons, of which the United States produces over half. The Atoll islands of the South Pacific Ocean, originally coral formations, are extraordinarily rich in phosphates, and deposits on two islands in the Gilbert group are stated to contain 50,000,000 tons suitable for export.

In the case of rocks less acid than granite, the weathering action, although essentially similar to that already described, results in the formation of larger quantities of the more basic products. In the basic rocks, the dark ferro-magnesian and aluminous silicates are in excess, and in decomposition, their peculiar products predominate, the distinctly magnesian ones yielding serpentine, while those more aluminous alter to chlorite, in either case with separation of such important minerals as iron oxide and carbonate, calcite, dolomite, magnesite, talc, asbestos, together with valuable accessory minerals such as chrome iron ore, magnetite, and possibly the oxidized nickel and cobalt ores which occur as double silicates with magnesia, in New Coledonia.

The important mineral, bauxite, a hydrated oxide of aluminum containing oxide of iron and other impurities, is a decomposition product of highly aluminous silicates. Opinions differ as to its exact mode of formation in many instances, but there is no doubt that processes similar to those already enumerated have played an important part in its production. The consumption of bauxite in the United States in 1907 was 122,841 tons valued at £171,770, and France, in the same year exported over 100,000 tons. About 60,000 tons of bauxite was consumed in 1907 for the production of about 32,000 tons of aluminum, but bauxite has many other uses.

Over 130,000,000 tons of iron ore varying in iron content from under 40 to nearly 70%, and averaging slightly under 40, is mined annually, the United States contributing considerably over a third of this total, and also supplying ore of higher average iron content than any other large producing country. The world's annual production of pig iron amounts to about 60,000,000 tons, Great Britain contributing about a fifth, and the United States nearly two and a half times as much. About four-fifths of the pig iron is converted into steel, and from first to last it is probable that well over 130,000,000 tons of fuel is consumed in mining and converting the iron ore into finished metal. By far the larger proportion of this fuel consists of coke made from bituminous coal. In the production of this coke, immense quantities of by-products, such as ammonia and ammonium sulphate, are produced, together with tar whose amount is now about equal in quantity to that produced in gas works and similar to it, although somewhat inferior in value. Waste gases, rich in combustible gas and intensely hot, as they leave the blast-furnace in which the pig iron is produced, are now no longer run to waste, but are employed for motive power to drive the whole plant, and I have seen, at Middlesbrough, the overplus employed for evaporating brine which has itself been raised from the strata below the works by pumps operated by engines driven by combustion of the waste-gases.

The manner in which one industry affects others, and in which each may depend upon the other for its success, could not indeed be better shown than in the case of the iron and steel industry. The direct effect on mining and on the chemical industries through the quantities of ore and fuel required and the immense amount of waste power and by-products resulting, is by no means the end of the tale.

The requirements of the steel-maker have resulted in an enormous use of ores containing manganese, chrominum, and nickel, and the producers of such ores depend now more on this use than any other, and are able to dispose of ores which, when the chemist was practically the only purchaser, were unsalable, an ore which is utterly unsuitable for one purpose being often the best for another. In the case of manganese ores, pyrolusite or peroxide of manganese is practically the only one employed on a large scale by the chemist, while braunite, which may be described roughly as the sesqui-oxide, and others of the less highly oxidized ores, are preferred by the steel-maker and the producer of ferro-manganese and spiegel, who prefer as little available oxygen as possible. Lime is objectionable, but phosphorus harmless to the former, while to the metallurgist the position is exactly reversed.

It is worthy of note that over 100,000 tons of waste manganiferous residue from the roasting of franklinite and other zinc ore from New Jersey, were smelted for making spiegel and ferro-manganese in 1908, and that much of the true manganese ore which is smelted also contains zinc. So much zinc oxide is produced from blast-furnaces as to almost justify the installation of zinc retorts by the iron-masters.

A study of the manner in which certain minerals are usually found associated in nature, commonly

those which are isomorphous or which contain the same group of elements, but very often of entirely different mineralized and chemical character, is of particular importance to the commercial man, and should be of great assistance to such chemists and physicists as study the genesis of minerals and elements and the so-called degradation of the latter. Just as the Periodic Law of Newlands and Mendeléef was evolved from the tabular marshalling of chemical and physical data, and was found capable of prophetic use, so one may learn and predict much from a study of the known associations of minerals, and particularly those of the rare metals. There is the advantage of knowing that minerals have been produced under natural conditions where no mistakes or errors of manipulation can have occurred and where no difficulties due to want of time, material, or facilities for experimenting existed; in other words, where the personal factor was absolutely non-existent.

Probably the most promising field for research exists in the oldest plutonic rocks and particularly in such pegmatites and other extremely old granitic and other rocks as have been subjected at great depth and pressure and at high temperature, to the action of intruded flows of fused mineral matter from still deeper-seated sources, or of vaporized mineral matter of similar origin. Such rocks exist in many parts of the world, but the pegmatites of Norway, the old granites of Greenland, and many of the old but less highly crystalline tin-bearing deposits of Cornwall may be instanced as likely to throw light on the origin of many metals, and especially of those at the 'heavy' and 'light' ends of the periodic table.

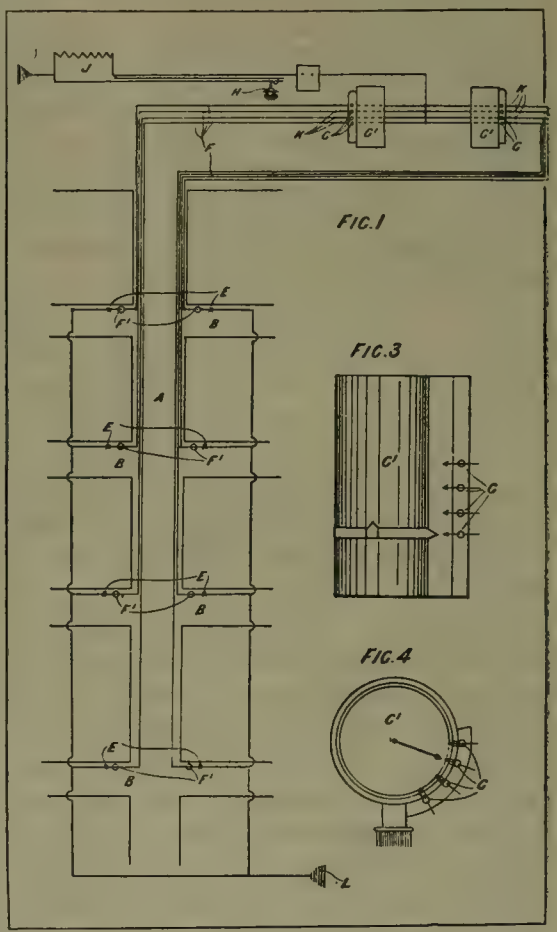
Improvements in design of steel mine timbers must go hand in hand with accurate knowledge as to the character of the loads to be sustained and the stresses produced in the material itself. Where the strata are horizontal, or approximately so, the loads are applied normal to the collar with a practically uniform distribution and produce therein bending moments, with compressive stresses in the legs, these stresses in the legs being equivalent to the half load on the beam, and the minimum amount of material is employed when the legs are exactly proportioned to this half load. Where the dip of the strata is great or where the ground is swelling, legs and collars may be called upon to take both bending and compressive stresses at the same time, and allowance must be made in the design for this joint action. In a vertical mine shaft through solid ground, the loads which need be borne will be not much greater than the weight of the lining itself, and stiffness and strength will only be required for the proper alignment of the cage guides. In heavy ground liable to displacement, or in an inclined shaft, the wall plates may be called upon to carry both bending and compressive stresses, and certainly the buntons will be called upon to sustain a large share of the load.

Calumet & Arizona has paid $10,600,000 in dividends on a capitalization of $2,000,000, par value $10 per share. The present dividend rate is $4 per share, but the company is earning more. The stock sold as high as $184 in 1906.

Electric Signals in Shafts.

By W. E. Wainwright.

*Several serious accidents, which had occurred owing to the station or 'plat-man' leaving the plat without first withdrawing the 'chairs' from the shaft, set me scheming to devise a mechanically operated system which would obviate such accidents and be 'fool-proof'. It was obvious at the outset that some means of indicating to the engineer by the movement of the chairs themselves, whether they were 'in' or 'out' of the shaft, was necessary. An arrangement for signaling similar to railway semaphores was



considered, but was rejected owing to the difficulties accruing from the large number of communicating wires which would be required down the shaft—two for each level. After several experiments, a comparatively simple and efficient electrical system was devised, and which is covered by Commonwealth Patent No. 10,402. One of the chief features of the apparatus is its simplicity, and its strongest point is the fact that both the engineer and plat-man receive visual indication of the position of the chairs.

The arrangement consists of miniature colored glow lamps, one for each level of each shaft compartment, arranged and placed beside numbers and arrows corresponding to the various levels, on the hoist-engine indicators. There is also a large indi-

*Abstract from *Trans.* Aust. Inst. Min. Eng.

cating glow lamp installed at each compartment at the various levels, in proximity to the levers for operating the chairs. Upon moving the levers an electrical current is completed which instantly indicates in the engine room by the glowing or extinction of the corresponding miniature lamp, the position of the chairs. The large glow lamp at the underground station indicates in unison with the small lamp on the engine indicator, giving ocular notice of the position of the chairs to the man operating them, and is a visual reminder not to leave the plat without withdrawing the chairs. The plat and engine indicator lamps are arranged in series, so that one cannot illuminate without the other, a defect in one causing

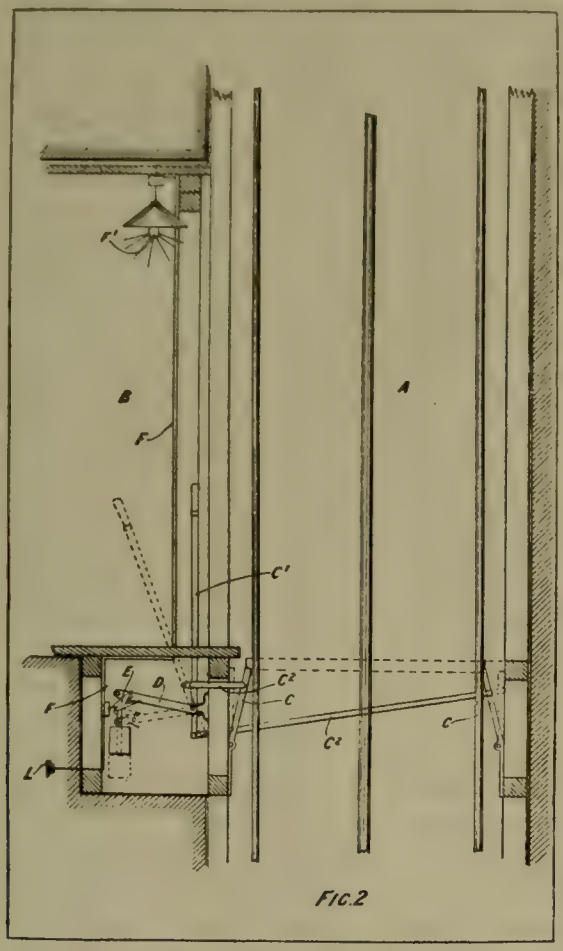


FIG. 2

non-illumination of both lamps. This arrangement is a safeguard, as the glowing of the plat lamp indicates the recording of a similar signal on the winding engine indicator.

By reference to the diagrams (Fig. 1, 2, 3, and 4), the arrangement of the equipment will be readily understood. Fig. 1 represents a two-compartment mine shaft with four plats. Fig. 2 represents a side section of shaft and plat at one of the levels, showing the connection with the chairs. Fig. 3 and 4 are detailed views of drum and dial indicators, showing position of the miniature indicating lamps at winding engine. A is the shaft, and B, B, B, B, the four plats at which chairs C are arranged for operation by the lever C^1, and connecting rods C^2. An arm D, engaging with an electric switch E, operates a circuit F, which causes a current to pass through the indicating glow lamp F^1 in the plat, and thence through the circuit F passes through the miniature indicating glow lamp G, arranged opposite the arrows and pointer for the various levels on the winding engine indicator G^1.

Upon the plat-man operating any of the chairs at the various levels, the large glow lamp for the corresponding compartment immediately glows, and thereby informs him that the engineer has notification of the chairs being in at such level and compartment. A further casual advantage is afforded by the increased illumination at the plat from the glowing lamp, when the chairs are in for loading or unloading the cages. A pilot lamp H, in Fig. 1, arranged to glow at a low temperature, and placed in direct view of the hoisting engineer, is advisable, as the extinction of this gives immediate notification of any failure of the current from the source of supply to the indicator circuits. The current for operating these lamps may be taken from any convenient lighting circuit at 50 to 120 volts, and is shown in Fig. 1 at J, which represents the secondary of a transformer operated by alternating current; the latter is preferable for damp or wet shafts, but a common return is preferable to an earth return in cases where telephones are installed in the same shaft. The estimated cost of installing the apparatus in a double compartment shaft of six levels is approximately £75.

Investigations made by the United States Geological Survey have disclosed the fact that the total cost of fires in the United States in 1907 amounted to almost one-half the cost of new buildings constructed in the country for the year. The total cost of the fires, excluding that of forest fires and marine losses, but including excess cost of fire protection due to bad construction and excess premiums over insurance paid, amounted to over $456,485,000, a tax on the people exceeding the total value of the gold, silver, copper, and petroleum produced in the United States in that year. The cost of building construction in forty-nine leading cities of the United States reporting a total population of less than 18,000,000 amounted, in 1907, to $661,076,286, and the cost of building construction for the entire country in the same year is conservatively estimated at $1,000,000,000. Thus it will be seen that nearly one-half the value of all the new buildings constructed within one year is destroyed by fire. The total fire cost in this country is five times as much per capita as in any country of Europe. The first cost was greater than the value of the real property and improvements in ony one of the following States: Maine, West Virginia, North Carolina, North Dakota, South Dakota, Alabama, Louisiana, Montana. The actual fire losses due to the destruction of buildings and their contents amounted to $215,084,709, a per capita loss for the United States of $2.51. The per capita losses in the cities of the six leading European countries amounted to but 33c., or about one-eighth of the per capita loss sustained in the United States. In addition to this waste of wealth and natural resources, 1449 persons were killed and 5654 were injured in fires.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Slime Concentration.

The Editor:

Sir—I desire to continue the subject of 'Slime Concentration' introduced last July in your 'Discussion' department, commenting upon the relatively low efficiencies maintained by belt and table concentrators, and consider the possibility of constructing a modification of one or the other which should be capable of universal application or at least beneficial in individual cases. It is but natural to look to the manufacturers of concentrating machinery for help in this direction, but they seem to be so enthusiastically engaged in developing their respective machines from a commercial standpoint that but little attention is given to improving the working principles. Yet I may say here, that as much as ten years ago, John W. Nesmith introduced a successful system of concentration which today is practically unknown in the gold-producing counties of California where milling and concentrating is practised so extensively. Along the Mother Lode, and especially in Nevada and Sierra counties, the concentrates are all obtained by belts and canvas tables and there are no vibratory tables save in a few cases. These have there been rejected after brief periods of trial. It is not my intent to criticise milling or concentrating practices in California, but to endeavor to show the defects in existing machines, and to suggest reasonable remedies, and to emphasize Mr. Nesmith's sound advice: 'avoid slime-losses; don't make slimes'.

There are individual particles of sulphides that will not settle owing to their physical structure, such as thin scales which float buoyantly; finely ground mineral which floats in moving water, but would settle immediately in quiet water; particles which will settle to the belt but do not develop friction to cause adhesion to the belt and withstand the sluicing action of the stream. Other particles settle upon the belt midway between the distributer and the discharge, and the attendant having been instructed to save the mineral clean, permits that percentage of mineral to escape by using too much clear water.

In the case of highly mineralized ore, when a certain percentage of mineral settles to the belt it finds the surface already occupied by other particles, and is then sluiced off with the rest of the pulp. Also, there is quite a percentage of mineral which gets past the pulp-distributer to the space between the pulp and clear-water distributers, where it is exposed to the action of the clear water and is washed away with but little chance of returning.

I have watched concentrating tables for hours, studying their behavior with a powerful glass, and I can testify that the loss from this one cause is considerable. At times I have been able to check this loss by using one and sometimes two clear-water distributers, made as follows: a piece of 2-in. pipe as long as the width of the vanner and perforated with $^1/_{16}$-in. holes, 1 in. apart. The last holes at each end were swaged a little to compensate for excess material next the lip. Water connections were made through reducers from 2 to ½ in. at each end, and both fed from a single valve, centered above and connected with a small suspended reservoir having its inlet protected by a piece of 30-mesh screen to prevent the holes in the distributer from choking. This style of distributer admits of being secured to the frame, and may oscillate with the belt, provided a short length of hose be used to connect it with the clear-water valve. Its chief value lies in distributing an even film of clear water without splashing or channeling, and the water being under pressure at both receiving ends, a much more uniform distribution is effected. Care must be exercised in boring and reaming the holes, as ragged edged holes cause trouble.

Having ascertained the losses, the next consideration should be, how can some of these losses be avoided? For the purpose of illustration, let one of the so-called 'free-milling and concentrating' properties in California, equipped with a 20-stamp mill, vanners, and canvas tables, be the object of investigation. Begin by carefully panning and re-panning the tailing below the vanners, noting and recording the physical characteristics of the minerals forming the concentrate so panned, and also the middling. Recover 4 oz. of fairly clean mineral and middling from average samples of tailing and then prepare a rubber pan as follows: cut a disk of rubber from an old vanner-belt free from pits or cracks, of a diameter which will snugly fit into a gold-pan from the bottom up the sides to within 1 in. of the rim; then take the pan and bore a dozen holes ⅛ in. diam. equidistant around the side of the pan and about 2½ in. below the beveled rim; next punch a series of holes in the rubber disk to correspond with those in the pan. A bucketful of water on the disk in the pan answers very well as a weight to hold it firmly in position while the holes are being punched. As each hole is punched it should be riveted, using copper rivets and washer, swaged on the outside of the pan. Be careful that the bottom is smooth and tight. Take half of the sample of concentrate, throw it into the pan, and cover with clean water to a depth of ¼ in. or less, and agitate briskly and then 'corner' suddenly, noting whether the middling hugs close to the cornered mineral or lags behind; next agitate slowly and regularly, 'corner', and again note the position of the clean mineral and the middling. If there is no clean mineral in the corner no further experiment need be tried, but if clean mineral appears, proceed further by holding the pan nearly level in the left arm, and vibrate by striking gently with the right hand, imparting a horizontal motion and allowing a recoil by keeping the left arm rigid, repeating these movements rapidly until the clean mineral and middling have stratified over the bottom in an even film, showing lines of demarkation reasonably clear. Then, still keeping the stratification wet by gently tipping the pan so that they remain saturated but not disturbed, have an assistant introduce a small flow of clear water, equal to one of the graduations on the clear-water distributer of the vanners, letting it down

into the pan identically as in actual practice, and note the amount of mineral that withstands this flow. At this point, as a rule, inspirations are born. The interested observer generally discovers his clear water distributers to be too high above the belt. Anyway, whatever shows in the pan to have resisted the flow is precisely what will be saved in practice. Further proof of the vanner's ability to save more under certain conditions may be obtained by roughly panning down 250 lb. of tailing and dyeing the concentrate resulting therefrom a readily distinguishable color, and after drying throw the same into a launder leading to a vanner and then watch the cleaning-space which will presently show an appreciable quantity of the dyed mineral. In any event the experiment with the pan will govern the next step, which is to set up and put in first-class working order a spare vanner of any convenient size and deliver to it half the tailing from one of the other operating machines. With the pulp flowing freely, and all adjustments in working order, notice that the vanner is saving a small amount of mineral. An effort is made to save this by reducing the inclination a degree at a time, until, having cut the fall in half as compared with the other machines, the pulp barely discharges. At this point commence to add clear water to the launder feeding the pulp, diluting it until the pulp discharges as freely as on its more steeply inclined companions, simultaneously reducing the speed a little at a time and increasing the oscillations a few strokes per minute until in appearance the machine is loaded like its neighbors and is saving just as much in proportion. It will, however, have the advantage that the pulp remains on the belt nearly twice as long, affording time for the mineral to settle. Fully 60% of what had been found in the pan will be saved clean, and 15% more, if a small quantity of middling and coarse gangue be allowed to come through with the mineral.

FRANK R. PORTER.

Blair, Nevada, January 23.

Modern Quicksilver Reduction.

The Editor:

Sir—Replying to H. W. Turner's letter appearing in your issue of November 20, his correction that "the soot is formed in the condenser" is timely as well as self-evident. Regarding the percentage of mercury recovered as pure metal and from the soot, the statement quoted from Spirek ("only 6.5% of the total production being recovered from the soot" at Monte Amiata), does not agree with Schnabel, who states, in Vol. II, 'Handbook of Metallurgy' (Ed. 1907), page 341, that "thus at Monte Amiata only 20 to 30% of the mercury is got in the form of the metal—the rest is converted into 'stupp';" on page 430, he states that "recently at Idria, of the total production of mercury, including a loss of 9%, 56% was obtained by pressing the soot and 15% by distillation of soot residues;" on page 435 he states that, "according to recent communications from Mitter, in Idria, the extraction of mercury is at present distributed as follows: metallic mercury taken direct from the condensers 20%," and then follow the figures quoted on page 430. It is evident from the above that there is considerable difference of opinion among those who are authorities. The high extraction made in California, 70% of the total mercury being recovered as pure metal from the condensers, is excellent work as well as interesting information.

LESTER W. STRAUSS.

Lima, Peru, December 20.

The Editor:

Sir—Concerning the disagreement in the statements of Schnabel and Spirek as to the amount of free metal obtained in the Monte Amiata quicksilver furnaces, quoted by Mr. Strauss, it may be noted that Spirek was the metallurgist in charge of these furnaces during the period reported on by him, and should have known absolutely all the details of the recovery of mercury.

H. W. TURNER.

San Francisco, January 13.

Dredging in Montana and Idaho.

The Editor:

Sir—In the article on 'Dredging in Montana and Idaho' in your excellent annual number (January 1, 1910), I am quoted as authority for the statement that "N. S. Shaler was responsible for tests which proved the portion of Ruby valley that receives the wash from Alder gulch to be profitable dredging ground." This statement is too broad, and owing to the respect given to articles in your paper, it may lead to an erroneous impression. The success of the Ruby valley dredging field has attracted attention to the development of that enterprise, and as the property holds a unique position in gold dredging annals, the profession is interested in more accurate historic details.

It was in 1896 that the first steps were taken to prove the value of the area below Alder gulch for machine-mining. J. C. Sloss, a well known and experienced placer-miner, superintended the preliminary explorations by test-shafts and drilling with Keystone drills. The general recognition, acquisition, and early development of the property were due to P. N. Moore who had charge of the engineering features and to the late H. G. Bixby who looked after the business side. Although Mr. Shaler was a business associate, and was familiar with the situation, he did not see the property until after the exploration and acquisition by the syndicate of which all the gentlemen named were members. The history of this enterprise, particularly from an engineering point of view, is highly interesting to those engaged in auriferous gravel mining. The struggle for success has been of great educational value to the profession, and perhaps all the better modern machines embody in some details the mechanical improvements evolved, particularly in the bucket-line and in the practice for cold-weather operating.

A. H. WISEMAN.

Seattle, March 1.

Tungsten salts are used in fireproofing cloth for curtains and draperies; in weighing silks; in glass making; as a mordant in dyeing; and for other purposes.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Excavation in earth by a 90-ton steam-shovel should average about 18 cu. yd. per hour.

Maximum length of drill-steel for open rock-work, drilling deep holes, may be as great as 20 feet.

Pile-heads immediately upon being cut should be coated with hot asphaltum thinned with creosote oil.

The Federal mining law does not extend to Texas, the Philippines, Porto Rico, nor the Hawaiian Islands.

Asphaltum should be applied to all cut surfaces of creosoted timbers, when fitting and setting up, either in framed structures or in mine timbering.

Creosoted timber twenty years old has been found by tests in testing machines to be as strong as newly treated timber.

Leading-hose for conducting compressed air to the upper bench in driving the Bergen Hill tunnel of the Pennsylvania railroad was of rubber and cotton, covered with woven marlin, 3 in. outside diameter.

Powder consumption at the Alaska Treadwell mines averages 2 lb. per ton. This is slightly in excess of the usual amount, due to the character of the ore, which is hard and tenacious.

Eight elements only are of special interest as regards quantity in the earth's crust. Of the others the proportions are so small that probably few exceed 0.01 per cent.

Placer locations are required to conform as nearly as practicable to the rectangular system of the public surveys, so as to prevent 'shoe-string' locations. The ideal lode-location is in the shape of a parallelogram. A placer claim should be square in form even when within unsurveyed land.

Actual work in the removal of gravel for extraction of the metallic content, the sinking of shafts, or the installation of mining equipment for operating a placer claim, is the character of improvement contemplated by law as performance of annual labor to hold title.

Alumina in excess in a charge for copper smelting requires generally an increase in temperature, and leads to conditions favoring the reduction of iron to the metallic form, causing serious difficulties in smelting. In rare cases slags containing as much as 24% Al_2O_3 have been successfully smelted.

Annual labor on an association placer-claim of 160 acres, as required by law, is the same as for an individual claim of 20 acres, namely, the equivalent of $100 worth. Work done in good faith to operate or explore a deposit, whether productive of a profit or not, is acceptable, so long as it is done to benefit the claim.

Steel used in drilling the new tunnels for the Pennsylvania railroad through the diabase mass of Bergen Hill, New Jersey, including that lost and scrapped, was almost exactly 1 ft. for each 10 cu. yd. of excavation, or 1¼ in. per cubic yard. The loss due to sharpening was from ¾ to ⅞ in. per cu. yd., that work being done with an 'Ajax' sharpener.

Inspection was formerly relied on in steam-boiler practice to maintain them in condition. It is still wise to make periodical investigation of the internal condition of boilers, but the true way to get the best results is not to allow mud and scale to accumulate inside, but to remove all such impurities from the water before it enters the boiler. The best way to keep a boiler clean is to put only pure water into it.

Grouting the surface of concrete in order to make it smooth, leaves it subject to unequal wear, owing to the lack of uniformity in the degree of hardness in such a thin layer of cement. The 'set' of a thin sheet of cement is not the same as that of a larger mass. For this reason the tops of concrete blocks for setting heavy machinery should not be made 'true' by grouting, but by dressing down after the block has set, in the same way as the surface of a stone would be finished.

Launders should not be made of concrete. Such launders cut rapidly under the abrasion due to mill-pulp. Steel and iron abrade still more rapidly. Concrete lined with wood makes a good launder. The softer woods are better for this purpose than hard woods, but 'clear' stock should be selected. In the Garfield mill of the Boston Consolidated Copper Co. (now absorbed into the Utah Copper Co.) concrete launders lined with plate-glass are employed, and the wear is reported to be inappreciable after two years' service.

Disruptive power of frost is merely physical. Its shattering force is comparable with the grinding of ore in a mill prior to its chemical treatment, although its effect is limited to a large extent by the physical condition of the mineral itself. One mass of rock or mineral may be comparatively unaffected, while an adjacent deposit, of practically the same mineralogical composition, may be completely disintegrated and decomposed, merely on account of the physical condition of the latter being favorable to the entry of films of water between the crystals or interspaces, or into fissures or cracks.

Titanium, which is usually regarded as one of the rarer elements, occurs in greater proportion than most of the commercial metals, but it must be remembered that most rocks and most aluminous minerals contain titanium either as an accessory mineral or as an impurity, although true titanium minerals such as rutile, ilmenite, and the like, are comparatively rare. The proportion existing in the earth's crust is, however, no criterion as to the amount of an element commercially available. Iron, for example, is present in the crust to the extent of over 4½%, but the great bulk exists, as in the case of titanium and aluminum, only in the rock-matter or in other forms not available for use.

Special Correspondence.

CAMBORNE, CORNWALL.

Tin Mining.—South Crofty Pays Dividend.—Carn Brea and Tincroft Ore Poorer.—Dolcoath Report.—Wheal Vor.—National Minerals Promotions.

It is pleasant to be able to record that South Crofty has joined the list of dividend payers. This mine is close to Dolcoath and in days gone by was worked for tin under the guidance of practically the same people as Dolcoath. Owing to the high content of wolfram and arsenic, and also to shortness of capital, operations came practically to a standstill. In 1906 during the boom in tin, the Allen Meyerstein group in London came forward and provided new capital for reorganizing the mine and the plant. The old cost book company was transformed into a limited liability company with a capital of £50,000. On flotation the vendors received 20,000 shares credited 15s. paid with a liability of 5s., and the promoters subscribed for 20,000 shares at par. In 1907 and 1908 the remaining 10,000 shares were issued at £4 per share. The total cash capital subscribed was therefore £65,000. The company has sunk a new shaft and has by installments provided 60 stamps, together with tables and magnetic separators. For some time the mine has been paying its way, and for the year 1909 a dividend of 3s. per share has been distributed. The report for the year 1909 shows that the production was 696 tons of tin concentrate valued at £53,481, 142 tons of wolfram valued at £12,462, and 666 tons of arsenic valued at £6950. The actual receipts during the year from sales were slightly different from the value of the production, being £52,669, £13,939, and £7443 respectively, making a total income of £74,223. The cost of mining and dressing was £58,469, and London expenses came to £1105. The amount written off for depreciation of buildings and plant was £3266, and the balance of profit for the year was £10,791. Out of this amount £7500 has been paid as dividend and £2738 written off for development. The average extraction was 26.28 lb. of tin concentrate per ton, 5.38 lb. of wolfram, and 25 lb. of arsenic, these figures all show an increased extraction over the previous year when the corresponding figures were 23.8 lb., 5.18 lb., and 21.3 lb. The total value of the produce per ton was 24s. 7d. and the mine cost was 19s. 5d., as compared with 22s. 2d. and 20s. 11d. respectively in 1908. The mine has now been unwatered to the 225-fathom level and the new main shaft is nearly to that depth. When sinking is completed to that level unwatering and sinking will be continued for another 20 fathoms. During the year the company has completed the arsenic refining works and the output is sold well in advance. The last unit of 20 stamps out of the 60 came into operation at the beginning of the year. Other recent additions have been made to dressing plant, including an additional Buss table, four Frue vanners, and three slime tables.

In writing of Carn Brea and Tincroft six months ago I expressed a hope that the increased energy of the management would place this company on a permanently sound footing. The mine is a neighbor of Dolcoath and South Crofty and is the second largest producer of tin in Cornwall. Unfortunately the grade of ore has fallen off and the results for the second half of 1909 have not been so favorable. Though the ore treated is larger than ever before, being 37,813 tons, as compared with 34,790 during the second half of 1908, and 36,825 tons during the first half of 1909, the extraction has only been 29.52 lb. of tin concentrate per ton, as compared with 34.55 lb. during the previous half-year. Consequently, though the average price per ton has increased to £72, as compared with £69, the total income has been only £35,888, as compared with £39,428. Other small items of income from arsenic and copper ores brought the total income to £39,006. Against this the mining expenses were £41,266 and the lord's dues £1398, leaving a loss on the year's operations of £3657. The cost per ton of ore treated was 22s. 7d. Development work has about kept pace with the extraction, and it does not appear probable that the current year's operations will show any marked improvement.

Dolcoath did not do so well during the second half of 1909 as during the first. In the earlier part of the year richer ore was mined with the express object of employing less labor, which could therefore be transferred to development. It is not altogether a surprise therefore to find that the output of tin concentrate has diminished by 97 tons. The output of ore was 46,349 tons of ore and 203 tons of concentrate was produced. In August last I recorded that the produce during the first half year was 1000 tons, and mentioned that this figure had not been reached since 1901. The produce during the second half of the year was 13.6s lb. per ton, as compared with 18.85 during the first half, but nevertheless, with this exception, it is the highest yield per ton since 1901. The average price per ton was £82 6s. 6d., as compared with £79 16s. 4d., and the total receipts £74,411, as compared with £79,864. Other items brought the total income for the half year to £75,854. Against this the total cost was £63,132, including royalties of £1960, leaving a profit of £12,722, out of which £3203 was allowed for depreciation, and £8500 distributed as dividend, which is at the rate of 5% per annum on the capital, £350,000. The new main shaft is now down 2832 ft. from the surface, as reported in your columns at the time connection was made at the 440 fathom level between the present workings and the new shaft, in September last.

The Cornish mine known as Wheal Vor was re-opened in 1906 by the Dolcoath people. It is situated in the Breage district of Cornwall and in years gone by was a large producer. The work of re-opening has so far been confined to unwatering and clearing the shafts and levels, and it has been delayed by the unsuitability of the electric pumps provided at first. R. Arthur Thomas, the consulting engineer, reports that the present installation of electric pumps is working satisfactorily and that the mine is now unwatered to the 144-fathom level. The various levels have been explored and cleared, and some development has been done by tributors. Tin-bearing veins have been found at a number of places, and a substantial one averaging 30 lb. of black tin per ton is receiving attention. A significant remark made by Mr. Thomas recently was this: "It is no use disguising the fact that from the examination of the workings we find that the old men have been there before." More money is wanted to continue the work. The nominal capital of the company is £90,000, divided into 120,000 ordinary shares of 10s. each and 60,000 priority shares of like value. Of these all the ordinary and 24,000 of the priority have been issued. Of the ordinary 24,000 were issued, credited as fully paid, in payment of the purchase of the lease, and 96,000 were subscribed in cash on flotation to provide working capital. There are many overdue calls on the ordinary shares outstanding, and great difficulty is experienced in making shareholders pay. The priority shares were created in June of last year when funds ran short. Of the issue of 60,000 only 24,000 were taken and 2s. 6d. per 10s. share has been paid upon them. Certain London brokers have signified their willingness to underwrite the remaining 36,000 if they get any encouragement by local shareholders showing some disposition to subscribe for some of them.

I have from time to time referred to the doings of the London promoting firm known as the National Minerals Corporation in Cornwall in connection with the Falmouth Consolidated, St. Ives Consolidated, and St. Agnes Consolidated. The Corporation does not now issue the reports of its companies to the press; at least the yearly report of Falmouth Consolidated has not been issued. This company owns the Wheal Jane group of old mines between Truro and Chacewater, and I have already recorded how ball-mills were first installed and then thrown out, and stamps substituted. The stamps are now ready to start work and the chairman of the company recently announced that they should be in operation by March 1. It is nearly a year since the ball-mills were ejected, and the reason for the delay in getting the stamps ready is not quite clear. The chairman says the blame must be thrown on the weather. Fancy saying of any place in Cornwall: "In wintery weather this is a very boisterous place, and during the past few months the gales have been such as to render work on the surface, except at odd times, extremely difficult and painfully slow."

I do not know what the champions of the so-called 'Cornish Riviera' will say to this. My remarks in a recent issue about the exaggerated claims of Cornwall as a winter health resort brought hornets round my ears, but I never said anything half as bad as this. As regards the ore reserve, the chairman has indulged in even wilder and more ludicrous statements. Instead of giving a detailed account of the known, probable, and possible ore, he says that "in the opinion of the company's engineers the mine is of sufficient capacity to eventually keep supplied 500 or even as many as 1000 stamps." Most mining engineers had hoped that public opinion had been educated sufficiently during recent years to refuse to listen to such Whitaker Wright statements, and the profession generally is sorry that such methods are still in existence. Another point in connection with the methods of finance pursued by this corporation should be mentioned. In floating the Falmouth Consolidated the promoters received £75,000 in shares, £5000 cash, and an option over 20,000 more shares at par. This was out of a capital of £150,000, of which £44,683 were subscribed by the public. What did the promoters do to earn this preponderating interest? Nothing but transfer the leases of the properties to the new company and do a little hauling by horse-whim. The properties belong to Lord Falmouth and others, and are held on 21-year leases at a rental merging into royalties. In the prospectus the astonishing statement is made that nothing is being paid for goodwill. As a matter of fact there is no goodwill in an abandoned mine. But what was that £75,000 in shares paid for anyway?

WASHINGTON.

Alaskan Coal.—Reservation and Leasing Proposed.

A reasonable estimate of the value of the mineral wealth of Alaska is wanted in Washington just now. Representatives of the Guggenheim-Morgan syndicate, who appeared before the Senate Committee on Territories several days ago, gave startling figures. Their statements, made with the avowed purpose of counteracting the influence of muck-raking magazines, created more of a sensation in political Washington than any of the stories that had appeared in the magazines themselves. It left Congress in confusion. Mr. Beveridge, chairman of the committee, rallied and introduced two bills in the Senate. The first provides that all deposits of coal, lignite, and associated materials in the lands of the United States within the District of Alaska shall be withdrawn from location, entry, or sale and reserved for future disposition by Congress; provided, that the surface of such lands and other mineral deposits therein may be taken up and title thereto acquired under the laws that would be applicable thereto if this act had not been passed; and provided further, that all patents for lands hereafter taken up in this district shall expressly reserve to the United States and its lessees all deposits of coal, lignite, and associated mineral in the lands patented, and the right to use so much of the surface as may be necessary in the mining thereof. The second bill provides that all deposits of coal, lignite, and associated minerals, belonging to the United States in the District of Alaska, with the right to use so much of the surface as may be necessary in the mining thereof, shall be disposed of only by lease, under such rules and regulations and upon such terms and conditions as the Secretary of the Interior may prescribe; provided, that no lease shall be made to any one person, association, or corporation, of deposits underlying a greater area than 2560 acres, nor for a longer term than thirty years; nor shall any such lease be assigned or otherwise disposed of except by the express permission of the Secretary of the Interior; and all such leases shall be reported to Congress at the beginning of the first session following the granting of such leases.

Mr. Beveridge gave his estimate of the value of Alaska in the following language: The Geological Survey estimates that in all the coalfields now known there is a tonnage of 15,104,500,000 tons, that the areas known to be underlain with coal aggregate 1202 sq. mi., and that the present known coalfields aggregate an area of the enormous sum of 12,867 sq. mi. That, upon the basis of the testimony of the manager of the Alaska syndicate before our committee, would run the money value of the now known coalfields in Alaska into many billions.

DENVER, COLORADO.

Mining at Cripple Creek. — Proposed Asbestos Merger. — Coal Mine Inspector's Report. — Decision of the Inter-State Commerce Commission.

Mining operators in the Cripple Creek district were especially busy during February. The production for this, the shortest month of the year, was $1,206,527. The grade of ore averaged $22.81, which is slightly above the usual figure. Many leases have been granted during the month, and several rich finds made by lessees and by companies. The Deep Drainage tunnel advanced 259 ft., making a total distance of 12,604 ft. from the portal. The Elkton and Pharmacist companies paid dividends amounting to $37,500 and $7500 respectively. This brings the total of announced dividends up to $150,000 since the first of the year. It does not indicate, however, the profits made by lessees or by close corporations. On February 26 the properties of the Keystone Mining & Milling Co. and the Ida May Gold Mining Co. were sold by the sheriff under writs of execution issued by the district court of El Paso county. The Keystone properties were bid in by Horace G. Lunt on a judgment of $9858. The Colorado Title & Trust Co. secured the Ida May properties on a debt of $3437. James F. Burns has filed a petition in district court asking for a receiver for the Magnet Rock Mining Co., whose principal property is the Monte Cristo lode claim at Cripple Creek. He alleges that the company has held no stockholders meeting since 1906, and that since the officers, with the exception of the secretary, are out of the State he cannot examine the books. The Petrel Gold Mining & Milling Co. has recently been incorporated under the laws of Wyoming, to operate the properties of the Papoose Gold Mining Co. situated on Squaw mountain, besides other territory acquired by the new company amounting in all to about 30 acres.

There appears to be a movement on foot to form an asbestos trust. Representatives of the Amalgamated Asbestos Corporation of Canada have been examining the large deposits near Casper, Wyoming, and an offer, it is said, of a million dollars has been made for the control of this deposit covering about 1200 acres. The United States Asbestos Mining & Fiberizing Co. of Berkeley, California, and the International Asbestos Co., North American Asbestos Co., and the Wyoming Consolidated Asbestos Co., all of Casper, Wyoming, are interested in the merger. The organization of such a company would control 90% of the asbestos production of the world.

The report of the State coal mine inspector relative to the Primero mine disaster of January 31 has been handed to the Governor. The report holds the Colorado Fuel & Iron Co. responsible for the 76 lives lost in the explosion. The inspector holds that the company neglected to sprinkle the mine as required by law. Because of the excessive amount of coal dust in circulation the explosion extended throughout the mine, whereas it would have been only local had the mine been properly sprinkled. The report recommends that a law be passed by the legislature prohibiting miners, other than shot-firers, from taking powder, matches, or explosives of any kind into a coal mine. The United Mine Workers of America have also investigated the cause of the explosion. The report of their committee to the president of the organization charges the coal mine inspector and his deputy with allowing the company to violate the law. It might be urged at this point that the number of deputy inspectors be increased so that the mines could be properly inspected at frequent intervals, and that each inspector be made responsible for a certain number of mines. It is a physical impossibility for the present force of inspectors to do the work expected of them in anything like a thorough manner.

The Interstate Commerce Commission has recently handed down a decision that is of interest to all mining men in Colorado. The decision establishes joint rates from the Walsenburg coal district in Colorado to points in Texas, Kansas, and New Mexico. Heretofore the through rates

have been prohibitory. Under the law a satisfactory through rate is required if demanded by the shippers. The Cedar Hill Coal & Coke Co. was the complainant to test the law. Strong opposition was put forth by the railroads affected.

GOLDFIELD, NEVADA.

Goldfield Con. Ore-Shoots — Florence Goldfield Improvements

The Consolidated Goldfield Mines Co. is mining and milling 300 tons of ore per day from its Clermont workings and 200 per day each from the Mohawk, Red Top and Combination. The four shafts are sunk from 1000 to 1500 ft. apart along the north strike of the ore bearing zone, which has an approximate length of 6000 ft. and a maximum width of 2000 ft. The orebodies in this zone, which occur in shoots and lenses have usually a dip northeast, the gangue being a quartz and silicified dacite. In the Clermont shaft shoots of ore have been opened on all the levels. The ore shoot on the 600 ft. level is 150 ft. long, and has an average width of 15 ft., the ore carrying an average, thus far, of 6 oz. gold per ton. This same orebody has been opened on the 750 ft. level, where there is also a separate shoot 450 ft. long and 25 ft. wide, for the distance of 100 ft. the ore from the latter averaged over 20 oz. gold per ton. An orebody was recently opened by driving a cross cut from the 1000 ft. station, the average of the ore for two weeks being $30 per ton, the gold in this is associated with bismuth and antimony as sulphides. The principal tonnage from the Clermont is being taken from the 600, 750, 900, 1000 ft., and intermediate levels. The Clermont ores now mined average $50 per ton. An important ore shoot has been cut on the 600-ft. level of the Mohawk, a similar shoot on the 450, and still another on the 350 ft. level. Some ore of good grade has been found recently on the 250 ft. level, above the old Hayes Monette stopes. The most important of the newer Mohawk developments, however, is the opening of the shoot of ore on the 600 ft. level. New orebodies have been found on the Mohawk and Clermont, within the last two months, on practically all the levels, as well as a new ore-shoot on the fourth level of the Red Top. No new orebodies have appeared in the Combination workings, though the grade of ore there is said to be improving. The Mohawk ores run about 2 oz. gold.

The Florence Goldfield mine and mill are operated under the management of Willis Laurence. The main working shaft, single-compartment, 500 ft. deep, is being enlarged and re-timbered from the lowest station upward, to make room for two hoisting compartments. When the work is finished the 1½-ton skip now in use will be supplanted by four others of ample capacity for hoisting a large tonnage of ore. The double-drum electric hoist, Hendrie & Bolthoff make, now installed, will probably meet the requirements when the larger production is undertaken. The Rand air-compressor, electric and belt driven, has capacity for driving 25 air-drills. About half that number are now in use. Sullivan drills are used for sinking and driving and the work in the stopes is done with Waugh and Shaw drills. The first orebody is about 100 ft. below the surface and the first working level is at the depth of 150 ft. The second level is at 250, the third at 350, and the fourth at 500 ft. There are, however, intermediate levels from which ore is taken through chutes to the main levels. The equipment of the shaft for four hoisting skips will include a 100-ton ore-loading pocket at each of the main stations. The old workings, most of which were done by lessees, show there was a continuous orebody 1200 to 1500 ft. in length. It runs at right angles to the contact of dacite and andesite, and averages 8 ft. wide. There is, though, little regularity in these orebodies. Another vein, known as Engineers', is mostly in dacite, 60 ft. east of the main body, and about 75 ft. long, as it seems cut off by a fault-plane at each end. Much high-grade ore has been taken from it. The dacite-andesite contact, through which the main veins cut at right angles, strike east and stand nearly vertically. The north section of the mine is in dacite and the south, including Little Florence and Rogers shafts, is in dacite. Rich ore is exposed on all the levels; some of the highest grade that has been mined in the district came from the Florence. That which is now being mined and milled has an average value of $25 per ton. In the mine work all stopes are stulled, the square sets being put in only where there is an orebody of great width or where it is close under heavy buildings on the surface. A force of 60 men is engaged underground and 50 on the surface. The mill of the Florence Goldfield M. Co. is treating 175 tons every 24 hours by amalgamation, concentration, and cyanidation. The crushing is performed by 40 stamps, arranged in two sections of 20 set face to face, the mortar discharge from both sections being into a central launder between the two. Part of the stamps are 950 lb. weight, the others 1050. Their drop is 5 to 6 in., 100 per minute. Half the mortars are of the Hendy type, gauged for 9 in. shoes and dies, the other half are of another type. These are to be standardized. The battery screens are 16 mesh, in which No. 19 wire is used. The pulp from the batteries passes over amalgamating plates, each divided into four sections, resulting in the recovery of 40 to 50% of the gold content of the ore. It is then pumped to three hydraulic classifiers, the spigot discharge from which is concentrated by ten Card tables; the overflow product passes to ten Callow tanks. The concentrate product of the Card tables carries only about 5% silica, the bulk of it consisting of clean sulphide carrying 5 to 7 oz. gold, 2 oz. silver, and 2% copper per ton. The table tailing passes to a hydraulic cone, the spigot product of which is fed into two tube-mills by which it is pulverized to not less than 80 mesh; the tube mill product is joined by the overflow slime from the hydraulic cone, the two being raised by centrifugal pumps to three hydraulic classifiers. The discharge from the latter is re-concentrated on Card tables, the overflow going to Callow tanks. The settling from these tanks is concentrated over vanners. The Callow overflow and the vanner tailing make up the material that passes to the cyanide plant. It is first received in three collectors, each 36 ft. diam. and 20 ft. deep. It is then passed from the collectors through a mixer to four agitating tanks, 17 by 17 ft., where cyanide solution is first introduced, 1 lb. KCy to one ton of slime being used. After agitating six hours the slime is drawn into Butters filters, the gold solution from the latter being drawn to the precipitating boxes of zinc shavings. The mill work is in the competent hands of W. H. Barton, who was formerly at the Desert mill at Millers, Nevada. Mr. Barton states that by the three processes employed in the mill the total extraction is equal to 95%. In the work of concentration the highest product is from the vanners.

MEXICO.

Oil War.—Shipping Facilities at Tuxpan.—San Pedro Analco — Cinco Minas.—San Rafael y Anexas.

The oil war continues in Mexico, with the Pearson-Aguila interests still forcing the pace. These people claim that the war so far has cost them much less than their competitor, the Waters Pierce Oil Co., and that at the present cut prices they are securing a profit from some grades of oil from their Minatitlán refinery. Sir Weetman Pearson, head of the English firm of S. Pearson & Son, Ltd., who was expected in Mexico at an early date to personally investigate the present oil situation, has changed his plans and will visit Buenos Aires before coming here. It is reported that an agreement for a division of the Mexican territory was recently drawn up by the competing concerns, but that the settlement was abandoned as a result of a demand by the Pearson-Aguila interests for a division of crude-oil contracts, and the refusal of the Waters Pierce company to comply. The Mexican Petroleum Co., at present the most important producer of oil in Mexico, is delivering crude oil and distillate from the Ebano wells and refinery in the State of San Luis Potosí to the Waters Pierce refinery at Tampico, and will be soon in a position to increase deliveries of 'crude' as a result of the opening of the Huasteca fields in the State of Vera Cruz. In the Potrero del Llano, not a great distance from Tampico, the Pearson-Aguila interests have brought in a well that is said to be capable of producing 500 barrels per day, and a 200-barrel well was recently brought in by

the same people at Tanguijo, a new field south of the Tamiahua lagoon, in Vera Cruz. In the San Cristóbal field in Vera Cruz, in which the Pearsons have been operating for some time, oil has been struck in a new well. Deliveries of oil from the Furbero fields of the Oil Fields of Mexico Co. to the Minatitlán refinery will be commenced as soon as the pipe-line to the Gulf port of Tuxpán is extended under water to a point outside the bar, a distance of two miles. Great buoys will be placed at the end of the pipe-line, and tank steamers will be loaded there. In addition to supplying the Mexican markets the Pearsons are exporting refined oil to England. The recent return of a steamer-load of Minatitlán oil from England has been made a feature of the oil war by the Waters Pierce interests, but the Pearsons explain that the oil was some of the first produced at Minatitlán, that it was not properly refined, that their representatives in England made no effort to dispose of it, and that it was returned for re-refining. The steamer that brought the oil to Mexico took back a shipment of the highest grade Minatitlán. A well brought in some time ago by the Mexican Fuel Co., a Waters Pierce concern, in the Topila district of Vera Cruz, is producing steadily.

Some of the money received by José Landero y Cos and associates from the Camp Bird interests for their Santa Gertrúdis stock will be used to equip the San Pedro Analco mines in Jalisco with a cyanide plant, continue development,

Cinco Minas, Hostotipaquillo, Jalisco, Mexico.

and complete the hydro-electric plant on the Santiago river. Mr. Landero y Cos was president of the old Santa Gertrúdis Co., and has been heavily interested in the San Pedro Analco Co. for several years. The San Pedro Analco has just added, by denouncement, 79 pertenencias to its holdings, and the new ground has been given the name of Santa Gertrúdis. John M. Nicol, a mining engineer formerly of San Francisco, has taken a contract to sink a deep winze for the Marcus Daly interests at the Cinco Minas in the Hostotipaquillo district of Jalisco. The winze was started last year, and will be carried to a depth of 1000 ft. The new development work in the Cinco Minas continues to give gratifying results. The Daly interests are organizing a company to carry on operations. Ore assaying from 15 to 22 kg. silver and from 100 to 152 gm. gold per metric ton is being shipped from the Casados mines of the Consolidated Mining Co. in the Hostotipaquillo district. Returns from shipments more than cover development expenses. No stoping is being done, and a big tonnage of high-grade milling ore is being placed in sight. The Virginia & Mexico Mine & Smelter Corporation, which built the first modern reduction plant in the Hostotipaquillo district last July, is now producing from ₱8000 to ₱10,000 per week. Difficulties at the plant are being overcome, and it is expected to double the output within a few weeks.

During the last six months of 1909 the San Rafael y Anexas Co. of the Pachuca district of Hidalgo produced 44,348 kg. of silver and 204 kg. of gold, the value being ₱1,397,187. In that period dividends to the amount of ₱410,000 were paid. The expense of treatment in the company's cyanide plant was ₱3.84 per ton. Orders are being placed for equipment for the 300-ton cyanide plant that the Camp Bird interests will build at the Santa Gertrúdis mines in Pachuca.

NEW YORK.

Amalgamated Co. Reports Holdings.—Copper Producers Assn.—February Figures.—Nevada Con. Direc ors Elected.—United Verde Stock Sold.—Anaconda Appraising Mines.

The great interest shown in the statement of the Amalgamated Copper Co. made last week, has been the cause of no little comment. No corporation founded on mining as a basis has in this country been so widely known. The exposé of the formation of Amalgamated copper, the uncovering of the various cellars, sub-cellars, and secret passages, to say nothing of ground floors, was the first big gun in the campaign of muck-raking that is still in progress. It is not remarkable, therefore, that those who have followed this market leader should be interested in learning what stands back of the hundreds of thousands of shares that have been bought and sold. The application made to the listing committee of the New York Stock Exchange when released showed that the company does not entirely own any of the properties in which it is interested. Its holdings are given as follows: 620,000 shares of Anaconda copper, par $25, out of a total issued capital of 1,200,000 shares; 149,915 shares of Boston & Montana, par $25, total shares issued 150,000; 197,220 shares of Butte & Boston, par $10, total shares issued 200,000; 115,299 shares of Parrot Silver & Copper, par $10, total shares issued 229,850; 9995 shares of Trenton Mining & Development, par $100, total shares issued 10,000; 30,459 shares of Washoe copper, par $100, total shares issued 30,464; 6395 shares of Big Blackfoot Milling Co., par $100, total shares issued 6400; 149,993 shares of Diamond Coal & Coke, par $10, total shares issued 150,000; 1107 shares of Mountain Trading Co., par $100, total shares issued 1110; 100,000 shares of Greene Cananea, par $20, total shares issued 2,500,000; 50,000 shares of Butte Coalition, par $15, total shares issued 1,000,000. The output of the producing mines Anaconda, Washoe, Parrot, Butte & Boston, Trenton & Boston, and Montana is stated to have been during 1909, 292,000,000 lb. copper, 9,837,268 oz. silver, and 59,074 oz. gold. It is further stated that the company has never considered it necessary to block out large ore reserves, but that there is as much ore blocked out now as at any time. The Big Blackfoot Milling Co. is stated to own over 1,000,000 acres of timber lands, and two large saw mills. The profits derived from this company have not been distributed in dividends, but have been invested for some years in additional property. The Big Blackfoot Milling Co. is to be reorganized into the Big Blackfoot Lumber Co., and all of the stock will be owned by the Amalgamated. The property of the Diamond Coal & Coke Co. consists of about 13,000 acres of coal land in Uintah county, Wyoming. The laws of Wyoming do not allow a mining company to operate company stores. The Mountain Trading Co., was, therefore, organized to take over the commissary department of the coal company. This is the first statement ever made by the Amalgamated, giving a list of the securities owned by it, and the statements made by the various subsidiary companies are also the first ever made covering their production. Butte & Boston reports a profit for the six months ending June 30, 1909, of $282,384; Boston & Montana for the same period, a profit of

$1,144,911. Washoe Copper a profit of $906,791. the Parrot which has for a long time been reputed to be making just about a new dollar for an old one, shows a deficit for the period covered, of $42,500. The income account of the Amalgamated covering a period from May 1, 1909, to January 1, 1910, shows dividends received from subsidiary companies, $2,949,334, other items, interest on loans, etc., $405,782, total income $3,355,116, less administration expenses, $70,682, net income for the eight months, $3,284,434. There is outstanding $153,887,900 of the capital stock of the Amalgamated, and the net earnings as given are equal to a little more than 2 1/3% on the issued capital, or a little better than 3% per annum. Amalgamated copper sells at about $82 per share, and pays 50c per share quarterly. Goldfield Consolidated sells for $8.50 per share and pays 50c per share quarterly. This is not the only comparison that is being drawn against some of the coppers. Utah copper is selling at $50 per share, and paying $3 per year, while Kerr Lake, the Lewisohn property at Cobalt, is expected to declare the same rate, 75c per share quarterly, at its next meeting, and Kerr Lake sells for between $8 and $9.

There was not a little disappointment manifested when the figures of the Copper Producers' Association appeared March 10. February being a short month, and Western mines having a great deal of severe winter weather to contend against, it was expected that production would show a material curtailment and that the copper surplus would as a result of further inroads be reduced to a comparatively negligible quantity. It was something of a surprise, therefore, when the report showed an increase of nearly 9,000,000 lb. Exports are figured by the association at 37,369,518 as against custom house figures of 55,538,000 lb. This discrepancy is due to the fact that some 23,000,000 lb. of copper billed for export were included in last month's figures of the Producers' Association, but did not clear through the ports until in February. The production in February was 112,712,493 lb., being a decrease of but 3,834,794 lb. from January figures, and being really an increase in per diem production. The copper surplus on March 1 was 107,187,992 lb., as against 98,463,309 February 1, the net increase being 8,724,683. Domestic deliveries for February were about what was to be expected, totaling 66,618,322 lb. The statistical position of copper is not as strong as it was thirty days ago, and the necessity for further curtailment is plain. To paraphrase the late John Sherman, "the way to curtail is to curtail."

The long drawn out struggle between the Utah Copper crowd and the Nevada Consolidated stockholders headed by James Phillips, Jr., has resulted in the exchange of 859,361 shares of Nevada Con. This is not sufficient on its face to carry the absolute control of Nevada Consolidated, which has an issued capital of 2,000,000 shares, par $5. At the meeting held March 10, C. M. McNeill, D. C. Jackling, and S. Guggenheim were elected to the board of directors.

It has not generally been supposed than any stockholder of the United Verde Copper Co., outside of Senator W. A. Clark, held as much as 500 shares of United Verde. There was a good deal of interest, therefore, in the sale of 500 shares of the stock this week at auction in New York at $70 per share. Otto Sussmann is making an examination of the Granby for the American Metal Co., Ltd., which is the American representative of Henry R. Merton & Co., Ltd., of London. The examination of the Granby has renewed the talk of the consolidation of the important producers of the boundary camp. A. B. W. Hodges, who has for many years been general manager of the Granby, has recently resigned his position to become general manager of J. B. Haggin's Cerro de Pasco mines in Peru. Mr. Hodges' successor has not yet been chosen. Mr. Hodges has also for several years been consulting engineer for the Shattuck-Arizona, one of the recently developed producers at Bisbee, Arizona. The Esperanza Mining Co., Ltd., of El Oro, Mexico, has increased its quarterly dividend, according to London advices by cable March 10, from 1s. to 1s. 6d. J. F. Kemp, of Columbia University, Herman Keller, and P. L. Foster, of New York, are engaged with B. B. Thayer, of the Anaconda Copper Co. in making the appraisals of the various Amalgamated mines at Butte.

TORONTO, CANADA.

Cobalt Shipments and Improvements — Railway to Porcupine Promised.—Mackenzie & Mann Invest on Bear River.

Shipments of ore from Cobalt for February amounted to 2276 tons, as compared with 2115 for February 1909. The list for February last is headed by La Rose with 566 tons, followed by Nipissing 400 tons, Kerr Lake 388, and Crown Reserve 291. The Cobalt Power Co. has for some time been delivering power in small quantities from Ragged Chutes on the Montreal river and the supply has lately been increased, among the companies receiving power from this source being the Conlagas, the Cobalt Central, and the Temiskaming. The Nipissing and La Rose are also preparing to handle it. The Mines Power Co. is developing an electric current from the Matabetchouan Falls, and will have two stations at Cobalt for generating compressed air, and in addition wires have been erected for electricity. Contracts have been signed with a number of companies. It is altogether reasonable to anticipate that the arrival of cheap power will largely increase shipments. One effect is already evident in a slight upward movement in the stock market, affecting mainly the cheaper issues. At the Temiskaming high grade ore has been found at the bottom of the shaft at 425 ft. depth. The quartz-calcite vein in which it occurs runs through the mine, but previously had not carried anything better than a little milling ore. The pay-streak varies from 2 to 12 in. At the Nipissing the Meyer vein at 185 ft. shows a width of 6 to 8 in. of high-grade ore, and on the 75 ft. level the ore runs in places 9000 oz. per ton. Vein No. 100, worked from the Fourth of July shaft, varies in width from 2 to 15 in., with rich silver content. Raises are being driven to connect the first and second levels of the Fourth of July vein, where stoping will shortly be commenced. On vein No. 64, remarkable for its great width, 18 to 36 in., high-grade ore has been found at 300 ft. The two lower levels are being connected with raises preparatory to stoping, and development in this and other workings has considerably increased the ore reserves. The Gifford has struck a 3-in. calcite vein heavily mineralized with copper, galena, and iron. The Rochester in driving and cross-cutting at the 45 and 75-ft. levels has encountered a number of promising veins. At the 45-ft. level from the new shaft known as No. 3 the vein which showed at the surface over 5000 oz. silver per ton, was again cut. It is 5 in. wide and apparently as rich as on the surface. Two narrow high-grade veins have been found at the Crown Reserve in a cross-cut at the 100-ft. level. At the La Rose in a raise from the 135-ft. level from the shaft on the hill on No. 3 vein a new ore-shoot has been found, and driven on about 50 ft. It averages 4 or 5 in. of high-grade ore.

The Ontario Government has announced that railway facilities are to be given to the Porcupine mining district. A branch line of the Government road, the Temiskaming & Northern Ontario, will be run through Whitney and Tisdale townships. The first shipment of ore has been made from the Porcupine camp. It comprised six tons of high-grade ore and was from Timmins Bros., who are operating the Hollinger property. The Ontario Government just now is being subjected to severe criticism in the Legislature for its vacillating and unbusinesslike way of dealing with the Gillies Limit properties. The whole business is being overhauled by a committee of the Legislature. One particularly rank deal entailing a heavy loss to the province has been disclosed whereby the lot now owned by the Wyandoh company was sold to J. A. Young and M. J. O'Brien for $10,000, and a few weeks afterward changed hands at $330,000. Of course valuable discoveries had been made in the meantime, but the question naturally asked is why the Department of Mines, with the resources at its disposal did not make them before putting the property on the market.

D. D. Mann, of Mackenzie & Mann, vice-president of the Canadian Northern Railway, has made an important investment in British Columbia mining lands. In association with a number of American and Canadian capitalists he has secured control of 4368 acres along the Bear river in the northern part of the province, north of Prince Rupert and the main line of the Grand Trunk Pacific.

General Mining News.

ARIZONA.

GRAHAM COUNTY.

The New England & Clifton, formerly known as the Copper King, has a shaft down 8875 ft. on the old Copper King vein. During the year the New England has installed large compressors and machine-drills, and an aerial tramway about two miles in length. A concentrator and smelter are promised during the present year.——The Polaris mine is now being operated by a development company, which has a bond on the stock of the old Polaris company. The company owns about 40 claims, and has done considerable development which has exposed some important bodies of copper ore of good grade. This property is in the vicinity of the New England holdings.——The Weaver group has recently been taken hold of by the Shannon Copper Co., which is now pushing development. As the surface showing is good, this property should be heard from as a producer.

MOHAVE COUNTY.

(Special Correspondence).—The U. S. S. R. & M. Co. has nearly completed road building and equipment work, and mine development is under way. At Stockton Hill three large hoists have been installed on the Banner, Bryan, and Infallible properties, and sinking started. The Banner, which is generally regarded as the strongest vein in the Cerbat range, is already partly developed by an adit 1900 ft. long, every foot in ore, making the longest continuous ore-shoot in Mohave county, and one of the longest known. The ore is a lead-zinc, containing gold and silver.——Farther north, and in the same range, the Champion and Twins mines have been equipped with new hoists. The shafts are being enlarged and retimbered preparatory to additional sinking. In its Little Jimmy and Big Bethel mines, which adjoin the Golconda zinc mine, the company is drifting and cross-cutting. The shaft of the Big Bethel is in a porphyry dike, whose average width is 75 ft., and as the zinc of the district occurs in such dikes, a cross-cut to prospect it has been started from the 200-ft. level.——Ore has been found at 45 ft. in the new shaft on the C. O. D. property.——At Chloride draining of the Tennessee mine is progressing slowly. Though the surface waters, which were believed to be the main cause of the delay have been flumed, two pumps of 120-gal. capacity have been unable to lower the water in the shaft. A bad cave, at a depth of 115 ft., caused more trouble and resulted in shifting of timbers for 70 ft. above. A 150-gal. Dow pump is now being installed.—— The Dandy mine, in the Weaver district, about 25 miles northwest from Chloride, has been sold by William Hall to J. P. Hutchinson, of Chicago. Mr. Hutchinson, who is associated with Charles Schwab in the San Toy silver mines of Chihuahua, Mexico, sampled the property several months ago. The main vein, which is developed by a shaft 220 ft. deep, and by about 1000 ft. of drifts, contains an average of 3½ ft. of ore, assaying $20 per ton. A cross-cut from the 200-ft. level has exposed a second vein with 5 ft. of ore averaging $11. All the ore is free-milling and a high saving has been made in the small mill on the property by a straight amalgamation process.——The discovery made at the Tom Reed, at Oatman, last week at a depth of 250 ft. in shaft No. 2, is showing better with development. Driving has been started toward the main shaft 1500 ft. away, and the entire face of 5 ft. shows high-grade milling ore. The new mill has been accepted.——The Boundary Cone mine is installing a hoist and compressor. On an adjoining prospect Bob Rohe and Henry Lovin have exposed a vein from which samples taken across 4 ft. assay $8 per ton in free gold.——Work has been started on an extension of the Kingman power line to the Hercules mine, in the Silver Creek district, where a stamp-mill and cyanide plant are to be built.——H. N. Tracy, president of the power company, was in the district a few days ago and stated that another unit would be added to the plant at Kingman immediately.

Kingman, March 12.

PIMA COUNTY.

The Pioneer Smelting Co. will have its new customs smelter completed by next July. J. A. Highlands, the general manager, is in Denver, where the machinery is being built. Mr. Highlands recently contracted in New York for a traction engine and several freight cars for use in hauling the machinery to the smelter. The site for the smelter has been graded and everything now awaits the material.

YAVAPAI COUNTY.

The Consolidated Arizona Smelting Co. has announced that its plant will be open for receipt of ore not later than April 1.——The Great Republic has discovered a body of sulphide ore containing copper and gold in the cross-cut from the 300-ft. station of the main shaft. The ore, as far as exposed, shows an average thickness of 20 ft. Driving the cross-cut has been discontinued, but the shaft is being sunk to the 500-ft. level.——Active development is to be resumed at once on the properties of the Commercial Mining Co., in Copper Basin. A. J. Pickrell, who has charge, is sinking a new double-compartment shaft 4 by 8 ft. in the clear, perpendicular and well timbered. It will be sunk on a large quartz porphyry dike which cuts through the basin. The shaft will be sunk a short distance from the site of the Copper Basin reduction plant built twenty years ago and later dismantled. The sinking of the deep shaft has been under consideration since large bodies of ore were uncovered and partly exploited by Brown & Murphy. John Edwards and his associates three years ago furnished a large tonnage to the Humboldt smelter at a handsome profit. The Commercial Mining Co. is allied with the Phelps, Dodge & Co. interests.——Another company which will begin work at once is the Saratoga Gold Mining Co. Good mechanical equipment is on the ground with accommodations for many men. Under the direction of O. Place, a shaft about 250 ft. in depth was sunk. The showing was attractive and the property was rated as one of the best in that zone. The belt on which the six claims are situated is one of the oldest known in that district, and in the original exploration was known as the Moody & Place properties. The fissure was traced to the Crowned King mine, which, on being opened gave to the Bradshaw region its fame as a mining centre.

YUMA COUNTY.

Discoveries continue to be made in the Thumb Butte mining district. W. R. English a few days ago found a vein of gold-bearing quartz one and one-half miles from the original discovery, a sample assaying $3360.——E. O. Grady and his wife have located a claim three miles from the Thumb Butte shaft which shows free gold and which will, undoubtedly, assay well.——A dozen outfits are working in the hills around Thumb Butte, all finding promising rock. ——J. P. Moffat, in charge of the work at Thumb Butte, reports the work at the mine in good shape.

CALIFORNIA.

AMADOR COUNTY.

The South Eureka is being examined and sampled with a view to purchase. Levels at 1500 and 2700 ft. are known to be in ore.

KERN COUNTY.

A gusher was brought in March 4 on the Sec. 30, 31, and 32 tract of the Mays Oil Co. The well shot a stream of oil over 400 ft. from the rig. Before anything could be done thousands of barrels of oil had flowed down the canyon. It is estimated that the well was producing at the rate of 30,000 bbl. per day, when it bridged and ceased flowing. The drill was down to a depth of 2790 ft. when the gusher was brought in. This is the biggest producing well in this section. A sump with 8000-bbl. capacity was filled in less than an hour and the oil flowed for a distance of over two miles. It is of high gravity and tested 22.5. So great was the force that a large hole was soon worn through the pipe leading to the sump hole.——A protective association for the benefit of oil men in this field has been organized with W. L. Leland as chairman and E. M. Sheridan as secretary. The association members "agree to submit controversies in reference to claims to title rights or possessions, where

there are adverse claimants to government land to an executive committee of five men to be appointed by this association and to abide by the result of the majority decision of an arbitration committee of three men to be appointed by not less than four of said executive committee.

NEVADA COUNTY

Williams Brothers and Clyde Cole operating the Red Ledge mine near Washington have discovered quartz assaying $8 to $10 per ton while ground sluicing. ——The Canada Hill mine is being unwatered and is now open to a depth of 1000 feet.

SHASTA COUNTY

The Michigan copper mines, adjoining the famous Bully Hill has been bought by New York capitalists who have incorporated the Bully Cave Co. and placed E. J. McLaggan in charge as superintendent. The Michigan group was located by the pioneer, H. H. McClure. Next to the Bully Hill it is the best copper mine in this district. ——W. A. Winberg has taken a bond on the Conners group of mines on Salt creek. A force of a half dozen men has been put to work. ——The Uncle Sam mine has installed a compressor. About 20 men are employed. ——James Sallee has purchased for $5000 the Lyon group of claims adjoining the National property on Rich gulch and the old Murray claim on Flat creek. For the latter the price was $1500.

SIERRA COUNTY.

(Special Correspondence.) The Sierra Butte has resumed operations with a small force of men. The Hayes Brothers, of San Jose, are owners.—Los Angeles people are arranging for the immediate resumption of activities at the Mountain mine. The property embraces 688 acres and is equipped with a 40-stamp mill. Next to the Sierra Butte it is the largest gold property, from point of tonnage developed, in the county, the owners placing the reserve at from 130,000 to 160,000 tons, above the main tunnel, that will average $4 per ton. The owners state that working costs will not exceed $1.75 per ton, and that $40,000 will be expended in developments. President L. H. Carver will take personal charge of the work.—— The Snowden Hill has suspended operations until the equipment can be increased. The presence of deep snows has greatly interfered with operations during the winter. ——The cross-cut from the Sixteen-to-One vein to the Tightner vein in the Twenty-One mine has opened a shoot of rich ore. It ranges from 10 to 24 in. wide. The strike was made at a point 240 ft. below the Tightner lower adit. F. M. Phelps is manager.

Downieville, March 11.

SISKIYOU COUNTY.

Martin Schuler, superintendent for the Scott Bar Hydraulic Mining Co., is getting the mine and ditch into shape to start mining. —Nesbitt & Crawford are working a crew of men in their shaft at Scott Bar and have found good ore. ——Hicks Brothers are driving an adit on a very promising pocket stringer near Scott Bar.——The McAdams creek dredge is now running and is operating smoothly. About 20 men are employed.

COLORADO.

BOULDER COUNTY.

R. D. George, State Geologist, returned March 2 from Washington, D. C., where he has been in conference with the Director of the United States Geological Survey and arranged for co-operation between the State and Federal Geological Surveys. As a result Federal surveyors will be in southern Colorado fields surveying the topography of that part of the State early next summer. The State Survey will send several parties to work in and around Leadville and in Garfield county and to test the clays of the State.

CLEAR CREEK COUNTY.

(Special Correspondence.).—The Bell adit on Seaton mountain has been driven for 200 ft. Scattered ore is showing and the bore will be advanced 1300 ft. additional. ——Moonan & Co., leasing on the first level of the Shafter, are stoping on a 12-in. streak of gold-silver ore that mills $90 per ton. On the third level Warren & Co. are driving east, following an 18-in. streak of $22 ore. This drift will be extended to cut under the workings of the first named operations. ——Work is to be resumed in a few days on the Bertha mine, situated on Seaton mtn. The property has passed over to the Dollar Saving, Mining & Milling Co. Large funds are said to have been provided.

Idaho Springs, March 8.

EL PASO COUNTY.

J. S. Smith of the Colorado Tram Co. is constructing an aerial tram for the Standard plant of the United States R. & R. Co. at Colorado City. He recently finished building a similar tram for the Little Brothers company at Canon City.

GILPIN COUNTY

(Special Correspondence.) The Buell mill, at Black Hawk, is being overhauled and repaired preparatory to bringing the machinery into commission. The plant has been purchased by the U. P. R. M. & M. Co. The water from the Buell mine is to be fitted to the 700 ft. level. ——Large

Gregory Buell Mine, Gilpin County.

development is under way at the Iroquois property. During the last 18 months the shaft has been sunk for 200 ft., while 1000 ft. of driving has been performed.— Shipments have been started from the Senator mine, the last returns recorded being 1.15 oz. gold and 12.68 oz. silver per ton, with 7.20% in lead.——Lyng & Co., leasing on the Indiana, are sending out regular shipments of smelting and concentrating ore, the first class milling as high as $300 per ton, while the second class brings $40 per ton.——The Gilpin-Eureka Mining Co. has placed an order for three 50-kw. transformers which are to be used in the mill, while a 75-hp. compressor is to be purchased for the mine.

Central City, March 8.

GUNNISON COUNTY.

The Spar Copper mines at White Pine, consisting of 56 patented acres, have been sold to the United Mining & Holding Co., of Boston, Massachusetts. The consideration is said to have been $60,000. The mines were purchased and patented by Charles L. Tutt, now deceased. At the time of his death, Mr. Tutt in developing the Spar-Copper group had cut, in the deeper Parole tunnel, six long rich ore-shoots with 600 ft. of backs. The property has a creditable past production. Large ore reserves are now opened, and a fine equipment is at hand.

LAKE COUNTY.

The Belgian shaft will be sunk an additional depth of 250 ft. to uncover the large sulphide orebodies that have already been developed in the adjacent claims, such as the Tucson, Louisville, Adelaide, and Humboldt. The Belgian has never been troubled with water. The properties are well equipped with substantial buildings and good machinery for hoisting. The shaft is down 620 ft. Nearly all of the new work will be carried on through the Yak tunnel. ——A new plant of machinery has been erected on the Red Hook, one of the Iron mine properties.——Lead carbonate to the amount of 25 tons per day is being shipped from the Corona.——Andrew Hill has completed the erection of a plant of machinery on the Printer Boy mine. This was necessary on account of the heavy demands on the old plant since a vein of gold-bearing ore was found. The

Printer Boy is one of the historic mines of the district.——The Lovejoy, also on Printer Boy hill, is producing. This property is working under the management of H. J. Hersey. A gold-bearing ore is mined. The product is hauled to the Moyer switch at Oro.——The electric compressor at the Saguach tunnel in the Sugar Loaf district has been installed and is now ready for operation. It is a 75-hp. machine, situated at a station 250 ft. from the portal of the tunnel and connected with the lines of the Central Colorado Power Co. The tunnel itself is now in the hill 600 ft. The bore is 6½ by 7 ft. in the clear. This enterprise has been promoted and financed by the National Mining & Milling Company.

OURAY COUNTY.

Organization of the Wanahak Mining Co. was completed on February 26 with John T. Robert, president; E. C. L. Bartow, vice-president; Samuel McCurdy, treasurer; G. H. Barnhart, secretary and general manager; and B. H. Du Praw, mine superintendent. The capitalization is $400,000. The company owns and operates the Bright Diamond property north of Ouray. Since December 16 men have been at work in the development of the mine. Ore has been blocked to the extent of about 30,000 tons. A compressor plant and tramway will be installed as soon as weather conditions will warrant, and a concentrating plant with the initial capacity of 100 tons per day is being arranged for. All the ore from the mine will be treated locally at the pyritic smelter north of town. A new contact vein of ore, five feet thick, has been opened above the upper contact which has been worked for years. Five raises have been made into this upper ore zone, covering an area of more than 100 ft. square, and proving its continuity at least to that extent. The concentrating ore will average from $9 to $16 in value.——Ore is reported from the Atlas mine in the Sneffels district. Fred Carroll, the manager, says that in one of the drifts a shoot of the characteristic free gold Atlas ore has been uncovered. The shoot is of considerable extent. Work in the east drift along the vein to connect with the workings of the San Pedro is rapidly progressing with something like 1800 ft. intervening between the breast of the tunnel and the objective point. The ore along the vein is proving continuous and of excellent value.

SUMMIT COUNTY.

The American Zinc Extraction Co. is continuing its shipments of about 30 tons of ore per day from the Little Sallie Barber property, in the Breckenridge district, to Leadville. The mine was taken over by this company more than a year ago and has been operated successfully and continuously since. It is one of the best zinc producers in that portion of the State. Many improvements have been made on the mine itself under the new management.——Gibson hill is rapidly coming to the front. Wright & Lipp, at the Standard, have run into a 7-ft. streak of hard carbonate ore, containing gold to the amount of over $20, with some silver and lead.——Work at the Wellington mine and mill is going on with the usual regularity, and the cars on the track are being filled as fast as the teams can get the ore from the mill. Lack of trains from and to Denver temporarily disarranged shipments early this month.——The power house at the O'Reilley mine is completed and ready for the machinery.

TELLER COUNTY.

More men are employed at present at Cripple Creek than for many years. This is due to the large number of lessees at work and also to the mining of low-grade ore made possible by the United States R. & R. Co.'s recent cut in treatment charges. March is starting out with a heavy daily tonnage and the month is expected to close with a big gold output.——Fackerell and associates, operating on the Buena Vista property, on Bull hill, have made their initial shipment. The lessees are working principally between the sixth and eighth levels, where ore assaying from $30 to $40 per ton is opened to a width of three feet. The Buena Vista is owned by the Isabella company and Fackerell and associates are sub-leasing from H. C. Harris. The Western Investment Co., leasing on the Empire State of the Isabella company, is making a good monthly tonnage with the ore averaging $22 per ton.——Seaver & Henry, operating on the Peggy mine, on Gold hill, above the town of Anaconda, shipped a car of ore. The lessees are breaking ore assaying $20 per ton from a vein 2½ to 3 ft. wide.

MONTANA.

FERGUS COUNTY.

The Lentz Mining & Development Co. in the Twin Bridges district was recently sold at sheriff's sale to satisfy a judgment of $600. Messrs. Harvey and Oppenheimer, of Pittsburg, have appeared on the scene, and as two of the big stockholders in the company they propose to redeem the property and resume development. John A. Drake and others of New York own a controlling interest in the North Moccasin gold mine which was sold recently to satisfy a judgment given in favor of the Bank of Fergus county as trustee for the bondholders for $121,643. The North Moccasin is regarded as one of the best gold mines in the Kendall district and adjoins the Barnes-King.

SILVER BOW COUNTY.

The property of the British-Butte Mining Co., three miles west of the city, will not be mortgaged in order to raise funds to pay off its indebtedness. At a special meeting called for the purpose of ordering a mortgage on the property, it was announced that the directors had completed arrangements to settle the debts. Operations at the property stopped last fall, and it is said that the debt is in the vicinity of $260,000. The work of the company has been carried on with considerable difficulty in regard to reaching the gold-bearing ground. From 5 to 7 ft. of clay has to be removed by the dredge and then about 2 ft. of gold-bearing ground is reached, resting on false bedrock. The dredge cannot work beyond the rock. An engineer is now at work making a thorough examination of the property and among the officers there is a belief that operations will be resumed.

NEVADA.

LANDER COUNTY.

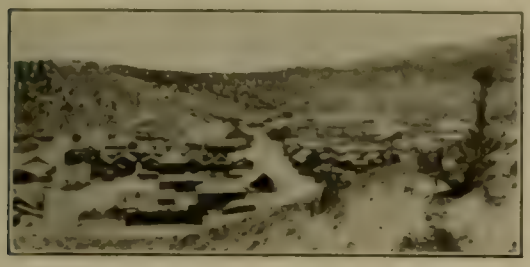
(Special Correspondence).—A French syndicate, represented locally by M. Labardee, of Golconda, has bonded several silver-lead and gold properties near Galena and is negotiating for sites for power and reduction plants. The Hider ranch, comprising 15 acres and several valuable springs, has been secured and negotiations are under way for the Wilson ranch of 160 acres. The latter will be used to deposit the tailing from the mill. The plans call for the erection of a cyanide mill and smelter. The ores will be sent from the various properties to the reduction plants by means of a tunnel 4500 ft. long. Work on this has already commenced.——The drift from the adit on the Mayer-Reber lease is said to have opened 25 ft. of ore running $8 per ton in gold. The strike was made at a depth of 100 ft. The lease is on Nevada-Omaha estate.——The Dalton-Haworth lease has opened 6 ft. of milling ore at a depth of 30 ft.——The Bannock Mining & Leasing Co. has cut a narrow seam of white quartz carrying iron pyrite. It is expected that ore lies near by.——The Moscow lease, on the Golden Bee, is making good progress and reports fair ore.——Owing to the storms and high water in the Reese river, transportation has been tied up and several properties have been forced to suspend until the shipment of ore can be resumed.

Battle Mountain, March 5.

WHITE PINE COUNTY.

(Special Correspondence).—The output of copper from the Steptoe Valley M. & S. Co. for February was 5,000,000 lb. of blister copper, which was about 1,000,000 lb. short of the December record, because of severe winter weather. As the mines of the Nevada Consolidated are now producing an average of nearly 8000 tons of ore per day, it is expected that the present month will be a record maker. The ore is all produced by steam shovels at Copper Flat.——The Ely Centennial is installing a drilling and lighting plant. The equipment was purchased last week in Salt Lake, and is now on the road to the mine. The property is being rapidly developed, and makes a splendid showing of high-grade copper ore.——A flow of water was struck in the Clipper shaft of the Ely Central last week which came in with

such force as to threaten the submerging of the pump. Lee Gleckler, the manager, immediately wired to Salt Lake for another and a larger pump which is now on the road. It will be installed and in operation in a few days when work will be resumed in the shaft. The same company has been having a considerable amount of trouble with its Eureka shaft, which is in soft wet ground and hard to hold. The superintendent has resigned and it is expected that Jack Gallagher, formerly of the Homestake mine in



East Ely, Nevada.

the Black Hills, will shortly arrive to accept the position. —E. W. Ralph, manager of the Boston Ely, is this week installing a machine drill which will be used in extending the cross-cut from the 1125-ft. level of the Emma shaft. The cross-cut has been in ore for the past 50 ft. and is expected to reach the limestone on the contact about the latter part of the month.

Ely, March 12.

TEXAS.

BREWSTER COUNTY.

(Special Correspondence).—The Black Kettle group of copper claims, near Sierra Blanca, are now owned by a syndicate of Baltimore men. Considerable development work has been done upon the property and preparations are being made to resume operations on a large scale.—— It is reported that the Hazel mine, owned by H. J. Clifford, will soon be reopened. This property, which is situated near Van Horn, was closed down in 1895 owing to the decline in the price of silver and has been idle ever since. It has a record as a producer of rich silver ore, the shipments that Mr. Clifford made to the smelter assaying as high as 5000 and 6000 oz. per ton. During the short time that the mine was operated it netted $251,000 above all expenses. The workings are only 575 ft. deep.——The station of Marathon, situated on the Southern Pacific, 25 miles east of Alpine, will soon become the shipping point for the Del Carmen Mining Co. which is developing a rich zinc mine on the Mexican side of the Rio Grande, just opposite Boquillas. An enormous quantity of ore is already on the dump awaiting the completion of an aerial tram across the river. The company has gone to heavy expense constructing a wagon-road from the river to Marathon, about 90 miles. It is stated that the ore-wagons will be pulled by traction engines. The United States Government recently established a sub-port at Boquillas in order to handle the importations of zinc ore from this mine.

Alpine, March 10.

UTAH.

JUAB COUNTY.

The Holden tunnel, which is being driven from the town of Eureka, a distance of 3000 ft., to the Centennial Eureka mine, will be completed within a couple of weeks. This tunnel will tap the main working shaft at a depth of 500 ft., and a station will be cut and a pump installed for raising the water from the 2200-ft. level. The tunnel was started last September, and has been opened rapidly. The pump was ordered in Switzerland and shipped six weeks ago. It will have a capacity of 1000 gal. per minute, and will reach the mine to be installed immediately upon the completion of the tunnel. With the draining of the lower levels of the mine a larger tonnage of ore will be extracted, and heavier shipments made to the United States smelter at Bingham Junction. The copper furnaces of this smelting plant have never been completed as the management claims the company would not be justified in doing so until larger contracts for smelting copper can be closed.

CANADA.

BRITISH COLUMBIA

(Special Correspondence).—The Granby Consolidated has acquired the Summit group in Phoenix district of about 20 claims, nearly 1000 acres. The property is known to contain large deposits of low grade copper-gold ore similar to that now being mined on the Granby property. A large contract for diamond-drill exploration has been awarded to Boyles Brothers.—The coal property of the Columbia Coal & Coke Co., near Princeton, is to be opened immediately. George L. Fraser, formerly with the International Coal & Coke Co., at Coleman, is in charge.—— The new Rand compressor and other heavy machinery recently purchased by the Hedley Gold Mining Co. has arrived and is being installed. —— The Le Roi No. 2, Ltd., shipped in January 2440 tons of ore worth $42,358. This included 58 tons of concentrate, worth $1515.——Zinc-lead miners near Nelson note with pleasure that the Dominion Government will expend about $50,000 in experimental work on zinc smelting.

The Van Roi Mining Co. went behind about $20,000 during the past year, due to a 1300-ft. adit being driven to open the deposits at depth and make a straight working level. Ore has been cut in this work and will shortly be developed. With steady operation it is expected the property can be made to pay nearly $175,000 per annum. The higher tariff on zinc concentrate imposed by the United States Government upset the plans of the company.—— Shipments from the Yankee Girl mine are temporarily suspended owing to the bad condition of the roads. Snowslides have caused minor damage to the plants of the Ymir, Queen, and Wilcox mines in Ymir and Sheep Creek districts.—— The Crows Nest Pass Coal Co. shipped an average of 4100 tons per day during January, constituting a record. The Hillcrest coal mines are making delivery of 25,000 tons to the Great Northern at Michel.——A five-drill air-compressor and an electric lighting plant is being installed at the Perreault mine in the Portland Canal district.——J. P. Morgan is stated to have bought an interest in the Swede group, Morseby island, Queen Charlotte Islands. The average ore assays 3½ to 4% copper. The property adjoins the Sullivan group which changed hands some days ago.——The Marble Bay mines, Texada island, look promising. On the 1000-ft. level a 250-ft. shoot of bornite is being worked that is 20 ft. wide and carries approximately 9% copper, $7 gold, and 25 oz. silver.——It is understood that the Dominion Government does not intend to renew or continue the existing bounty on iron and steel.

Rossland, March 12.

MEXICO.

SONORA.

(Special Correspondence).—The Southern Pacific railroad company has completed its branch line from Corral to its coal land concession on the west side of the Yaqui river. The first regular train ran March 6. The company obtained the concession of about 6500 acres some ten years ago and did considerable prospecting for two years. The work opened 38 veins of anthracite coal having an approximate dip of 30°. These vary from 1 to 12 ft. in thickness. Operations were suspended at the property and work on the branch line started. The road is 110 miles long following the course of the Yaqui river, the grading has been difficult as much of the road-bed had to be shot out of the solid rock with a number of tunnels along the line. The work has opened a large portion of the Yaqui valley and a number of prospects are now in position to become paying mines. The lead-silver ores have been the best developed to date, but there are a number of copper prospects with a few whose chief value is in the gold content. At one place near La Dura a dike has been opened that is 200 ft. wide and assays from $4 to $6 per ton gold, with portions that run as high as $15 to $20 per ton. But very little work has been done on this property on account of the high cost of freighting.

La Dura, March 5.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

FRED T. WILLIAMS is at Butte.

J. T. DURYEA was in San Francisco.

J. W. INGERSOL is at Tonopah, Nevada.

R. H. BURROWS is at Chihuahua, Mexico.

ALGERNON DEL MAR is at New York City.

ROBERT R. HEDLEY is at Victoria, British Columbia.

E. L. BECK is at Carrville, Trinity county, California.

R. A. F. PENROSE, JR. has gone to Europe for a month.

J. P. IDDINGS has been spending the winter in the Philippines.

C. E. KEYES, JR., of Oakland, has gone to Kennett, California.

F. M. FIELD is in New York on business pertaining to a mill in Idaho.

JACOB W. YOUNG has left Cobalt, Canada, and is now at Philadelphia.

LEO D. DOUGAN, of Plumas, South Dakota, is now at Wickes, Montana.

GEORGE B. JAQUES, JR., has gone to New York from Round Mountain, Nevada.

LYON SMITH is at Cortez, Nevada, for the Cortez Metals Recovery Company.

JULIUS BURGGROF is now with the Real del Monte company at Pachuca, Mexico.

T. H. OXNAM, JR., is with the Bonanza Gold M. & M. Co., Victorville, California.

F. WALLACE WHITE, of Chicago, Illinois, has moved to Springfield, Massachusetts.

E. D. NORTH has left Tonopah for Los Angeles, where his address is 1033 Ingraham street.

CHARLES F. SHELBY has gone to La Fundicon, Peru, for the Cerro de Pasco Mining Company.

H. A. BALL has been appointed resident manager for the Imperial Gold Mining Co., of Canada

J. P. MONTAGUE is superintendent of the new mill of the Tonopah Extension M. Co., at Tonopah.

S. H. BRADY has taken the management of the properties of the West End M. Co., Tonopah, Nevada.

E. G. WOODFORD, who is now living at Tacoma, Washington, is at the Palace hotel, San Francisco, this week.

R. E. SCHULTZ, of Pierce City, Idaho, has removed to New York City, where his address is No. 2 Rector street.

HENRY FRANCIS LEFÈVRE was in New Orleans from Costa Rica recently, but sailed immediately for Central America on mining business.

T. H. JENKS has returned from Gunnison county, Colorado, and is now temporarily at 403 Commerce Building, Kansas City, Missouri.

D. M. MUNRO has resigned as manager for the El Favor Mining Co., Hostotipaquillo, Mexico, and is returning to the United States and Canada.

GODFREY D. DOVETON and E. G. SPILSBURY, of the metallurgical staff of Spurr & Cox, Inc., are working on the cyanide mill of the Virginia & Mexico Co., at Hostotipaquillo, Mexico.

THE CORDILLERAN SECTION of the Geological Society of America will meet at the University of California March 25 and 26.

CHARLES F. AARON, general manager for the New York Leather Belting Co., died at his home in Plainfield, New Jersey, March 4.

ON FRIDAY, March 4, the Bunker Hill & Sullivan M. & C. Co. paid dividend No. 150 of $75,000. This makes the amount of dividends paid since January 1, 1910, $180,000, and the total to date $11,466,000.

Market Reports.

LOCAL METAL PRICES.

San Francisco, March 17.

Antimony	12—12¾c	Quicksilver (flask)	49½—50⅝
Electrolytic Copper	15¼—16½c	Spelter	7—7¼c
Pig Lead	4.95—5.00c	Tin	36—37½c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Mar. 10	13 37	4.51	5.72	50⅞
" 11	13.31	4.50	5.70	51¼
" 12	13.31	4.50	5.69	51⅜
" 13	Sunday.	No market.		
" 14	13..5	4.49	5.66	51¼
" 15	13.25	4.48	5 64	51⅜
" 16	13.25	4.48	5.64	51½

ANGLO-AMERICAN SHARES.

Cabled from London.

	Mar. 10. £ s. d.	Mar. 17. £ s. d.
Camp Bird	1 7 3	1 7 6
El Oro	1 8 9	1 8 3
Esperanza	2 17 6	2 17 6
Dolores	1 8 9	1 8 9
Oroville Dredging	0 10 0	0 10 0
Mexico Mines	8 6 3	8 10 0
Tomboy	0 17 6	0 18 1½

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, March 17.		Closing prices, March 17.
Adventure	8	Mohawk	61
Allouez	50	North Butte	41¼
Atlantic	9¾	Old Dominion	41½
Calumet & Arizona	72	Osceola	100
Calumet & Hecla	615	Parrot	15½
Centennial	21¼	Santa Fe	2
Copper Range	75½	Shannon	14⅝
Daly West	8½	Superior & Pittsburg	13¼
Franklin	19⅛	Tamarack	68
Granby	85⅛	Trinity	8¼
Greene-Cananea, ctf	10¾	Utah Con	31¾
Isle Royale	20	Victoria	4
La Salle	15¼	Winona	10½
Mass Copper	61¼	Wolverine	135

(By courtesy of J. C. Wilson, Mills Building.)

SOUTHERN NEVADA STOCKS.

San Francisco, March 17.

Atlanta	$ 16	Mayflower	$ 3
Belmont	2 32	Midway	40
Booth	14	Montana Tonopah	95
Columbia Mtn	8	Nevada Hills	50
Combination Fraction	60	Pittsburg Silver Peak	78
Daisy	8	Rawhide Coalition	19
Fairview Eagle	12	Rawhide Queen	18
Florence	2.40	Round Mountain	54
Goldfield Con	8.25	Sandstorm	3
Gold Kewenas	8	Silver Pick	9
Great Bend	3	St. Ives	18
Jim Butler	14	Tonopah Extension	80
Jumbo Extension	36	Tonopah of Nevada	7.37
MacNamara	28	West End	40

(By courtesy of the San Francisco Stock & Exchange Board.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, March 17.		Closing prices, March 17.
Amalgamated Copper	77¼	Miami Copper	23⅜
A. S. & R. Co	84⅞	Mines Co. of America	½
Boston Copper	19⅛	Montgomery-Shoshone	⅞
B. C. Copper Co	6⅞	Nevada Con	23¼
Butte Coalition	25⅛	Nevada Utah	1¼
Chino	14⅛	Nipissing	10¼
Davis-Daly	3¼	Ohio Copper	4⅜
Dolores	6	Ray Central	3⅜
El Rayo	2¾	Ray Con	21⅞
Ely Central	1¼	South Utah	2¾
First National	4½	Superior & Pittsburg	13⅞
Giroux	9⅛	Tenn. Copper	32½
Guanajuato Con	1⅜	Trinity	8½
Inspiration	8½	Tuolumne Copper	3¾
Kerr Lake	8⅝	United Copper	7½
La Rose	4½	Utah Copper	49½
Mason Valley	17⅛	Yukon Gold	4½

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EDITORIAL.

FIRES in the National Forests were less destructive last year than in 1908, despite the number being 410 greater. Almost 80 per cent of the fires were extinguished before five acres had been damaged. In reducing the annual fire-loss the Forest Service is of great and much appreciated benefit.

APPARENTLY the interests of the United States in Mexico are in competent hands. Mr. Henry Lane Wilson, the new ambassador, who was presented to President Diaz on March 6, made a speech that was admirable. With many expressions of goodwill, he carefully avoided reference to matters which have been the objects of recent diplomatic negotiation. Mr. Wilson knows how to express himself graciously, without being either blunt or oracular.

THE MINING MAGAZINE for March contains the usual departments, with interesting editorials. Among contributed articles of special note are: 'Steel Making in China', by Thomas T. Read; 'Dredging at Neviansk', by Chester Wells Purington; 'Sintering of Copper Ores', by Walter G. Perkins; 'The Great Mines of the Rand', by T. A. Rickard. Mr. Purington's account of work on the Siberian placers will be read with particular interest on the Pacific Coast where dredging is such a large and profitable industry.

DOUGLAS is fairly seething. As one local writer puts it "the smelting pot of the world, literally boiled" when it was learned that the Los Angeles Chamber of Commerce planned to spend no more than a beggarly hour and a quarter there, while touring Arizona. This is no case for interference by an innocent bystander, but we do venture to assert that Douglas can entertain any body of distinguished guests much longer than seventy-five minutes, and still keep them interested.

REDUCTION of the iron in ferruginous copper slags in the electric furnace is the subject of an interesting communication by Mr. Lewis T. Wright to the Transactions of the American Institute of Mining Engineers. He points out that the metallic iron so produced carries with it practically all the copper, gold, and silver, and more than 50 per cent of the sulphur of the original slag. The current used varied from 70 to 80 amperes, and the time of fusion was approximately an hour and a quarter. The copper content of the slags was reduced in one case from 0.55 to 0.1 per cent, and in others from an average of about 0.3 to 0.05. The concentration was approximately 25 per cent.

OURAY, according to *L'Illustration*, was a prospector of French descent who in 1906 discovered rich gold veins in southwestern Colorado and so gave name to the beautiful little mountain place which is cited as an example of the promptness with which cities are built by 'get rich quick' American methods of 'booming'. The Indian chief Ouray, who really gave name to the mountain, county, and town, has been so long dead that he probably will not mind this attempt to supplant him, but to deny existence to the city itself prior to 1906 would require rewriting much eventful history. We fear that our Paris contemporary itself has fallen into the hands of a 'get rich quick' space writer.

CONSERVATIVE methods mark the operation of the Tennessee Copper Company. During 1909 it made no effort to augment its production. This was 14,058,954 pounds, a trifle below the point reached the previous year. The cost was 10.57 cents per pound, in which are included depreciation, interest, and retirement of bonds to the extent of $50,000. The depreciation account now stands at $187,000, in addition to which there is a general reserve fund of $75,000, and $7276 retained as liability insurance. The price received for copper during 1909 averaged a little less than 13 cents, and a dividend disbursement of 5 per cent on the capital stock of $5,000,000 has been made.

BRAZIL has been making extensive investigations of its iron resources. These are said to be so great that the State of Minas Geraes alone can supply the world with iron and steel for centuries. Discounting the hyperbole, and admitting the impossibility of being certain of the quality throughout such enormous masses of ore as there exist, or of foreseeing the world's demands through such periods of time, the fact remains that Brazil is blessed with reserves that bid fair ultimately to shift the centre of iron-production across the equator. Gen. F. M. de Sousa Aguiar has recently arrived in this country as special commissioner from Brazil to study the steel industry and to arrange for the exportation of iron ores to North America.

PERMANENT injunction was granted last year against the Arizona Copper Company, Limited, and its neighbors, restraining them from discharging tailing into a stream from which it would overflow upon adjacent agricultural lands. The case was notable because of its accentuation of the rights of the individual against the privileges of a corporation on which a considerable community depended for a livelihood. The outcome of the injunction has been the presentation of sufficient evidence to show that the objectionable tailing can be impounded, so that the judge has ordered a suspension of the injunction pending decision on an appeal which has been taken to the Supreme Court of the United States. A special officer of the court is appointed to inspect the works for impounding and restraining tailing, and a bond for $20,000 has been executed as guarantee against damages which may be sustained by Mr. William A. Gillespie, in whose favor the earlier decree was entered.

TAXES on mining property in Mexico are due in March, July, and November of each year. It may be of interest to those who, for any cause, become delinquent to know that immediate forfeiture of title does not ensue. The tax may be paid the following month with the addition of a penalty of 50 per cent, and if delinquent into the second month, the property may be redeemed by paying double the amount of the original tax. If, however, the tax is not paid within 60 days the pertenencias become forfeit and hence subject to re-location.

LESSENED activity in mining circles, so far as the initiation of new business goes, has been a feature of the last six weeks, both in the West and the East. The demand for lead and zinc has been good, but the copper market has not rallied as was expected two months ago. The addition to the surplus stocks of that metal, as shown by the Copper Producers' Association, had a chilling effect, and discouraged preparations for the opening of mines that are awaiting a price of 15 cents. A remarkable circumstance is the steady growth of the steel business, without a corresponding increase in the demand for copper. The indications are, however, that the world is probably consuming the output on the present basis of production. The March and April output of the copper refineries will apparently be reduced somewhat, but this cannot have a beneficial influence upon the mining centres, except as it insures the properties now active against necessity for curtailment. It may be assumed that the statistics of the steel trade and railroad returns constitute a reliable barometer. The outlook is for good industrial weather, which must improve the position of all metal-producers. The gross earnings of the leading railroads of the country for February were 13 per cent in excess of those for the corresponding month of 1909, which period had shown a similar improvement over February 1908. This gain is the more interesting when it is remembered that February of this year was characterized by unusual obstructions to traffic by storms in the West and Northwest, and that the cotton movement showed no improvement. The growth of traffic was due to the expansion of trade in general, which inevitably leads to an increased demand for metallic products.

Proposed Seismological Studies.

Earthquake studies under the direction of the Smithsonian Institution are now proposed. Mr. Bois Penrose has introduced an amendment to the sundry civil bill, appropriating $20,000 for beginning the work. The matter has been referred to the Committee on Geological Survey in the Senate and to the Library Committee in the House. The suggestion is excellent and it would seem that even in these days of 'economy' so small a sum might well be spared to so important an object. The United States has lagged behind in seismologic studies despite their great scientific and practical interest. It has been abundantly shown that no part of the country is free from earth-tremors, and destructive shocks have occurred at Boston, Charleston, and in the Mississippi Valley, as well as on the Pacific Coast. Careful

studies of the duration and intensity of the minor as well as major shocks are needed. Periodic measurements of the relative displacements of fixed points on the surface would probably enable the growing stresses of the earth to be measured as accurately as is the movement of a glacier. It is even probable that something may be done in forecasting earthquakes, and it is certain that field-studies will permit the mapping of the territories likely to be most damaged by shocks. The Japanese have done much by intelligent study and they probably stand at the head as students of seismology. They are closely followed, if not equalled by the Italians, while the Germans at Strassburg are attacking these problems with the method which has done so much to secure their position in science and industry. Following the earthquake at Valparaiso, Chile established one of the most complete stations yet built and secured as Director, Count Montessus De Ballore, one of the foremost European investigators. The interest of the United States is at least equal to that of any country, and it can not well be expected that others will solve our local problems. A small sum regularly spent on the work would be adequate, and the Smithsonian Institution is admirably adapted to administer such a trust economically.

Two Institute Meetings.

During the first week of March two great societies representing mining technology in North America held their meetings. The American Institute of Mining Engineers assembled on March 1- at Pittsburg, and the Canadian Mining Institute met at Toronto on March 2. Both meetings were characterized by an unusually large number of important papers. As was eminently fitting, deference was paid at Pittsburg to the coal and iron industries that make the greatness of the metropolis of western Pennsylvania. Messrs. F. Z. Schillenberg and Edward McGrew discussed the 'Systematic Exploitation of the Pittsburg Coal Seam', which means so much for the future prosperity of the district. The wasteful methods of earlier days have been giving way to better practice, reducing the loss in gob and unrecovered pillars. Mr. William H. Blauvelt described 'A Commercial Fuel-Briquetting Plant', and naturally the testing plant of the Technologic Branch of the United States Geological Survey received attention, both by description in a paper presented by Mr. Joseph A. Holmes, and by a visit to the laboratory where demonstrations were made in the presence of the members. The School of Mines at the Pittsburg University, and the Technologic Schools of the Carnegie Institution also claimed suitable notice. Aside from these papers the meeting was notable for three contributions that mark forward steps in the development of technical operations. One of these was the announcement of Mr. E. Gybbon Spilsbury of a new system of air-agitation of slime in the cyanide treatment of gold and silver ores. The distinguishing feature of the innovation consists in the introduction of the air into the pulp so distributed that its passage through the slime in bubbles of appreciable size is prevented. The object is, so to speak, to saturate the pulp with air, instead of merely to agitate it with bubbles. The wastefulness of air in agitation increases with great rapidity as the diameter of the bubbles become greater. The ratio between the volume and the surface of the globule when the diameter is unity is exactly as 1 to 6, whereas with a diameter of one thirty-second it is nearly 1 to 153. Mr. Spilsbury describes a diaphragm which he calls a silica-sponge, impervious to solids, but permitting the free passage of air under pressure as low as two pounds per square inch. The pulp is aerated by treatment in shallow tanks, the bottoms fitted with the silica-sponge, an air-pressure of not more than six pounds per square inch being used. The time of treatment by this method is claimed to be less than six hours, while the consumption of cyanide is reduced.

Other noteworthy contributions to technologic advance were the papers by Mr. Robert H. Richards, past president of the Institute, on the 'Development of Hindered Settling Apparatus', and by Mr. Harrison E. Ashley on 'The Chemical Control of Slimes'. The investigation of slime is one of the greatest problems confronting the metallurgist today. It is growing constantly more important as the exhaustion of high-grade ores compels resort to leaner deposits, in the treatment of which, whether by cyanidation in the case of gold and silver ores, or by concentration in the case of copper and other metals, the loss in slime constitutes an enormous proportion of the whole. It is doubtful if any of the great concentrating works today save 75 per cent of the total metallic content of the ore, and many are vainly striving to keep the public from discovering how far below 60 per cent their extraction falls. Whatever contributes to an understanding of the physical conditions existing in slime, and to reliable methods for overcoming the resistance offered to the release by flotation or by settling of the metallic minerals, will add distinctly to the resources of the world.

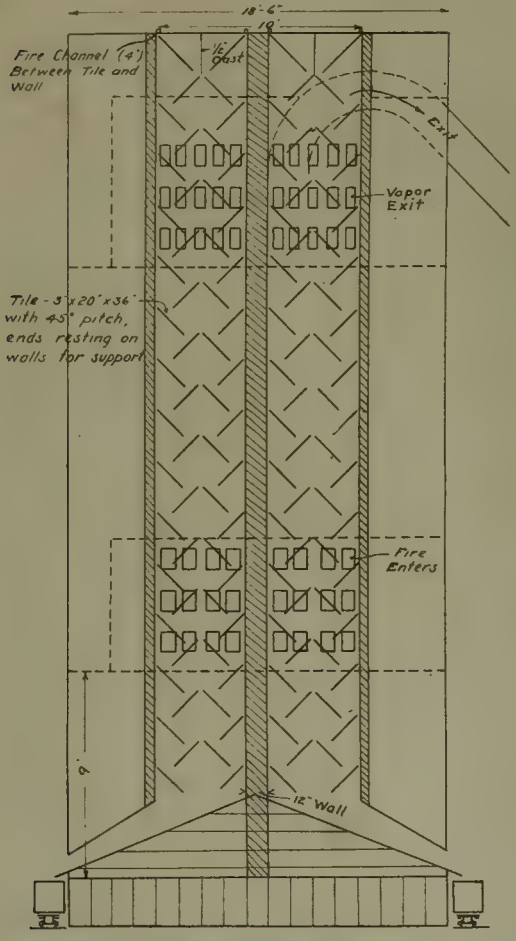
The address of welcome was made by Mr. John A. Brashear, to which a felicitous reply was made by the president, Mr. D. W. Brunton. Dr. R. W. Raymond performed the sad duty of giving obituary notices of two of the leading spirits in American technical circles, Charles B. Dudley and William Metcalf, both distinguished for their splendid contributions to knowledge of the character and treatment of steels.

We have given extended notice of the Canadian meeting elsewhere in this issue, so that further comment on the excellent work of the Canadian engineers need not here be made. At Toronto emphasis was laid upon electro-metallurgy, which is appropriate in view of the abundant water-power close to the centres of population in the Dominion. The report of the Council showed the Institute to be in excellent condition as regards membership and finances. The election of Mr. F. D. Adams to the presidency, following Mr. Willett G. Miller, is a high compliment to the geologists, and indicates a pleasant appreciation of the close relations of mining to scientific investigations. America is fortunate in having two such societies as the American and Canadian mining institutes.

Guadalupe Quicksilver Works.

Written for the Mining and Scientific Press
By Courtenay De Kalb.

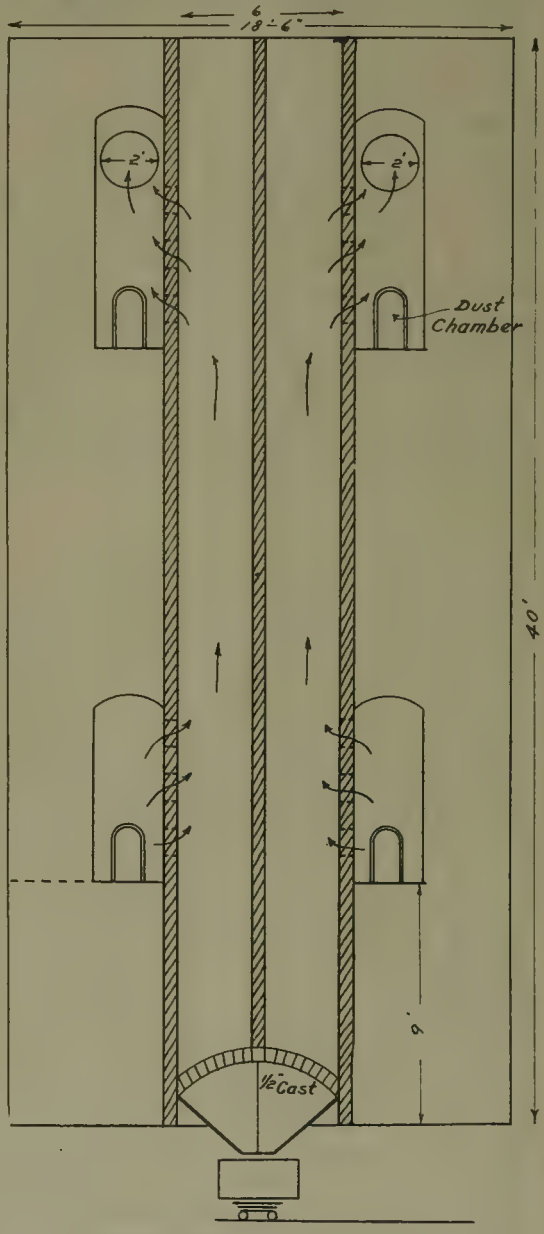
Cinnabar was first mined in Santa Clara county, California, in 1824, by Antonio Sunol and Luis Chaboya. The property was originally called the Chaboya, but was later christened the New Almaden, appropriately perpetuating in America the fame of the great quicksilver mine of Spain. A short distance from the New Almaden property is the Guadalupe, which also has had a record of large production from the early days of mining in the State. Extensive operations were begun here in 1855 by the Santa Clara Mining Association of Baltimore, and



Litchfield Furnace, Great Western Quicksilver Mine.—Longitudinal Section.

continued until 1875, when the property was sold to the Guadalupe Mining Company of California, which conducted the work with falling fortunes until 1886. It then remained idle until 1890, when the Century Mining Co. was organized by H. C. Davey, later taking the name of the New Guadalupe Mining Co., and a new period of productivity was inaugurated that has lasted to the present. In its palmy days the mine yielded as much as 1900 flasks of quicksilver per month. This was when high-grade ore was available. The output is now 200 flasks, of 75 lb. each, per month, the recovery averaging 2% of the total ore treated.

The original main shaft was sunk in the valley close to the channel of Capitancillos creek, and the workings reached a depth of about 1100 ft. Much difficulty was experienced with water in the mine, and the decreasing tenor of the ore rendered econ-



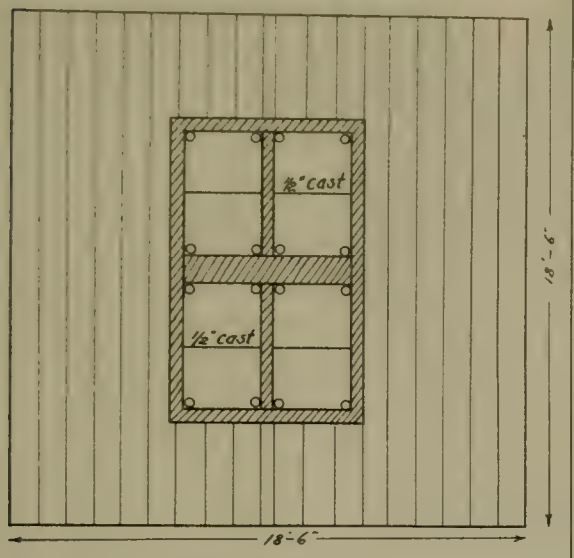
Litchfield Furnace.—Transverse Section.

omical mining impossible. The hills on both sides of the creek were also extensively prospected and considerable ore found. The deposit now worked is at a depth of about 700 ft. under the hills on the north side of the creek, and is reached by an adit over 2000 ft. long. The cinnabar occurs in serpentine in proximity to intrusive masses of rhyolite. The exact content of the ore is unknown, but the extraction is quite complete. Of the total recovery as much as 63% is obtained as metal direct from the condensers, the remainder being extracted from the

soot. This result is probably due in large part to the fact that oil is now used for fuel, and the combustion being quite perfect the amount of soot produced is small. The soot carries mercury with it, and the reduction of the quantity of soot necessarily lessens the percentage of the metal which fails to condense and drain from the condensers.

The ore on coming to the works is crushed in a Hendy rock-breaker, 8 by 12 in., the feeder consisting of a short trommel, thus avoiding the re-crushing of material already fine enough for the furnaces. An elevator takes the product to a screen with 1½-in holes, dividing it into coarse and fine grades which are distilled in separate furnaces. The average size of the coarse ore treated is 3 inches.

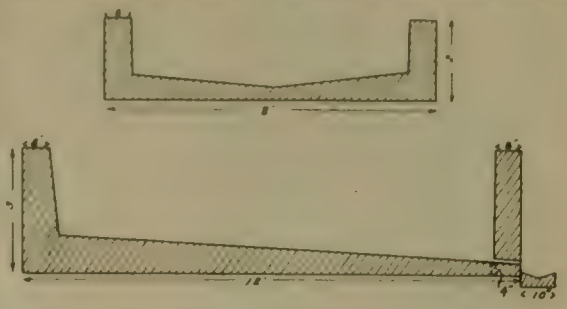
The distillation takes place in modified Litchfield furnaces. The accompanying drawing shows a typical Litchfield furnace, such as is used at the Great



Plan of Litchfield Furnace.

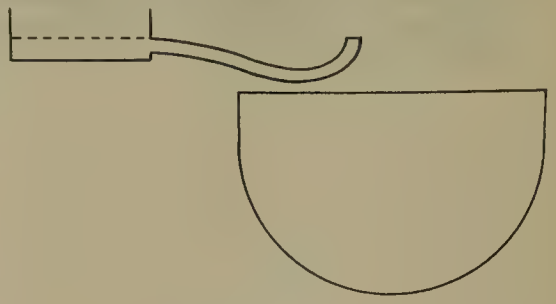
Western Quicksilver Co.'s mines in Lake county, California. It consists of tall distillation chambers with inclined tiles placed so as to cause the ore to slide downward in a zig-zag from the feed-hopper at the top to the base where it is drawn off into cars. The double distillation chambers are paralleled with chambers in which fire is maintained, the heated gases passing through ports from these. The Litchfield furnace used at the Guadalupe mine differs in important details. It has eight distillation-chambers or 'channels', 40 ft. high, and 3 by 6 ft. each, in horizontal section, the block being 30 by 18 ft. in plan. The upper part of each channel contains a constriction called a 'throat' which the ore completely fills as it passes through. Above the throat is a dryer, consisting of a prolongation upward of the channel, fitted with additional inclined tiles. This device is an improvement patented by H. C. Davey. An auxiliary fire is used to effect the drying in this upper shelf-furnace. The condensers at the Guadalupe works are brick chambers, two in number, placed tandem. They are of red brick, and are 12 by 40 ft. in plan and 20 ft. high. From these the fume passes through a series of brick flues, 2 by 3 ft., expanding into smaller condensing chambers at frequent intervals. The total travel of the fume from the retort furnaces to the stack is 8000 lineal feet, and draft is induced by a 6-ft. fan placed at the entrance to the stack. The fan is driven by a 2 hp. motor.

There are two blocks of furnaces, the fine-ore furnace having a capacity of 30 tons per diem, while the coarse-ore block treats 12 tons. Calcined ore is drawn off every hour. The oil burned amounts to



Soot Table.

1 bbl. to each 10 tons of ore distilled. The soot was formerly distilled in iron retorts, but is now treated on concrete 'soot-tables' 12 ft. long by 8 ft. wide, made in the form of a broad shallow V-shaped trough, inclined from the head toward the discharge end. The soot is placed on the sloping floor of this table, where it is hoed with ordinary garden hoes at frequent intervals. The metal collects into globules of sufficient size to run out of the soot, which is left undisturbed a few hours after each hoeing. In this way the extraction is so perfect that but little quicksilver remains, and the soot is then returned to the ore fed into the top of the distilling furnaces. Cement-lined brick channels lead from all the condensers and from the soot-tables to cast-iron quick-



Mercury Siphon and Kettle.

silver wells of 3-ton capacity, which are kept locked. Above the wells are boxes which receive the mercury before it passes into this final receptacle. These boxes are partly filled with water, and a 'goose-neck' pipe leads from the bottom of each, overhanging the well. Thus the quicksilver is freed from dirt and grease, and automatically discharges as it accumulates.

Labor in the works consists of three men to each shift of eight hours. Sixty men in all are employed, above and below ground. Extensive improvements are under way, including the installation of a 125-hp. Pelton wheel, to take water under a head of 734 ft. This will drive air-compressors for drilling in the mine, in addition to operating the surface works. At the present time 75 hp. is consumed, this being developed by a water-wheel.

The Northern Cascades.

Written for the MINING AND SCIENTIFIC PRESS
By HORACE F. EVANS.

Although some progress was made in the international boundary region in the seventies and eighties, it was not until recent years that mining on a permanent and successful basis began, and the industry has of late been stimulated by the introduction of capital, following the further extension of the continental railway system. It was not until 1901 that George Otis Smith and staff made a geological reconnaissance across the Cascade range near the forty-ninth parallel, and in 1902, the data for the Osoyoos quadrangle were obtained. This work was in charge of R. A. Goode, geographer. The topographic mapping was done under the direction of L. C. Fletcher, and the triangulation was in charge of C. F. Urquhart and J. G. Hefty.

This quadrangle is a 30-minute strip from Lat.

Part of the Osoyoos Quadrangle.

48.30 to 49.30′ and from Long. 119 to 119.30. The elevations are from 913 to 6065 ft. above sea-level. The chief features of the quadrangle are the Osoyoos basin, Osoyoos lake, Okanogan valley, and the junction of the Okanogan and Similkameen rivers.

The Osoyoos basin possesses a climate that differs greatly from the country surrounding it. The climate is semi-arid. Sagebrush and cactus comprise much of the characteristic vegetation. Trees are comparatively scarce, and bunch-grass is not so plentiful as in the adjacent mountains. The annual precipitation in the immediate vicinity of Osoyoos lake is small, and the summers are dry and hot. The thermometer in summer has been known to register 114° in the shade and sometimes a little more. The temperature in winter is milder in the Osoyoos basin than in the surrounding country, and even in exceptionally cold winters the temperature in the vicinity of Osoyoos lake is always higher than elsewhere in the valley. Snow remains only a few days on the ground, and the winter season is short.

A noteworthy exposure of the rocks of the Similkameen and Okanogan valleys within the Osoyoos basin occurs about a mile and a half northwest of the town of Oroville, Washington, and a good view of the rock-sections may be obtained from the Great Northern trestle-bridge across the Similkameen. The Carboniferous rocks, comprising slates, some of them schistose, with sandstone, limestone, and with conglomerates and interbedded volcanics, are seen to much advantage from this point and at the sides and in the bed of the Similkameen river. The Carboniferous rocks with the granites are overlain by sandstone, the structure and lithology of which suggest a later age. Near the trestle already mentioned a gray sandstone occurs, holding plant remains and pieces of coal, suggesting Eocene age, but details are wanting as to the sandstone and some other overlying rocks, including some coarse conglomerates that may be a remnant of the basal Cretaceous, though the official geologists have provisionally assigned these conglomerates to the Tertiary. Overlying most of the later sediments near Oroville are andesites, some of which are hornblendic in character. The andesites are extrusive as well as intrusive, and in the case of three exposures near Osoyoos lake it has been determined that the relation of the sedimentary and volcanic rocks is one of unconformity.

In the hills lying between the Similkameen river and Osoyoos lake in the Okanogan valley, the sections show a black silicious slate lying in a trough of contortion, on beds of gneissic mica slate, where the latter occupies the higher ground in the centre of the hills. On the western shores of Osoyoos lake thick beds of coarse conglomerate occur, having a dip of 70° in a direction E. 25° S. About 1200 ft. to the west these beds have been strongly folded and lie at nearly as high an inclination to the west. Near the old crossing at the international boundary a thin band of hard feldspathic porphyry is found to be intruded in the beds, and close to this, in 1861, H. Bauerman, then geologist to the British section of the International Boundary Commission, while making examinations in the neighborhood, found a bed of sandstone close to a small sheet of water, carrying green and blue carbonates of copper. The carbonates covered a considerable portion of the sandstone surface. No lode could be found, but it was ascertained that the carbonates were produced by the decomposition of quantities of chalcopyrite in grains scattered through not only the sandstone but in other rocks in the neighborhood.

In later years Noel B. Kelsey, a prospector who had acquired some experinece in California and Nevada, began the exploration of the country thus pioneered by Mr. Bauerman. Kelsey's investigations resulted in interesting Michigan capitalists who organized the Detroit-Oroville Exploration Co. some months ago. This corporation has begun the systematic development of the copper area immediately west of Osoyoos lake and south of the international boundary, and proceedings were commenced some time ago to secure a patent to these holdings which include much of the ground examined by Mr. Bauerman nearly 50 years ago.

Not far from Oroville, and close to the junction of the Okanogan and Similkameen rivers, green and black slaty rocks are continuously exposed. They are contorted similarly to those mentioned as occur-

ing on the hills, but no gneissic rocks seem to come to the surface. Much of the granite of the Similka meen country is hard and finely crystallized. It contains mica and hornblende with white and red feldspar. Syenite occupies a considerable area and both are penetrated by numerous feldspar porphyry dikes.

The property of the Detroit-Oroville Exploration Co. comprises a part of Sec. 5, T. 40, R. 27 E., and consists of 15 claims, on all of which copper ores occur. During the summer of 1907 I made an examination of the conditions under which copper ores exist on the property of the Exploration company.

The Osoyoos basin seems to have been a sedimentary area from Paleozoic time, and the Paleozoic column was evidently capped by Permian rocks. I found the intermixture of copper carbonates, oxides, and sulphides to be a marked characteristic all over the area and also in adjacent properties. The shape and manner of occurrence of the ores are somewhat irregular. Within the mineralized zones is always a clue to the ore, though this may at times be faint. The most important occurrences appear to be in the limestones and sandstones, though details are yet wanting. The area is an old sedimentary one from Paleozoic times, which has been overlain by later sediments and subsequently intruded by andesites. The andesitic covering at one time evidently occupied a much greater extent of territory than at present. The sedimentary beds were uplifted and fractured, and possibly fissured, in late Tertiary age. Porphyritic and quartzose material fills seams, fractures, and other cavities. These are often found containing chalcopyrite of a rich yellow color, with associated carbonates and oxides.

Sullivan Drill at the Detroit-Oroville Exploration Co.'s Property.

The granite seen across the lake does not appear to have forced tongues into the sedimentary beds on the west side, and from this it is inferred that the granite is not intrusive on that side of the lake. The evidences of contemporaneous deposition in the limestones do not seem to conflict with the theory that the copper ores have been recruited or reinforced by the agencies accompanying the andesitic invasion, for the copper ores evidently possess more than two distinct sources. The later rocks, such as the conglomerates, hold copper-bearing pebbles from the black slates which are known to be of Carboniferous age, while there is nothing that definitely determines the character of the surface-deposits of copper. No data are yet available to determine approximately the extent of the upper portion of the copper-bearing sediments that was removed by denudation, but a large volume of the andesite-capping evidently has been removed by erosion.

In the spring of 1908 the Exploration company, acting on a recommendation in my report, contracted for 600 ft. of boring to determine the relations of the copper-bearing sediments in six different parts of the field. For this purpose a diamond core-drill of the Sullivan 'Beauty' type was brought to the ground and six different holes were put down. The lowest hole was on the flat ground near the shore of the lake, and a depth of 110 ft. was obtained. Three holes were put down vertically, and three at various angles. In every instance copper ores were found to the limit of depth bored. In the arenaceous rock the occurrence was the same at the lowest depth reached as at the surface, namely, fine grains of chalcopyrite disseminated through the rock. The carbonates disappeared at a depth varying from a few feet below the surface to 40 ft., and were rarely seen beyond that distance. The bottom of the zone of oxidation was not reached. In a semi-arid country oxidation may extend to 300 ft. or more.

The richest cores were from a limestone, somewhat silicified and altered. In a zone of dark slaty rock the cores showed small quantities of copper glance. In a number of instances calcite veins appear to have determined the precipitation of the copper. The peripheral zone, lying between the sedimentary rocks and the andesite is accentuated by an abundance of quartzose material, though no detailed investigation of the conditions existing in the direct contact between the andesites and the Carboniferous sediments has been made. The areal extent of the copper ores is not limited to the boundaries of the corporation's property. On adjacent properties and even on the east side of the lake, copper ores occur in slaty rocks and in quartzose sediments, but investigations there have been almost exclusively superficial. Some assays of hand samples of copper ores taken from the Exploration company's property have been made, and these have varied from 1.75 to 30.13%, with gold at times from a trace upward. The bore-holes will be deepened also by a diamond core-drill for the purpose of determining the conditions at a greater depth.

Relation Between Mineral and Chemical Industries.—II.

By George T. Holloway.

*My experience with the rare minerals found in the older rocks induces me particularly to refer to the vast field which they furnish for research for those who regard the rare metals from the commercial point of view, for those who wish to improve our present defective methods of both qualitative and quantitative analysis, and for those who are searching for new elements. I would especially draw attention to the 'black tin' concentrate obtained from the tailing and slime run to waste from the 'dressing floors' of the Cornish tin mines. This waste passes down what is known as the Red river from Camborne to the sea at Gwithian, and is collected and re-treated over a length of about eight miles, by 16 independent firms or individuals known as 'streamers', each of whom extracts as much as possible from what passes by his holding. Finally, on Gwithian beach, where the waste passes into the sea, the waves perform the last dressing operation, and, at low tide, little patches of the heavy tin ore which have thus been collected, are scraped up by the last of the tin dressers, to complete the tally. It is an interesting proof of the necessity for efficient dressing appliances for minerals, to note that the Red river produce amounts to over 800 tons annually of 'black tin'—which, by the way, is red—containing an average of about 50% of metal, notwithstanding that the ore, before the waste is rejected by the mines, has passed through more dressing processes than any other mineral with which I am acquainted.

My excuse for this digression, is that the black tin from the Red river contains not only the tin, but there have become concentrated in it minerals of tungsten (representing, according to my analyses, an annual loss of over 100 tons of wolfram), uranium, vanadium, tantalum, niobium, molybdenum, and other known heavy rare metals as well as strong indications of rare elements, which have somewhat similar properties, but which have not yet been isolated. Those who have had experience with tin and wolfram ores from certain Cornish mines and elsewhere, have encountered difficulties in their analysis due to the presence of unidentifiable metals, and, as the waste from most of the mines passes into the Red river, the natural concentration originally made by nature in the rocks and followed up by the ore dressers at the mine, has been completed by the streamers. The minerals of the rare elements, owing to their greater friability, became more finely ground than the tin during the dressing of the ore and therefore pass into the slime so that the produce from the Red river, consisting, as it does, mainly of slime, forms an ideal material for research, being always available in large quantity, easily procurable, and probably containing in the most accessible form, many of the missing links which, since the discovery of radium, have become of interest and probable value.

*Abstract from Bulletin of the Institution of Mining & Metallurgy.

The fact that radium is a product of the breaking down of uranium and that uranium and all the allied heavy elements, as well as many of the light elements which may also be products of similar degradation of elements, occur, so far as we know, only in deposits which are distinctly of the most deep-seated and ultra-plutonic origin, may perhaps be coupled with the peculiar force or 'emanation' which frequently accompanies sudden volcanic outbursts, and which kills so instantaneously as not to be attributable to any gas or to any cause with which we are acquainted.

The occurrence together of practically all the heavy rare elements and the almost invariable occurrence with them, or at any rate in the same or similar rocks, of many of the rare alkali, alkaline-earth, and allied elements such as lithium, caesium, rubidium, cerium, thorium, didymium, beryllium, zirconium, etc., is of extreme interest. All occur in pegmatites or other of the oldest and particularly the acid rocks, and practically none are found elsewhere except under conditions directly traceable to such an origin. Where uranium abounds the other heavy metals are usually present in comparatively small quantity and the other groups of rare elements are practically non-existent while, under conditions where uranium is absent or only found in comparatively small quantity, the others may be found associated either as components of minerals of complicated constitution or each in its own characteristic mineral form.

It is extremely probable that there is a definite connection between these occurrences and the birth or decomposition of the elements, and that a study of them may elucidate many doubtful points more simply and conclusively than attempts, however well directed, to artificially produce results which Nature has already achieved. The occurrence of fluorides with these rare metals or in the rocks where the same occur, is also of importance. Both fluorspar and cryolite are commonly, although by no means always, associates of them, and it is considered by many that these fluorides, which often occur in fissure veins in granites, diorites, gneisses, etc. of great age, have been produced, in many cases, by the action of metallic fluorides whose decomposition has resulted in the production of metalliferous deposits and of such fluorides as fluorspar and cryolite, and of minerals containing fluorine, such as topaz, tourmaline, etc. The important and growing use of flourspar and cryolite as fluxes in metallurgical operations, has resulted in a great increase in their production during recent years. The color of topaz, zircon, and many others of the more or less precious stones which occur in the old rocks, is probably often attributable to the action of uranium or other radio-active substances and the effect of uranium and radium in coloring these stones and such minerals as fluorspar and quartz, with which uranium minerals occur, is now fairly well known. Certain peculiarities in the color of these two minerals, as found in place, are even taken as an indication of the presence of uranium by the miners. The first reference to this property was made by Richard Pearce, who published a note on the subject in the Journal of the Royal Institution

of Cornwall in 1861, long before radio-activity was dreamed of, and experiments have recently been made by him and the author in this direction with radium itself.

The peculiar action which the heavy rare metals have when added to steel shows how curiously they stand as a class distinct from others. Uranium, tungsten, molybdenum, tantalum, niobium, vanadium, and even titanium, have extraordinary powers in producing special effects when added to steel, even in small quantity. These powers might be considered only as of passing interest from the point of view of the chemist, were they not practically confined to one group of metals and possessed more or less by each member of that group. It is true that valuable properties are imparted by other metals, such as aluminum, manganese, nickel, and chromium, but their effects are less marked and are produced by the addition of a comparatively large quantity of the metal, excepting in the case of aluminum, whose action is, however, of an entirely different nature.

The recent demand for these rare metals has resulted in a large increase in the production of the minerals containing them. They were commonly passed over by the prospector or ignored by the analyst, and the present increased supply is mainly due to increased education, and is much on a par with the production of monazite and other thorium-containing minerals used for incandescent lamp mantles, and now obtainable from alluvial and other deposits in many parts of the world, in addition to its early and only source in Brazil. Over 200 million of such gas mantles are now produced annually. The best concentrated monazite sand averages only about 5% of thoria and other earths actually required by the mantle industry, so that a large field is open for research to utilize the ceria, zirconia, didymia, etc., which are obtained as by-products.

Tantalite, at one time almost unobtainable, is now found in larger quantities than are required, and is even produced as a by-product in washing cryolite, with which it occurs, as might have been expected from a study of the natural associations of the rare elements mentioned above.

Reliable statistics as to the output of minerals of the rare metals are not obtainable, but it may be mentioned that the world's output of tungsten ores was over 5500 tons in 1908, as against about half as much in 1905, although the price obtainable per ton had nearly doubled during 1904-8.

A lengthy list of important close associations of certain of the ordinary commercial minerals might be added with a commentary as to the reasons for such association, but want of space forbids more than a passing reference to them.

The invariable association of selenium and tellurium with sulphur, of cadmium with zinc, and of nickel with cobalt, and the common association of potassium and sodium, of calcium, barium, and strontium, and of the halogens excluding fluorine, is too well known to need comment. They may be explained by the similarity of their properties, but there are many other mineral associations of elements which, like that of the precious metals as compared with lead, are not in any way similar, and a knowledge of them is of great assistance to the mining man and mineralogist in searching for minerals and in his anticipation of what may be expected to follow such indications as are found in prospecting, as well as to the metallurgist and chemist as a guide in searching for valuable or objectionable constituents in such minerals as he has to treat.

One of the most common associations is that of zinc blende with galena, copper and iron pyrite being also usually present. Such an association is objectionable in every way commercially, and although these minerals may be separated mechanically, hydraulically, or magnetically, when the minerals are not so fine-grained or so intimately interlocked that a preliminary crushing will not break them apart, millions of tons of ore of high assay value exist which have not yet been treated at a profit and which are known as 'refractory zinc-lead ores'. When it is remembered that ores containing zinc, lead, silver, and gold to the amount of perhaps ten pounds or more can be obtained for little more than the cost of mining, of almost uniform composition and in unlimited quantity, there is no wonder at the numberless attempts which have been made to solve the problem and which have raised more hopes and emptied more pockets than any other metallurgical problem during the last century.

It is true that pyrite as such, does not constitute a commercial ore of iron, but the oxide left by the roasting of pyrite is regularly smelted for the production of pig iron, and it must not be forgotten that a considerable proportion of iron ore deposits is the result of the decomposition of sulphide of iron in one or other of its forms.

Since iron pyrite is of such commercial importance, being the chief source of the world's supply of sulphuric acid upon which so many of the chemical industries depend, it may be well to discuss the changes which occur during the weathering of this mineral, and their important and far-reaching results.

This subject has received considerable attention since before the time of Henckel, whose 'Pyritologia, or a History of the Pyrites, the Principal Body in the Mineral Kingdom', published in Germany over 150 years ago, states that hot baths, volcanoes, and whirlpools "derive their matter from pyrites and sulphur." Most interesting work in connection with the oxidation of pyrite has been accomplished during the last twenty years, the introduction of the cyanide process for gold extraction having made such investigations an absolute necessity. So thoroughly has this been done that, at the present time, the number of minerals which are either directly or indirectly credited, by both practical man and theorist, with a pyritic parentage, is legion.

Briefly stated, the result of the weathering of iron pyrite is the production of ferrous sulphate and free sulphuric acid, followed by the oxidation of the ferrous to normal, and ultimately, to basic ferric sulphate. With certain kinds of iron pyrite—notably marcasite—the decomposition proceeds with great rapidity, a clean specimen soon becoming coated with minute crystals of ferrous sulphate even when enclosed in a mineral cabinet. The sulphates so pro-

duced are mainly carried away in solution or suspension, but a small quantity usually remains, and, by final conversion into oxide, reddens the mineral mass from which the pyrite has been leached out. Should gold be present in the solutions acting upon the pyrite, the reducing action of the ferrous sulphate precipitates it as metal, producing oxidized ferruginous gold ore. The presence of extremely minute traces of gold in many saline and other natural waters is well known, and, although this store of precious metal will most certainly never be profitably tapped by mankind, nature is continually drawing from it and depositing the gold in concentrated and therefore available forms.

Enormous quantities of pyritic ores containing the precious metal exist under conditions which altogether preclude such an explanation of the deposition, but the fact that the rich surface indications of a gold mine are by no means a sign of continuance in depth (as would be the case were the gold merely left behind by the weathering of pyrite already containing it) is a significant proof of the frequent deposition of gold from surface and other waters.

As already indicated, the products from the weathering of pyrite have caused much trouble in the application of the cyanide process to gold ores. Being especially suited to ores containing the precious metal in a finely divided condition, the cyanide process is widely employed in the treatment of pyritic gold ores, and particularly of the tailing, from which the coarse gold has already been extracted.

In addition to their far-reaching effects upon the igneous and other rocks already referred to, the soluble products from the weathering of pyrite also react upon such carbonates and other compounds of lime, magnesia, alumina, etc., as they come into contact with, producing the corresponding sulphates. The carbonate of iron produced from such interaction, may be directly deposited as chalybite or spathic iron ore, but is more commonly converted, by loss of carbonic acid and subsequent oxidation, into various forms of ferric hydrate or oxide, such as limonite and hematite.

The familiar rusty iron stain which settles from chalybeate waters, affords an indication of the manner in which such ores have been produced, and the thick brown mud so frequently found in disused mines, are further examples.

The natural or induced weathering of iron pyrite is taken advantage of in the case of low-grade cupriferous iron pyrite at the Rio Tinto mine, both metals being dissolved out as sulphate and the copper finally precipitated as metal by treatment with pig or scrap iron. It is interesting to note that the Rio Tinto ore is one of the very few which lend themselves to such weathering. Many large deposits exist, which, although very similar in appearance, are almost incapable of such weathering, and, being too poor for smelting, have had to be abandoned.

Although Henckel's views as to the effect of pyrite were too advanced, there is probably no mineral on which so many industries depend or which yields so many direct or indirect by-products of commercial value. Although not a tenth of the total sulphur mined yearly in the form of pyrite, and practically none of that existing in other minerals, is utilized, the remainder passing into the atmosphere or being otherwise directly lost, nearly 2,000,000 tons of iron pyrite averaging about 45% sulphur, is annually mined, as a source of sulphur, mainly for utilization in the manufacture of sulphuric acid. This huge supply is supplemented by a comparatively small return of sulphur recovered from alkali waste by the Claus-Chance process, and particularly by the large amounts of native sulphur mined in Italy and probably attributable to natural processes acting on sulphurous gases somewhat as the Claus-Chance process, and by the rapidly increasing output of Louisiana. The two latter sources account between them, for about three quarters of a million tons of crude native sulphur annually.

Selenium occurs, although only in minute quantities, in native sulphur and in all pyritic ores, and becomes concentrated throughout various stages of their treatment. Its production as a by-product of sulphuric acid manufacture is well known, but its latest and principal source is the anode mud or slime from the electrolytic purification of crude copper. Although its percentage in the cupriferous pyritic ores from which the bulk of the world's copper is obtained, is so small that it cannot usually be determined, it becomes to a large extent concentrated with the copper through the various stages of treatment, and when one remembers that the bulk of the world's copper is purified by that process and that most of the selenium becomes accumulated in the mud left by solution of the anodes, the possibilities as to supply of selenium, should the demand increase, will be readily realized. Not only do these anode residues contain selenium; they contain often as much as 50% of their weight of gold and silver, together with much bismuth, all similarly concentrated by the selective power of metallic copper from the otherwise non-recoverable traces which occur in the original ore, and all obtained as true by-products by a treatment which would be necessary in most cases even were they not present. As regards bismuth, it may be noted that, in addition to the amount recoverable from the copper, over 800 lb. is stated to escape daily from the smoke-stack of a single copper smelter, the Washoe smelter of Montana, and that bismuth is now obtained from the anode mud in electrolytic refining of lead bullion.

Discovery from time to time of new gold-placer deposits in Alaska helps to maintain the general interest in that region and to give it importance in connection with monetary conditions and prospects. So long as gold is almost universally the basis of money, and so long as it is generally available for free coinage, its rate of production will be a matter of primary importance in the world of finance. The question whether the present high prices of many kinds of products are properly chargeable to the use of gold as a measure of values and to its free coinage, as some eminent students of finance have contended, or to other causes, may easily provoke warm discussion, but whatever may be the final judgment on this question, the immense gold output of Alaska must still command interest.

Paracale and Mambulao Districts.

By Warren D Smith

*This district comprises roughly 400 square kilometres of country of moderate relief. The topography is marked by a number of hills which extend outward as spurs from the cordillera, and have approximately a north and south trend. Between these hills are broad valleys largely filled with nipa and mangrove swamps. The whole country is densely wooded. The most elevated point is Mount Bonotan, about 500 metres high. Metamorphic rocks are a prominent feature of this area. The formations are pyroxenite, schist, granite-gneiss, granite, shale, sandstone, and andesite from north to south in the order named. The strike of the sedimentaries is roughly east and west, and they now stand nearly on end.

Prior to the Miocene disturbance, which flexed these formations into a nearly vertical position, the section of strata was probably as follows: at the base a pyroxenite and diorite complex; above this sandstone, shales, and possibly limestone; with andesite overlying. With the Miocene uplift came the intrusion of granite. Exposures of the granite cutting across the basic rock can be seen. Along the contact of the two, gneiss and schist were developed. Later, and probably before the outflow of andesite lava, there began a period of vein filling and ore deposition. Naturally, the principal deposition took place along the weak zone of the contact and in the adjacent fractures. The principal lodes today are found along this granite-diorite contact and in the irregular fractures in the granite near its border. The placer deposits are found along the rivers which cut across these veins, and are naturally richer near them. When the last annual bulletin was published there was only one dredge in operation in the Mambulao district, and all the lodes remained practically as the natives and the former Spanish and English operators, the Philippine Mineral Syndicate, had left them. Eight months ago there were only the old workings of the syndicate in this part of the district, and a few recent shafts and tunnels as assessment work. I shall not discuss the innumerable shafts and tunnels, ancient workings dating from before the Spanish Conquest, with which the country is honeycombed. Since that time two companies, the Tumbaga and San Mauricio, have been getting ready for immediate operation.

Dredging Ground on Paracale River.

Tumbaga lies two and one-half kilometres south of the town of Mambulao. The orebody is in a brecciated zone between andesite porphyry and sandstone. The trend of the orebody is northeast. In this there is some slate through which innumerable calcite stringers ramify. Some of these stringers carry free gold; possibly all of the gold may be found to lie in these innumerable veinlets cutting the slate. Mr. Cavender, the superintendent, has opened up 305 ft. of drifts and cross-cuts, most of which is new work, also a shaft over 50 ft. deep, and has constructed a drainage tunnel of 355 ft. long. He has also, assisted by Mr. Collins, put into working order the old plant, parts of which were missing, and the remainder in considerable disorder, so that he was

*From advance report to Bureau of Science, Philippine Islands.

able to make a test-run on his ore. The plant as it now stands consists of the following: one Blake crusher; one 5-ft. Huntington mill, having a capacity of from 12 to 30 tons per day; two Johnson concentrators; besides the usual accessories, boilers, hoisting drums, skips, and the like.

Although the mineralized zone in places attains a width of 35 ft., this is not constant. The orebody is lenticular. According to Mr. Cavender, a trial run of 22 hours was made with this plant in November last. Eleven tons of ore were treated with the result that 93.6 oz. were cleaned up, which represented merely the free milling part of the ore. The concentrate has not been treated. If these figures are correct, as I have no reason to doubt, this ore contains some rich streaks.

The San Mauricio property is just one kilometre from Mambulao, on the hill to the east of the town. The orebody is a quartz filling along the contact between the granite and the basal rock, which here is more nearly a diorite than a pyroxenite. There has been a total of about 1000 ft. of drifts and cross-cuts opened, part of which represent old workings, and part extensions made by the present company, the superintendent of which is Mr. Blake. Besides this development work there has been erected a 20-stamp Traylor mill consisting of the following: 20 Traylor stamps, Blake crushers, Challenge feeders, and 8 Traylor concentrators. The stamps are 1050 lb. each, and it is proposed to have them dropped at the rate of 94 per minute through a 5-in. drop. This mill for completeness, general plan, and the way it has been set up, should be a model for future mills in these islands. In October, 1909, a severe baguio struck this coast and did damage to all the properties. At the San Mauricio the head-frame was blown down, but no other serious damage was done. It is not my intention to go much into detail in discussing the rocks and ores of this property, as it is planned to have a detailed study of the district made during the coming year by members of this division.

Other lode properties on which development work has been carried on are: Dinaanan, north of San Mauricio; the Le Duce property, southwest of Mambulao, and the group of claims known as the Iron King, Gordon, Isla, Guinto, Abe Lincoln, and Navotas, a different property, all a short distance east of Tumbaga. These are all promising prospects.

The history of operations in Paracale is quite different from that of Mambulao. Here the present operations are confined almost entirely to placers. The early history of Paracale has been written many times, so that I shall merely mention the progress made since the last report of the Division of Mines.

Two more dredges have begun operations above the Paracale dredge. The Stanley dredge farthest up the river is a New Zealand model, operated by New Zealanders. The Philippine dredge is of Risdon make and was operated by an American company. The hull for the fourth dredge is almost completed and plans for a fifth are under way. Of three dredges on the river, the two New Zealand ones are running steadily, but I regret to say that the third, up to the present time, has failed to get results, and has temporarily ceased operating. The Paracale Extension is a new company which plans to work ground farther up the Paracale river above the Stanley. The services of Mr. Kane, formerly dredge-master of the Paracale company, have been secured. The ground was being tested when I was in the district, and I witnessed some of the work. Most of the ground on the Paracale and Malaguit rivers has been tested and staked. However, there are no operations on the latter as yet. These rivers lie in broad valleys, covered with mangrove and nipa, through which the dredges work their way. The mangrove is used for firewood, and the nipa is either thrown aside or used by the natives for house-building. A test-hole in an adjacent river, which serves to give a general idea of the ground to be dredged, showed the following strata: soil, nipa, etc., to 5 ft.; sand and gravel, with some gold, from 5 to 25 ft.; heavy black loam, with considerable decayed vegetable matter, from 25 to 38 ft.; gravel, pay-streak, from 38 to 40 ft. The bedrock is a white decomposed granite and gneiss.

In some localities the bedrock varies between 10 and 60 ft. deep. In the last few months testing has been active. One party tested along the Tabas, Malaguit, Malagbang, Bosigon, Gumaas, Bulalakao, Mambulao, Colombayungon, Tigbi, Maniloc, and Ponso rivers. Other parties have carried on extensive boring in the Malaguit river; one company putting down over 300 holes. This gives only a small proportion of the testing in progress. The Paracale river, of course, is the most thoroughly tested field.

In the forthcoming bulletin of the Mineral Resources I shall describe somewhat in detail the types of dredges. The ground being worked by the dredges now in operation is unusually rich, in one case ₱2 per cubic yard, according to the dredge-master's sworn statement. It is not likely that such richness will be found in all, or even in many parts of the district. The concentration at certain spots is due to the fact that the river cuts across the veins in these places. This can be easily and clearly seen by an examination of the field relations and of the fresh, crystallized gold as it is caught on the dredge. While this richness may not be maintained throughout the district, there is not much doubt that a great deal of profitable ground exists in the district and that there is room for more dredges. Just at present the labor conditions in Paracale are not entirely satisfactory. In other places I have gone into the reasons for this and do not care to repeat them at this time. The Camarines coast is but sparcely settled and but little opened by commerce. The conditions ought to improve.

It is necessary at this time and in this place to make a general statement which undoubtedly will provoke some criticism; however, I firmly believe that the public which helps to pay for these operations has a right to know the general status of the industry. One dredge is lying idle because of insufficient knowledge of conditions, and a mill has been put up before sufficient development work was done. This jumping without looking ahead or backward has characterized many of our mining operations in the past. Masbate has suffered from it, but happily has recovered, and has made a good start in the right direction.

Pachuca District, Mexico.

Written for the Mining and Scientific Press
By J. Leslie Mennell

The centre of greatest mining interest in Mexico at present, is the famous old Pachuca district, and there is little doubt that during the next few years it will enjoy a 'boom' unprecedented in Mexican mining history. It is a very old mining town, indeed, one of the first worked by the Spaniards, and it has for more than 300 years been a constant producer of silver of great importance. It was the metallurgical problem of extracting the silver from the sulphide ores of Pachuca that gave birth to the old 'patio' process, invented by Bartolome de Medina in the middle of the sixteenth century. This process gave good results in the extraction of the silver, often as much as 92 or 93% with some of the ores, and it assured thenceforth the profitable operation of the mines. During the succeeding centuries large amounts of silver were produced and a great name earned in the silver mining industry of Mexico.

The veins of the district are strong and wide, the most important, the Vizcaina vein, averaging about 17 or 18 ft., and attaining in several places a size as great as 40 to 45 ft. in width. They have been traced on the outcrop over a great distance, the above-mentioned vein being distinctly shown for about 15 kilometres, and it has been worked by several companies over an extention of about 8 kilometres. Mining operations in depth have proved the orebodies to be persistent, richer and larger bodies having been found in the deep workings than near the surface. The deepest workings of the district are those of the Santa Gertrúdis Mining Co., which reach 1400 ft., and it is to be noted that orebodies were there developed equal in importance to any previously encountered. There are two systems of veins in the district, a north-south parallel system, or the 'Pachuca system' proper; and an east-west parallel system worked in the adjoining Real del Monte portion of the camp about six miles from Pachuca, to the north. The former system has to date proved to be the most important, but the east-west veins of Real del Monte have also produced enormous amounts of silver ore and have acquired great fame.

General View of Pachuca.

The exploitation of the mines during Spanish times and to the end of the nineteenth century continued apace and with great profit. English companies employing improved mining methods succeeded the Spanish workers in the early decades of the last century, and these were followed by Mexican companies that continued to work the mines under the old methods until a recent date. The operations were conducted upon an extensive scale, considering the conditions and facilities for mining, and the large size of the 'patios' required, as also the large number of men and animals and complications involved in the treatment of a large tonnage daily by the 'patio' process. Gradually, however, toward the close of the nineteenth century, the working of the mines under the old conditions became less profitable, and the district suffered a depression. Various circumstances combined to bring about this unfortunate result. On the one hand the costs of operation became increasingly greater, owing to the expense of mining at greater depth without modern machinery; as also the greater costs of the already expensive patio and pan-amalgamation processes, due to the rise in the cost of materials and labor.

A Pachuca Mill

On the other hand the gradually decreasing price of silver diminished the value of the output.

These conditions depressed the operations of the district until quite recently, when the successful application of the cyanide process to the treatment of ores solved the main difficulty. The re-awakening began in 1906, closely following the adoption of the cyanide process for the treatment of the Guanajuato ores in 1905. No sooner had the process proved successful in the latter camp, than experiments proved the Pachuca ores to be equally amenable to cyanide treatment, showing an extraction of 90 to 95% of the silver at a treatment cost of less than half that by the old patio process. The result was an immediate improvement in the district. The old Real del Monte y Pachuca mines were acquired by Americans and the old patio treatment of the ores at the Hacienda Loreto, in Pachuca, was discontinued, a modern cyanide plant, of a capacity to treat 250 tons of ore daily, being erected upon its site. The results of the treatment of the ores by cyanidation were a great success, and in consequence a second plant was erected by the same company near the Real del

Monte mines, namely, the Guerrero mill, which treats 300 tons of ore per day. This second plant is more efficient than the first, and the treatment has proved more economical also. The introduction of electric power into the camp, by the Cia. Eléctrica é Irrigadora de Hidalgo, also helped to cheapen power and facilitate the utilization of up-to-date mining and milling machinery in the several mines and mills of the district. With modern machinery to facilitate deep mining, with cheaper power, and the cyanide system of treatment cutting in half the costs previously incurred in the treatment of the ores by the patio system, the success of the mines and the speedy growth of the district to its old position among the important silver producers of Mexico, became assured. About the same time as the installation of the first plant by the Real del Monte company, the old Hacienda San Francisco erected a second custom-mill and cyanide plant to treat 125 tons daily, and this also was a great success. The Hacienda San Francisco No. 2 plant was the first in which the new system of agitation in 'Pachuca' tanks was used, and all plants since erected have followed its lead. These tanks have proved to be the most efficient and least costly agitators for slimed ores. Following the San Francisco mill, came the Union, also a custom-mill, a remodeled old plant in which was installed a cyanide annex. After this the San Rafael y Anexas company, working the famous Soledad mines, erected a 400-ton cyanide mill, and this is perhaps the most efficient plant in the district. The latest to be completed, and just now starting, is the Santa Gertrúdis Mining Co.'s plant, which has superseded the old patio plant at the Guadalupe hacienda in Pachuca. A second plant is being designed and will soon be erected by the same company near the mines. The site for a large plant is also in preparation by the Blanca Mining Company.

There are now installed in the Pachuca district six large modern cyanide plants, with a capacity of about 1500 tons per day, and two other plants are being installed. All of these are making large profits. All this progress has been the work of the last four years, the introduction of the cyanide process having been the main factor. Previously ores of less than 1000 gm. silver per ton were discarded on the dump, while ores of 500 gm. are now capable of giving good profits. This has made many of the large dumps valuable. Many of the old mines contain large amounts of 'filling' of that grade ore, and it is now being extracted and treated in the modern mills.

In consequence of such improved conditions, and of the great success in the adaptation of the cyanide process here, interest in the district is increasing rapidly. The recent purchase of the Santa Gertrúdis mines by the Camp Bird company has greatly accelerated this, and companies are being formed to take over other old mines. Also development companies are opening new ground in the same district. Much of this large system of veins is still virgin, or has been worked only superficially.

Coals containing the highest percentage of fixed carbon give the least smoke and are also the most efficient heat producers.

EFFICIENCY OF HEAT DRYERS.

By W. B. Ruggles.

*To determine the total efficiency of a dryer using direct heat is a simple matter, but to discover where the losses occur is not so easy. There are four sources of loss—unconsumed carbon, due to imperfect combustion; heat carried out by the exhaust gases; unnecessary heat carried away by the dried material; and radiation from the furnace and shell.

The first of these is generally ignored, this loss being charged against radiation. Recent tests, however, have shown it to be a considerable factor, unless a large combustion chamber is supplied, in which space and time are given for the perfect combination of oxygen with the carbon monoxide. When the dryer is so arranged that the flames impinge directly upon a cascade of cold and wet material they are quenched suddenly and a considerable amount of carbon passes off unconsumed. This, in certain types of machines, may amount to 7 or 8% of the value of the fuel.

The heat carried out by the exhaust gases is generally the largest item of the losses, and sometimes amounts to 30% or more. This occurs in dryers in which natural draught is relied upon to burn the fuel. As in a steam boiler, the temperature of the stack gases in such a dryer is seldom below 400°F., and is often 600° or more. It is easy to see that a dryer which utilizes, for instance, the 1200° between 1300 and 100° is, other things being equal, about 50% more efficient than one utilizing only the 800° between 1300 and 500°. In order to get as much of the heat out of the gases as possible, it is necessary to use an exhaust fan and draw the gases against the flow of drying material, so that just before leaving the dryer it has been in contact with the cold and wet material. Undoubtedly some condensation occurs of the steam being carried out; but there is no ultimate loss, as the heat given up in condensation is absorbed by the material and aids in drying later in the process. When the current of the gases is reversed and flows in the same direction as the material, a temperature of at least 212°F. must be had in the exhaust, so that no condensation may occur and no moisture deposited upon the furnished material.

The heat carried out with the dried material up to 212° should not be charged against the efficiency of the dryer, as that temperature is necessary to the rapid drying of the material. All heat of the material above 212°, however, is unnecessary in most operations, and, therefore, should be charged as a loss. This is generally not great, and is, in most cases, due to imperfect operation and not to the design of the machine.

Radiation varies greatly in different types of dryers. In some, the shell is cool enough to place the hand on without discomfort; in others, it is not uncommon to see the shell red-hot for 10 to 12 ft. from the furnace. This, of course, is in a single-shell type, in which the flames impinge directly upon the shell. The loss by radiation in such a dryer is great.

*Abstract from *Cassier's Magazine*.

Canadian Mining Institute, Toronto Meeting.

Written for the Mining and Scientific Press
By Phillips Thompson

The twelfth annual meeting of the Canadian Mining Institute was held March 2 to 4, at the King Edward hotel, Toronto, the attendance being large. The chair was occupied by Willet G. Miller, the president, who opened the proceedings with a comprehensive inaugural address, reviewing the growth and history of the Institute, and dealing with the condition and outlook of the mining and metallurgical industries. Noting the tendency toward the consolidation of interests by large industrial companies, he contended that this should make for increased efficiency and economy in management and operation. The progress of mining in late years was shown by the fact that it was the second of the staple industries of Canada in the value of its product. Dealing with the subject of mining legislation, Mr. Miller considered the mining laws of Mexico as almost ideal. He was disposed to favor an annual acreage-tax on mineral lands, rather than the imposition of working conditions, as a means of preventing the 'blanketing' of claims and holding for speculation, and he pointed out that such extensive blanketing, which was encouraged by permitting the staking by proxy, reacted against the prospector by putting too many claims on the market, many of them valueless. In the taxation of mining a distinction should be drawn between it and other forms of production, as the net earnings of a mine largely represent capital, and should not be taxed like other sources of income of a more permanent character. He alluded to recent utterances of Clifford Sifton, chairman of the Canadian Conservation Commission, who had stated that mining accidents were more numerous where there were many small mines or prospects in the early stages of development, than when operations were conducted on a larger scale. The question of explosives should be taken up by the Federal Government, which should also deal with the matter of technical education. A keen discussion followed, and a resolution moved by R. W. Brigstock, of Cobalt, and seconded by J. E. Hardman, of Montreal, expressing regret that the chairman of the Conservation Commission should have made statements reflecting on the mining and metallurgical practices of Canadian companies without being acquainted with the facts, was adopted.

The report of the Council showed an accession of 97 members during the year, and a total membership of 935. The financial statement showed receipts of $10,497, and a balance on hand of $1452. The election of officers resulted as follows: president, Frank D. Adams, McGill University, Montreal; vice-presidents, A. B. W. Hodges, Grand Forks, B. C., and R. W. Leonard, St. Catharines, Ontario; councillors, Selwyn G. Blaylock, Moyle, British Columbia; Robert A. Bryce, Cobalt; Arthur A. Cole, Cobalt; John A. Dresser, Ottawa; Charles Fergie, Montreal; R. T. Hopper, Montreal; G. G. S. Lindsey; Toronto; J. J. Penhale, Sherbrooke, Quebec; J. B. Tyrrell, Toronto, and O. E. S. Whiteside, Coleman, Alberta.

John McLeish, chief of the Division of Mineral Resources and Statistics, Canadian Mines Department, presented a preliminary report on the mineral production of Canada for 1909, showing the value of metallic products to be $45,188,387, non-metallic, $44,927,376, estimated value of mineral products not reported, $300,000, total, $90,415,763, compared with a total value for 1908 of $85,927,802. This gives an increase of a little over 5%. The metals nearly all showed an increased output. Among individual products coal was the most important, its value constituting 27% of the total, and silver occupied the second place with 15%. Complete statistics for gold were not available, the preliminary estimate of $9,790,000 revealing a slight decrease. Of silver, 27,878,590 oz. were produced, valued at $14,358,310; as against 22,106,233 oz., of a value of $11,686,239 in 1908. The production of Cobalt district showed a considerable increase. Returns from 31 mines showed shipments of 28,042 tons of ore and 2967 tons of concentrate. The total silver content of the ore, concentrate, and bullion shipped was 26,364,703 oz. The production of copper contained in blister and matte, and estimated as recoverable from ores exported, was approximately 54,061,106 lb., valued at $7,018,213, an increase in production of about 2%. The output of lead was 45,857,424 lb., valued at $5,832,246, and the value of the zinc product was estimated at $250,000. The nickel industry was particularly active, and the output was the largest on record, namely, 26,282,991 lb., valued at $9,461,877, as against 19,143,111 lb. in 1908, valued at $8,231,538. The shipments of iron ore amounted to 268,043 tons, valued at $659,120, as against 238,082 tons and $568,189 in the previous year. The ores were classed as magnetite 73,420 tons, hematite 190,473 tons, bog ore 3330 tons, and titaniferous magnetite (sand) 820 tons. An increase of 20% was shown in the production of pig iron, the total being 757,162 tons, valued at $9,581,864, as compared with 630,835 tons, valued at $8,111,194 in 1908. These figures do not include the output from electric furnace plants making ferro products. Of the output of 1909, 17,003 tons were made with charcoal as fuel, and the remainder with coke. The amount of Canadian ore used was 231,994 tons, imported ore 1,234,990, and mill-cinders, 25,508 tons. The total daily capacity of 16 completed furnaces was 2735 tons, and the number of furnaces in blast on December 31 was 11. Returns were received from 8 steel plants, showing a total production of ingots and castings of 754,719 tons, of an estimated value of $14,359,710, as compared with 754,719 tons, valued at $10,916,602 in 1908. The total bounties paid on iron and steel during the year amounted to $1,895,011. Coal was produced to an estimated amount of 10 411,955 tons, valued at $24,431,351, being a smaller production than in either of the two preceding years. The western Provinces show an aggregate increase of 505,404, which was not sufficient to counteract the decrease of the Nova Scotia output, amounting to 968,789 tons, owing to the miners' strike. The aggregate decrease for Canada was 474,356 tons. Of the total production Nova Scotia

contributed 54.5%, Sawkatchewan and Alberta 205, and British Columbia 24.5. The production of oven coke was 875,080 tons, valued at $3,557,147, being a slight increase. Full returns as to cement were not received, but, subject to correction, the output is given as 4,089,191 bbl., compared with 3,495,961 in 1908. Statistics of the year's production of the Provinces of Ontario, Quebec, Nova Scotia, Alberta, and British Columbia were also presented. The returns from the Department of Mines of Ontario showed a production having a total value of $32,652,072, as compared with $25,637,617 in 1908.

H. Mortimer-Lamb, the secretary of the Institute, read a paper by J. D. Kendall, of London, England, on 'Mining Engineers and Mining Institutes', in which he advocated the establishment of a mining institute by law in every mining country, to which every person practising as a mining engineer should be compelled to belong after having passed a satisfactory examination as to competency and character. R. W. Brock, of Ottawa, presented a paper on 'The Necessity of Distinguishing Between Prospecting, Developing, and Mining'. He dwelt strongly on the manner in which the legitimate mining industry was handicapped by 'wild-catting', money which should be devoted to development being diverted to unscrupulous promoters. The failure of wild-cat projects deterred investors from putting money into legitimate enterprises. He had not much faith in legislation as a remedy. The public must be educated to protect itself by using discretion. Instead of regarding any claim as a 'mine' the investor must learn to distinguish between claims, prospects, and mines. If this difference were generally realized the investments in mining would be greatly increased. A paper on 'Mining Literature', by Allan Greenwell, of London, England, was read by Frederick Hobart, of New York. L. L. Bolton, of Sault Ste. Marie, Ontorio, read a paper prepared by R. W. Seelye, of the same place, on 'The Helen Mine, Michipicoten', which, in addition to giving an interesting account of the history, present condition, and equipment of the mine, contained important information in regard to recent discoveries which considerably increase the value of the property. The length of the hematite deposit is 700 ft. and the line of greatest dimension runs east and west. At the end it is bounded by siderite containing 34% or more of iron, and at the west end the iron deposit is cut by a white clayey dike running north and south. Exploratory work was undertaken last year, and on driving west at the third level, after crossing the clay dike, a body of hard red hematite was found, which on analysis proved to be high-grade bessemer ore with the following content: iron 60%, silica 9.7, sulphur 0.05, phosphorus 0.03. A smaller parallel body of silicious bessemer ore was tapped 60 ft. to the north, showing on analysis, iron 50%, silica 25, sulphur 0.07, phosphorus 0.035. Driving undertaken at the fourth level, beneath the third level adit, also cut bessemer hematite, and the ore was being blocked out and preparations made for working at deeper levels. Explorations of the ground to the east, where the merchantable ore changes to low-grade pyritic matter, were also undertaken, and after 30 ft. of driving on the fifth level, a deposit of clean hard pyrite was encountered. On February 15 the drift had passed through 150 ft. of this material, and cross-cutting proved the occurrence of a large deposit of high-grade pyrite. Raises were being put in so that it might be ready for stoping on the opening of navigation. Analysis showed 49% sulphur and a trace of arsenic. Hitherto the mine had shipped only one grade of ore, but during the coming season three grades would be shipped, and in addition arrangements were being made for mining 50,000 tons of pyrite for spring delivery. The entire output of ore would be taken by the Algoma Steel Co. The total shipments of ore during the history of the mine amounted to 1,673,915 tons, and last year's shipments were 170,065 tons.

'The Iron Ore Deposits of Texada and Vancouver Islands' were dealt with by E. Lindeman, of the Mines Branch, Canadian Department of Mines, who in 1907 made an inspection of these deposits. He stated that, as a rule, the iron content of the magnetites is high, averaging about 55 to 60%, and sometimes reaching 68%. The phosphorus content is generally below the bessemer limit, and the silver varies from 4 to 8%. Sulphides of iron are often found, and may in some places render the roasting of ores necessary. The surface area of the deposits varies up to 30,000 sq. ft. The deposit on Texada island had been proved to a depth of 430 ft. Of the properties on this island the Prescott had been most extensively developed, and had shipped largely to Irondale, Washington. Detail descriptions of the workings of leading properties, with analyses, were given. Though it is impossible at present to make an approximate estimate of the ore in sight, there is a possibility of large quantities of merchantable ore being found.

At the evening session papers were read by P. McN. Bennie, Niagara Falls, New York, on 'Recent Developments in Electro-Siderurgy', and 'Steel from the Electric Furnace', by A. Stansfield, of Montreal.

On Thursday, March 3, the proceedings were opened with the delivery of an address by A. E. Barlow, of Montreal, on the origin of asbestos, his contention being that the material in asbestos veins was not brought from a distance, but resulted from the alteration of the rock in place, being an attempt at the crystallization of the serpentine.

John A. Dresser, of Ottawa, followed with a paper on 'The Distribution of the Chromite and Asbestos Deposits of the Eastern Townships'. These deposits were associated in the same rocks. Asbestos was produced in Canada to the value of $2,500,000 annually. It was produced 30 years ago in commercially valuable quantities, but its high cost prevented its general use. In 1893-94, however, the mine-managers undertook mechanical concentration, and large quantities of lower-grade were placed on the market, resulting in a great expansion of the industry, stimulating new discoveries. Asbestos being of the same chemical composition as the serpentine enclosing it no analysis could determine its value, and the rocks were obscure and difficult to determine. There were three main ranges of these rocks in the district southeast of the St. Lawrence generally known as the ser-

pentine belt. The asbestos mines were generally at the foot or on the side of the serpentine hills, and always to the north. The features to be looked for in prospecting for asbestos were the purity of the serpentine and the fracturing of the rock. It was generally considered that the presence of granite was necessary, but this was not invariably the case, though granite was favorable to the occurrence of asbestos.

F. L. Ransome, of the U. S. Geological Survey, Washington, D. C., read an elaborate paper on 'Criteria of Downward Sulphide Enrichment'.

Amendments to the by-laws were proposed, limiting the membership to those having been engaged for five years in practical mining or metallurgical work. After a lengthy discussion, which developed strong opposition to the proposal, it was voted down. Another amendment for the appointment of a nominating committee to choose the officers was also defeated.

Dr. James Douglas, of New York, presented a paper on 'Some Reminiscences of Copper Mining in Megantic county, Quebec, and the Possible Present Utilization of Low-Grade Quebec Copper Ores', which was optimistic in tone. He thought that improved methods of mining, and the extension of the railroad system, would enable many of the Quebec copper mines, now abandoned, to be profitably worked. The policy of restricting the exportation of pulp-wood and building up a pulp manufacturing industry, should lead to the utilization of the sulphur found in low-grade ore in the manufacture of sulphide pulp.

A smoking concert was held in the evening, G. G. S. Lindsey presiding, and J. D. Irving, New Haven, Connecticut, read a paper on the 'Formation of Ore Deposits by Displacement'. Among the papers presented at the session on Friday was one by Charles Camsell, of Ottawa, on 'Platinum Mining in the Tulameen District'. The history of platinum mining in this district dates from 1885, the metal being derived from the placers. In the early days little attention was paid to it, but when the price advanced sufficiently to make it worth while it was saved in cleaning up the gold. Previous to 1891 the miners were without capital, working singly or in small groups. Since that time several hydraulic enterprises were carried on, but these were not successful, and within the last four or five years placer mining in the district has only been actively continued by a few individuals. A company recently organized in Vancouver, the British Columbia Platinum Co., has obtained from the Provincial Government three leases in what was formerly the most productive platinum district. It was proposed to prospect the ground with a Keystone drill, and mine by ground-sluicing or drifting on bedrock. Much of the gold and platinum of the district is coarse, and has the rough unworn surface characteristic of nuggets which have not traveled far from their source. The ultimate source of the placer platinum must have been the solid rocks which underlie and are adjacent. The platinum-bearing tributaries of the Tulameen river are Slate creek, where the richest diggings were found; Cedar, Eagle, and Bear creeks, with Granite creek and its western branches. All these, except Cedar creek, have their origin in, or they cut through, a belt of basic rock running from the head of Newton creek at Ladestone mountain northward across the Tulameen. It has been concluded that here must be the source of the platinum. In the Tulameen district the nuggets of this metal are invariably small and I have not heard of any whose weight exceeded half an ounce. Figures bearing on the total production of platinum from this district are incomplete, and details are difficult to obtain. Much of the placer mining is done by Chinese from whom reliable data cannot be procured. So far as at present known the mineral does not occur in commercial quantities anywhere except in the placers. There are probably placers in the district that would repay a reasonable outlay of capital in an endeavor to recover the platinum.

The annual dinner of the Institute was held on Friday evening at the King Edward hotel.

COLD-STRAIN IN PIPING.

Cold-strain is a method for reducing the effects of expansion on a pipe-line. Cold-strain means the cutting of the pipe in such a manner that the pipe will be strained when cold in exactly the opposite way from that in which it is strained by expansion when hot. If the cold-strain be 50% of the normal expansion, the pipe will be strained 50% in the opposite or positive direction when hot. By this means it is possible to reduce the strain in a pipe to half the normal strain of expansion, and thus reduce the necessary allowance for the same in this proportion. There are advantages, however, in making the cold-strain greater than 50%. If, for instance, the cold-strain is exactly equal to the expansion, then the pipe is under strain when cold, and entirely free from strain when hot, or, in other words, the tendency to strain open one side of a pipe-flange is a maximum when the pipe is cold or when there is no pressure on it. The strain of expansion is also eliminated when that due to steam-pressure is a maximum, so that the pipe is not subjected to the two strains at the same time. If the cold-strain be something less than the full expansion, these effects are, of course, proportionately decreased. An example will show how cold-strain was utilized to prevent serious trouble. A leak in one of the main steam-pipes in a large hotel was causing great annoyance. It was due to the flanges being thrown out of line by the strain of the expansion of the piping. It was of the utmost importance not to shut off the steam from the pipes for more than a short time. It was suggested by William J. Baldwin that one length of flanged pipe be replaced by a similar piece of pipe, but cut enough shorter to eliminate entirely the excessive strain of expansion when the piping was hot. This new piece of pipe was made ready before the plant was shut down, and the time, therefore, during which it was not in operation was limited to a few minutes. Another advantage of cold-strain is that wherever flanged piping is used the flange-joint when unbolted will tend to open and allow an easy removal of the gasket.—*Proceedings* American Society of Civil Engineers.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

The Qualified Mining Engineer.

The Editor:

Sir—A letter in your issue of December 11, from John M. Nicol, again brings up the question of the qualifications necessary before a man have the privilege to sign and practise as a mining engineer. Mr. Nicol suggests examinations from time to time, each being more rigorous and searching than the last, such examinations to carry with them diplomas of increasing value. I quite agree with Mr. Nicol that a university graduate is merely an engineer still in process, but cannot accept his suggestion for differentiating the qualified from the unqualified engineer.

A university degree should not entitle a man to consideration as a mining engineer for the simple reason that university training alone does not make an engineer. All it does is to help elucidate some of nature's fundamental laws, impress the graduate with the dignity of his profession, and train his mind to reason logically, both analytically and synthetically. With this advantage over the non-graduate, the graduate is prepared to go into the field, and by observation and instruction from his superiors, to assimilate engineering knowledge of commercial value. His judgment is developed, and among his fellows he will soon find his level, while in the majority of cases his advancement will be a measure of his ability as an engineer.

It seems reasonable to suppose that the opinion formed of such a man by those in intimate contact with him and his work will be a better measure of his ability than any amount of cross-examination. In fact, it forms the best possible evidence for judgment as to his character, ability, and the many requirements for the making of an engineer. Would it not be a good plan to expand such a principle, and apply it to mining engineers as a body? This could, I think, be accomplished by the engineering societies. It is interesting to consider conditions governing physicians and surgeons in Canada. A degree of Doctor of Medicine from certain recognized colleges, carries with it a right to practise medicine, not by virtue of the degree alone, but because the degree covers membership in the Society of Physicians and Surgeons, and this membership gives a legal right to practise. These bodies are, as yet, provincial, but I have no doubt they will in time become national in character.

Applying this principle to engineering, I again quote a Canadian institution, as I am not familiar with the engineering societies in the United States. There is in Canada, the Canadian Society of Civil Engineers, embracing mining, mechanical, electrical, and civil engineers; this latter being used in its restricted sense, whereas the word 'civil' in the Society's name is in contradistinction to the word 'military'. Membership in the Society is of different grades, according to the record of the applicant, and is open to professional men only. I do not mean that a university training is necessary or even desirable, but it is absolutely essential that a man be an engineer in the strict sense of the word before he be allowed active membership.

A graduate in engineering of a university of the highest standard cannot become a member until after a definite period of professional responsibility and a record of some ability behind him. A man's training, whether wholly academic or wholly practical, is not the criterion by which his ability is judged; his works, and the opinions of his fellows, determining whether he shall or shall not gain professional standing in the Society. The result of such a policy is, among other things, a society, the members of which are recognized as men thoroughly qualified to practise engineering as a profession.

Confining my remarks to mining engineering, I think most engineers will agree that if only those who are really qualified to act as engineers; who possess the skill necessary to undertake the operation of a mine, and do so with the least loss or greatest profit; who are by their training, whether this be academic or practical, able intelligently to pass an opinion on a mining venture; who are, in a word, legitimate engineers entitled to recognition as such, were by law entitled to the distinction of being called mining engineer; to write E. M. after their names and to advertise themselves as such, then would the profession be put on a par with the other legally recognized professions.

If membership in an engineering society, similar in character to the one I have described, and national in its scope, were by law necessary before a man be entitled to write E. M. after his name, would this not be practicable, and would it not answer the purpose of differentiating the real engineer from the faker or the yet unfinished product? My suggestion is that it be made illegal and subject to penalties for any man to advertise as a mining engineer, unless he be a member of a society which has by its charter the right to grant such position.

The suggestion I make does not militate against the non-academic man; it draws no line between the graduate with a dozen degrees and the man with none at all, but it does effectually draw a sharp line between an engineer qualified to practise and the engineer still in the making.

The universities should be ready to adopt some plan to protect their graduates, and engineers to protect themselves and the public, against the untrained irresponsible man often miscalled an engineer.

Restricting the use of the title of 'mining engineer' does not prevent John Doe, 'mining expert', who is not eligible for membership, from taking a responsible mining position. It does not prevent him from reporting on a mining venture or proclaiming himself a mining man of international fame. It does not take from him his means of livelihood, but it does make him sail under his true colors, that is, a man who is not considered an engineer by those best able to judge.

Referring to the proposal to hold examinations, I

cannot see how these could be applied. Who would the examiners be? How many of the more eminent men in the profession would submit to what to them would seem the indignity of an examination? Finally, how can a man be examined to determine whether he is or is not a mining engineer?

ARCHIBALD BURNETT.

Greenwood, B. C., January 14.

Estimation of Cyanide in Mill Solutions.

The Editor:

Sir—In a communication in your issue of January 15, Algernon Del Mar points out the discrepancies between different authorities in the quantities of $AgNO_3$ recommended for making up the standard solution used in the estimation of KCN; he asks for the correct quantity for use in the practical work of a cyanide plant.

Mr. Del Mar's standard silver solution is that of which 1 c.c. titrated against a 10-c.c. sample is equivalent to 0.01% cyanide solution, 2 lb. per ton. The extremes on the list he gives are 13.076 and 13.036 gm. of $AgNO_3$ per litre of solution, a difference of four parts in 1300. Adopting the mean value as a standard, the greatest error involved in the use of a possibly incorrect standard is 2 in 1300, about 1½ in 1000. If then, a sample titrated against this mean standard is 0.01% KCN, 2 lb. per ton, it becomes in terms of the weakest 0.010015%, or 2.003 lb. per ton, and correspondingly less in terms of the strongest. But in the plant, cyanide is never weighed, nor can the solution be measured, with a degree of accuracy remotely approaching 1½ parts per 1000; therefore, the cyanide required for a plant can not and need not be known to 1½ lb., which is about 75c. in $500; furthermore, the end-reaction of the titration is often so obscure that a large error results; but the inaccuracy arising from these causes is not susceptible of exact computation.

Assuming that the cyanide can be weighed, the solution measured, and the end-reaction defined within any required degree of accuracy, there exists in the process of titration an inherent error which becomes important when small quantities of solution are used, for the accuracy of any titration varies inversely as the quantities of solution involved. A burette will usually deliver about 30 drops per c.c., rarely more; so one may say that it is an instrument sensitive, at most to $^1/_{30}$ cubic centimetre.

In practice a 10-c.c. sample is usually taken. If it requires, for the estimation of its KCN, 1 c.c. of standard silver-solution, equivalent to 0.01% KCN, there is a possible error involved of $^1/_{30}$, the strength of the sample lies between $1^{59}/_{60}$ and $2^1/_{60}$ lb. per ton; for a stronger or weaker sample the error is proportionately less or greater. The error for any given strength of mill-solution may be reduced by using a larger sample or a weaker standard, or both, for either expedient necessitates the use of more standard solution; thus by substituting a standard of which 1 c.c. equals 1 lb. per ton of KCN, the error is cut in half. Probably the average strength of the solution-samples of most cyanide plants is roughly 2 or 2½ lb. per ton. By use of the usual sample and 0.01% standard solution the error ranges from 1 in 25 to 1 in 50, but the greatest error involved in the use of any of Mr. Del Mar's list of quantities is 1 in 650; hence, in using the most incorrect of these, to titrate even 5 lb. solution, there exists the ample safety factor of 9.

It is necessary for scientific purposes that as nearly correct a standard as possible be ascertained, and having been established it is desirable that it be adhered to in technical work, if for no other reason than this, that it is just as easy to weigh out a correct quantity of $AgNO_3$ as any other; yet my answer to Mr. Del Mar's question is, that it is not of the smallest practical consequence which of the quantities he gives be used in a cyanide plant, for the burette can not discriminate between them.

J. E. COLLIE.

San Francisco, January 21.

Quicksilver at Huancavelica, Peru.

The Editor:

Sir—The comments on the amount of metallic mercury obtained direct as 'free metal' from the condensors have given interesting data regarding the Californian practice, where opportunity has existed for the study of the conditions which affect the high extractions obtained in using modern types of furnaces. In the Huancavelica practice, in Peru, where crude furnaces and condensing arrangements were employed, there was evidently little or no attention paid to the character of the ore, and to other conditions which would account for the low extraction of 'free metal'. In the discussion the type of furnace used seems to have been overlooked as a basis of comparing extractions.

After a more leisurely reading of the paper, as it appeared in the issue of October 23, 1909, I note a few mistakes which need correcting. As regards the trip of the Archbishop—the phrase "in the very early days of the Spanish conquest" should have been included. Pizarro commenced his conquests in 1532. Referring to the Ulloa tunnel the word 'before' in place of 'below', in the phrase "at a depth of 500 metres before the Nuestra Señora de Belen," makes an entirely different sense. The diameter of the fire-box of the furnace should read 1.5 metres, not 15. Lastly, the total of the detailed costs from January 1 to June 3, 1792, should be 31,558 pesos and 6 reales, instead of 13,558 pesos and 6 reales.

LESTER W. STRAUSS.

Lima, Peru, February 13.

Precipitation of gold from cyanide solutions by electricity has long been practised, although it has not come into general use. The Siemens-Halske electro-precipitation process is employed to some extent. A description of this method will be found in any standard treatise on the cyanide process.

Bonanza ore is said to have been found in veins in the Ocoña quebrada in the Province of Camaná, Perú. The veins are of quartz, traversing zones of diorite. In old workings in that district considerable bodies of ore have recently been developed assaying more than 1 oz. gold per ton.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Driving in hard trap rock, under the most favorable conditions, at the New Bergen tunnel of the Pennsylvania railroad, during the record week reached a speed of 6 ft. per diem.

Primary solid decomposition product of feldspars consists of clay in a variable state of purity, depending on the nature of the original rock. During the decomposition, the alkalies or other bases are mainly carried away in solution.

Lithium exists in such great abundance in the deposits of spodumene in the Black Hills of South Dakota that no market for the output from other sources can be found. The enormous deposits of lithium minerals in southern California have long been unworked for lack of a market.

Nickel-steel for automobile construction contains about 0.2 to 0.25% carbon. 3.5 nickel, 0.6 to 0.9 manganese, with sulphur and phorphorus together not exceeding 0.04. A slightly lower carbon is sometimes used for case-hardening. This steel is especially suitable for heat-treatment and for case-hardening.

Shallow concrete beams require little provision for taking shear by any other means than the concrete itself. In slabs shear is seldom provided for in the steel reinforcement. Only when beams begin to have a depth approximating one-tenth of the span does shear in the concrete become excessive, when provision for it is necessary in steel reinforcement.

Concrete is being used extensively in place of canvas tables for concentration of sand tailing from gold mills. In preparing the concrete it is necessary to make tests to find the maximum size of sand that may be used in mixing with the cement so as to give the proper coarseness of grain suitable for the best concentrating surface with the particular tailing under treatment.

Oxygen-ratio in slag-making is the ratio between the oxygen of the base and of the acid. It bears a definite relation to the replacement-value of the base. The more oxygen there is in a base the greater will be its power to replace the acid, that is, to counterbalance the oxygen on the silica side of the slag. Therefore the more oxygen there is on the base-side of a possible ore-mixture, the more silicious ore can be added to the charge.

Boiler-scale is due to the deposition of carbonates and sulphates of the alkalies, lime, magnesia, and the like, together with earthy sediment carried in the boiler-feed water. This not only lessens the available water-space in the boiler, but, on account of the non-conducting properties of such incrustation, it reduces the boiler efficiency. A crust of $^1/_{16}$ in. of scale will reduce the evaporative efficiency 13%; ¼ in., 38; and ½ in., 60. The amount of deposit from 1000 gal. of water may be calculated by dividing by 7 the number of grains of salts in solution, as shown by analysis. The quotient will be the pounds of deposit per day.

Vanadium-bronze possesses almost perfect resistance to corrosion from salt water and from acid waters. It is 10% lighter than any other bronze made, and has extraordinary tensile strength, ranging from 70,000 to 100,000 lb. per square inch. The so-called vanadium 'silver-metal', a bronze suitable for casting, and extremely resistant to corrosion, has an ultimate strength of 65,400, and an elastic limit of 44,500 lb. per square inch. The only acid against which it is not proof is nitric.

Chrome-nickel steels are usually made in both high and low-carbon types. The former is used for oil-hardened gears and springs, and the latter for general structural purposes, such as axles, shafts, forged parts, and for case-hardened gears in automobiles. The high-carbon type contains about 0.5% carbon, and the low-carbon type 0.25. The nickel varies from 2 to 3.5%, and the chromium from 1 to 1.5. These steels present difficulties in heat-treatment, forging, and machining.

Filtration of concentrate, after grinding and agitation with cyanide solution, was practised many years ago at the Black Oak mine, Tuolumne county, California, by Dan Balch. He used so-called vacuum-pans for this purpose. At that time the sand and slime were fed separately into collecting vats with filter-bottoms. The sand, after draining, was agitated and elevated to leaching vats. The slime was similarly treated, but with the aid of a slight vacuum under the filter. The clear solution, after settling, was also decanted.

Molybdenum deposits are by no means rare, and the mineral molybdenite is found quite abundantly associated with other sulphides in veins of copper and other metals. It also occurs in quite large deposits in Maine. Molybdenite is difficult to concentrate, and only that which can be hand-sorted to a suitable grade of purity could be economically produced. Commercial molybdenite ore or concentrate should contain not less than 92% molybdenum sulphide. The price ranges from 20 to 30 cents per pound for such material.

Case-hardening is a rapid process of cementation in which the surface of wrought iron is converted into steel by heating the article to be treated in an iron box in contact with some organic matter, which will yield up its carbon to the iron. Substances formerly used for this purpose were parings of horses' hoofs, leather, and the like. The operation was performed on a blacksmith's forge. Case-hardening is now done with a chemically definite material, such as a mixture of 60 parts charcoal and 40 of barium carbonate, at a temperature between 850 and 1050°C. After the operation the piece is allowed to cool just below the transformation point, namely, 600°. Reheating it and quenching at 900°C. then has the effect of rendering the centre fibrous.

Special Correspondence.

KALGOORLIE, WESTERN AUSTRALIA.

Taxes.—Ore Stealing.—Phthisis in Mines.—Tanami Explorations.—Phosphate Works at Fremantle.—Mergers.—Output and Dividends.

Some time ago the Western Australian Government demanded extra payment on the dividends paid by mining companies, they being in the habit of paying the dividends after the tax had been paid. This system, the Government declared, was wrong since the dividend was paid minus the tax. The test case against the Golden Horseshoe was decided in favor of the Government, and the company has to pay $21,000 tax and arrears. The total payable by all the companies will amount to $150,000. There have been several cases of illicit gold dealing of late, the latest device being the use of saloon keepers to dispose of the gold ore through the banks. There have been several convictions. The Government has decided to appoint a commission to enquire into the prevalence of phthisis among the miners. There is little doubt that in the dry and dusty mines of Kalgoorlie there must be many cases of this disease. The commission will also enquire into the nature of the air and gases in the mines, especially after firing shots. The Government analyst is busy taking samples.

The prospecting expedition which left Coolgardie about four months ago well equipped with a camel pack-train to examine the new field at Tanami near the northern border of Western Australia, and the northern territory of South Australia, has returned. The party covered 300 square miles in prospecting, and found little firewood; no water is obtainable by sinking; the country is mostly underlain by sandstone and basalt; wages are $25 per week with food; and freight is $200 per ton from Wyndham, the extreme northern port of Western Australia. In view of the increase in land settlement, and consequent increase in wheat production in the coastal districts, the Mt. Lyell company, of Tasmania, is erecting a plant for the manufacture of superphosphates at Fremantle. It is to cost $250,000. For the manufacture of sulphuric acid, the low-grade copper pyrite with 45% sulphur content, will be used. The phosphate rock will most probably be brought from Ocean island in the Pacific, or some islands nearer the Western Australian coast.

The latest among the many mergers which have been proposed is that of the Lake View Consols and Hannan's Star Consolidated. The former mine has some 175,000 tons of ore worth $7 per ton, with a 75-head mill using concentration, fine grinding in tube-mills, bromo-cyaniding, and filter-pressing; while the latter mine has about 160,000 tons of $7 ore, but requires a new mill. To save about $250,000 and much waiting on the part of shareholders, it is proposed to join forces, and crush right away. The mines, about one-half mile apart, would most likely be connected by an aerial tramway. In December the gold output from the State was valued at $2,800,000, making the final total for 1909 $33,850,000. Dividends totaled $6,400,000. The chief producers in December were as follows:

Name.	Tonnage.	Yield.	Profit.	Dividend.
Associated	11,481	$76,000	$2,300	.....
Associated North'n Blocks.	3,550	24,500	6,400	.....
Chaffers	4,294	34,000	4,400	.....
Golden Horseshoe	25,458	240,000	92,000	.....
Golden Ridge	2,167	28,000	14,000	$32,000
Gt. Boulder Proprietary	18,244	250,000	136,000	328,000
Great Fingall	10,613	75,000	7,900	.....
Hainault	5,870	40,000	7,600	.....
Ivanhoe	19,655	205,000	100,000	.....
Kalgurli	10,780	141,000	76,000	.....
Lake View Consols	11,306	76,000	12,500	.....
Oroyo-Links	11,917	82,000	16,000	.....
Oroyo-Black Range	4,290	53,000	18,000	75,000
Sons of Gwalia	13,484	116,000	49,000	120,000
South Kalgurli	9,021	62,000	13,000	.....

TONOPAH, NEVADA

Tonopah Extension.—Montana-Tonopah.—McNamara.—Tonopah Mining Co.—Belmont.—Tonopah Midway.

The Tonopah Extension Mining Co. is mining and milling 110 tons per day of ore that assays $14 per ton, the proportion of the metals being 30 oz. silver to 1 oz. gold. The mine levels are at the depths of 270, 400, 500, 600, 770, and 1050 ft. The bulk of the ore that is being hoisted comes from all levels down to and including the 600. Within a few weeks the 700 ft. level will begin producing. The shaft was sunk 180 ft. through the cap rock, then into the earlier andesite, cutting the vein at 220 ft. The ore-body has an east-west strike, and a dip of 40° north. The hanging wall is well defined, and the foot-wall not, the width of ore stoped ranging from 4 to 30 ft. The gangue material consists of quartz and silicified andesite. The vein is opened a distance of 200 ft. east of the shaft, extending to the property end lines; and 1000 ft. west from the shaft, with driving westward still in progress. Plans are made to cross-cut from the principal orebody to intersect and open two other veins which strike parallel to the main one. These two subsidiary veins are believed to contain ore of commercial value. The new mill, which has been in operation a little over a month, is doing satisfactory work, making an extraction of 90% of the gold and silver—35 by concentration and 55 by cyanidation.

The Montana-Tonopah is taking its principal tonnage of

Montana-Tonopah Mill.

ore from the Triangle and Martha veins, and mostly out of levels from the 396 to the 765 inclusive. The ore hoisted and milled amounts to 130 to 140 tons per 24 hours. An average extraction of 91% is made—37 by concentration and 54 by cyanidation. A coarse clean concentrate of 35 tons per month is made on Wilfley tables, and 65 tons of fine per month on the vanners. The coarse product contains 800 oz. silver and 5 oz. gold per ton, while the vanner product averages 220 oz. silver and 1¾ oz. gold per ton. The coarse concentrate contains usually 16% iron, 57 silica, 10 sulphur, 5 alumina; the vanner concentrate contains about 9% iron, 4 sulphur, 3 manganese dioxide, 2½ alumina, and 78 silica. In connection with the cyanide work the mill tailing is re-ground in tube-mills, subjected to cyanidation with agitation and aeration. The slime, 75 to 80% of which will pass 200 mesh, is put through Butters filters. The consumption of cyanide is 2 lb. per ton of ore milled, that of lime 9 lb., and zinc dust 1¼ lb. The precipitate is cleaned up in Merrill presses, then fluxed and melted in Butters tilting furnaces, for which crude oil is used as fuel; in each melt there are 1½ tons of precipitate, there being two melts per month. The bullion runs 875 to 900 fine, and is shipped without refining to the Selby Smelting & Lead Co., at San Francisco. Edgar A. Collins, the company's manager, states that the cost of mining is about $3.44 per ton of ore, that of milling $3.76. The development for 1909 cost $1.71 per ton of ore mined. The value of the ore is about $15 per ton. The power for all purposes is figured nominally at $8 per horse-power month, but it actually runs

up to $2 to $3 higher than this. The air-compressor, having the capacity of 1300 cu. ft. of free air per minute, is electrically driven, and this supplies air to run the mine-hoist and air-drills. The company, however, has a battery of three steam boilers and a steam-hoist in reserve. The mill work is under the superintendency of B. A. Bosqui.

The McNamara mine, under the superintendency of J. W. Chandler, is producing a carload of ore per day which is shipped to the Balaklala smelter at Coram, California, where highly silicious ore is in demand. This ore contains approximately 81.7% silica, 2.4 iron, 0.9 lime, and 5.3 alumina, and carries 1 oz. gold to 90 oz. silver. The value of the ore runs from $20 to $30 per ton. This production comes from the levels above and including the 375-ft. level. For 1909 the gross production of the mine was $359,579, the mining costs having been $4.58 per dry ton of ore marketed. During that year there were mined 16,229 tons of ore having an average gross value of $22.15 per ton.

The Tonopah Mining Co. is mining and milling 460 tons of ore every 24 hours, the grade averaging $21 per ton. Like most of the ore in this district the proportion of gold to silver, in ounces, is about 1 to 90. The ore contains about 85% silica and runs low in iron. The gold is mostly free, while the silver occurs as sulphide, chloride, bromide, and iodide. The principal veins are the Mizpah, having a dip of 60° north; the Silver Top, a vertical vein, and the Valley View, having a 45° dip north. The Mizpah shaft is 1500 ft. deep, though none of the present ore-producing levels are below the 700-ft., and the only development in progress below the 700 consists of diamond-drill exploration work on the 1500-ft. level. The Silver Top shaft, which is 740 ft. deep, serves as an ore-hoisting shaft for both the Silver Top and Valley View workings. The width of ore encountered in the three veins ranges from 1 ft. to 40 ft. The hoisting machinery consists of three flat-rope Wellman-Seaver-Morgan electric hoists. There are three air-compressors, one each of Ingersoll-Sergeant, Fulton, and Laidlaw-Dunn-Gordon, the last having a Rix automatic unloader for regulating the amount of air by holding open the intake valves till compression is needed. The company is sinking a 5 by 9½-ft. shaft just west from the railroad depot, on its Sand Grass claim. It is now down 160 ft. and may be sunk 500 to 600 ft. All work on this company's property is done under four department heads—W. H. Blackburn, mine superintendent; A. R. Parsons, mill superintendent; W. W. Charles, comptroller; J. T. Wolfe, of the power department. Each of these department superintendents reports direct to J. S. Austin, president of the company, at Philadelphia. A system of dividing up shifts in the mine has been inaugurated here which is claimed to work satisfactorily; the day shift goes on at 7 a. m., and goes off at 3:30 p. m.; the next shift works from 3:30 p. m. till midnight; the blasting crew of five men goes on at 9:30 p. m., firing the holes of both day and night drill crews, performing the work in such time as to give 7½ hours ventilation on levels, instead of 3½ hours where shifts are separated. This plan has been in vogue for a year. Development progresses at the rate of about 500 ft. per week, and the timbering costs 40c. per ton of ore mined. The mine force is 180 men, of which 90 are on the surface, including hoisting engineers, compressor men, machinists, assayers, surveyors, and electricians. Among other men on the mine staff, not mentioned elsewhere, are J. A. Burgess, engineer and geologist; J. M. Fox, assistant to Mr. Blackburn; J. D. Murphy, general mine foreman.

The Belmont mine is operated by the Tonopah-Belmont Development Co., with F. Bradshaw manager and R. J. King as mining engineer. This company no longer operates its mill at Millers, but ships its output of 100 tons of ore per day to the United States smelting plant at Kennett. The ore runs over $30 per ton, the proportion of gold and silver being the same as in other ores of the district. Their Desert Queen shaft is 1100 ft. deep, levels from which open the four veins of the property. The new Belmont shaft, which is 1000 ft. deep, is 1800 ft. east of the Desert Queen, and the design is that it shall become the main working shaft. A new body of ore was found in the vicinity of this shaft. It was opened by a blind level that was driven from a winze which was sunk from the 1000-ft. level of the old shaft. This blind level was then connected with the new shaft. The orebody is on the hanging wall of the Mizpah fault. The new shaft will be enlarged to 3 compartments, and further sinking will be started from the 1000-ft. station. The Occidental veins were opened by levels from the old workings at 800, 900, and 1000-ft. depth. The Occidental series is the same as the Valley View of the Tonopah M. Co. Before shipping the Belmont ore it is passed dry through a revolving screen, having 1-in. openings, thence through a revolving spiral ore-washer, Crane type, discharging upon a sorting belt, from which the fragments of barren porphyry are thrown out.

The Tonopah-Midway Mining Co., for 1909, shipped 4546 tons of ore, the gross value per ton being $38.59. The development for the year aggregated 6346 lineal feet, measuring raises, winzes, cross-cuts, and drifts. Those who are active in the management of the company's affairs comprise H. C. Brougher, W. J. Douglass, T. L. Oddie, N. Nelson, J. J. McQuillan, R. P. Stenson, H. Anderson, and E. J. Erickson.

JOHANNESBURG, TRANSVAAL.

Mineral Production. — The Outside Districts. — Base Metals. — Cape Colony Gold —Some Troubled Mines.—Esperanza and Rand Mine Sampling.

The Government Mines Department has issued its usual comprehensive report for the fiscal year to June 30, 1909, and, although behind the times, it may be made to provide some figures here in illustration of recent progress and the magnitude of mining operations in general. First in importance comes the mineral output; the main classes of product, compared in value for the years to June 30, 1908 and 1909, are as follows:

	1907-8.	1908-9.
Gold	£28,508,368	£30,986,965
Silver	90,175	87,457
Coal	778,669	851,150
Diamonds	1,879,551	1,295,296
Copper	32,400	49,027
Tin	81,677	148,336
Lead	21,761	25,432
Magnesite	900	1,487
Asbestos	11,802	7,400
Zinc	5,837	4,043
Flint	12,350	23,776
Graphite	20	78
Mercury	5	.....
Mica	.....	200
Stone, brick, pottery, etc.	153,615	173,555
Chemicals	4,834	24,300
Lime	52,474	61,955
	£31,634,128	£33,739,458

There is an increase under twelve heads. The silver yield is almost wholly represented by that obtained from Rand bullion. A visiting engineer remarked at a recent technical meeting that it was not generally recognized that the output of base metals in the Transvaal already equalled that of gold from districts outside the Rand. This statement was anything but true—for the outside gold yield averages £1,000,000 per annum—but the above figures clearly show that fair progress is being made. The value of the report is greatly enhanced by a general review of progress in the lesser mining districts by U. P. Swinburne, Inspector of Mines. The gold districts discussed are the following: (1) Barberton, in which two cases of disappointment had to be recorded in the failure of gold-dredging and in the lapse of the once famous Sheba into the tributing stage; (2) Lydenburg, which has been exceptionally active and of increasing prosperity; (3) Pietersburg, where a closing down of work has been the rule; and (4) Leydsdorp, where the proposed new railway has led to the acquisition of more ground for prospecting purposes. The principal base metals noted are tin, copper, and lead. The bulk of the tin yield still comes from Zadiplaats and Groenfontein, on which the two 'pipes' of rich ore are said to show no sign of de-

preciation. The colony's copper is drawn almost exclusively from the Messina mine, where the outlook is bright and where the large untouched area of ancient workings should further contribute to the output. The Inspector of Mines declares that the whole Messina area is well worth prospecting and that probably other mines will be located when the transport and working facilities have been improved by the construction of some northern railway. As for lead, the Transvaal has been showing little progress. The country's galena deposits are unfortunately poor in silver, and the lead alone is insufficient to give the small deposits much chance of commercial success. The Edendale silver-lead mine in the Pretoria district continues working on a small scale. The only other products mentioned in the report are molybdenum, deposits of which have been found, though without commercial value at present, and mica, which is being mined at Malalane, in the eastern Transvaal. Since the end of the fiscal year the Macoutsie River Valley Syndicate is reported to have been producing some mica of good quality. Too hopeful a view cannot be taken when the infinitely better favored mica mines of Bengal and Madras are finding difficulty in disposing of their high grade product at standard prices.

Judging by reports coming to hand from Cape Town, a determined effort is being made to revive interest in the Millwood or Knysna district, where certain conglomerates of the Table mountain series (bearing a resemblance to Rand banket) have been from time to time tested and found poorly auriferous. A company named the Cape Gold-Fields (Proprietary), Ltd., is being formed with a capital of £200,000 and a directorate of Cape Colonial magnates, whose experience of treasury deficits should enable them to face gold shortages and working losses with serviceable equanimity. The description of the property and extracts from the consulting engineers' report should be enough to condemn the property in the eyes of experienced mining investors, and those who are 'out for a gamble' would like to see smaller capital proposed. In looking into the prospects of the concern, one does not want historical explanations of failure nor elaborate descriptions of 'working facilities', but simply an intelligent summary of sampling results. These, it may almost be said 'of course', are not to be found in the columns of reading matter comprising the abridged prospectus. It is stated that "the company's engineer has defined 12 interbedded parallel reefs, and the average value is declared in the following words, 'I can with confidence describe the whole property to be an enormous highly mineralized field which will average 9 dwt. over a 3-ft. milling width.'" There is also a jumbled statement of 'composite samples', with results of doubtful significance. The promoters, with the common tendency of their profession, lay particular stress upon the perfect reliability of the assayers employed, including the Cape Government Laboratory, The Standard Bank, and Messrs. Johnson, Matthey & Co., of London, unmindful of the fact that for every ½% error in assaying there is probably a 100% error in the sampling, and that if an inefficient assayer poured away 9 dwt. in a 10-dwt. charge, he would often only be allowing a balance of personal errors to create a chance accuracy. At all events, in the present case, he would have helped unconsciously to remove the erroneous impression that Millwood is a "highly mineralized field averaging 9 dwt. over a 3-ft. milling width."

The labor position is improving satisfactorily, but the demands are so great and increasing that it is not yet time for thanksgiving. On the strength of the improved position the Geduld is starting, and many mines will receive recruits in time to save them from serious difficulties. While there are many bright spots along the Rand, it must be admitted there are several points of weakness. The closing down of the French Rand some time ago turns one's thoughts to the stability of other mines in the district. The Champ d'Or has now almost exhausted its ground and will be closing down in a few months. The Luipaardsvlei Estate is undoubtedly doing badly with its profit down to £200 in December. As a mine that has often been held up to the world as a model of technical skill, its fall appears the more serious. Dividends were paid in 1908 and 1909. Another mine—in more serious difficulties—is the Vogel Deep, where crushings are said not to have come up to expectations. Such a condition, if true, involves mystery, for the thoroughness of Rand sampling should leave no room for a discrepancy of more than 20%. The Simmer Deep has been doing wonders in the way of costs (12s. 6d., including development), but the fall in yield tells its tale (17s.). A large quantity of 'ore' is drawn from dump accumulations.

In an article on the Esperanza mine in the MINING AND SCIENTIFIC PRESS of December 25, W. E. Hindry gives some notes on sampling systems that appeal especially to the Rand engineers, for the Johannesburg mines are subjected to such thorough routine sampling. Mr. Hindry writes, "In case there was a doubt as to whether the portion of the stope where this occurred (erratic distribution of gold and silver) was above or below the payable limit, the broken ore was left in the stope until the pile could be thoroughly sampled." The care displayed in leaving underground rock upon which losses would be incurred in hoisting and treating serves as a good object lesson to some Rand managers, who, driven by the call of excessive plant and the clamor for low costs, put through the mill a great deal too much unpayable rock. When the stope sampling shows an unpayable face, it will usually be given another month's run, unless the development results preclude the possibility of a return to payability. But it would be something quite remarkable for managements to leave the ore already broken, on account of poor face-sampling. The reason is that the margin of payability on rock already broken is extremely low, owing to the comparatively small cost of subsequent operations. In the first place, it is probable nowadays that the plant is not being run at maximum capacity and that the extra cost for treating this broken rock would not be equivalent to the average costs per ton. Standing charges would be inappreciably increased under these conditions, and in any big mine, ore already broken may be ranked as payable if calculated to yield 6s. or 7s. per ton. This would mean, with 15% sorting and 95% extraction a payable mine grade of only 1.5 dwt., which shows that any precautions such as those taken at the Esperanza would not be justified upon the Rand, where a sudden fall in stope grade to this value (discovered after the rock is broken), would be a most remarkable experience.

NEW YORK.

Porcupine Scenery for Sale.— Bureau of Mines. — Phelps-Dodge Record.—Kerr Lake.—Mason Valley.—Guanajuato Amalgamated.

New York is receiving the vanguard of the Porcupine prospectors. The district itself is still covered with a three-foot blanket of snow, but some of the hardy pioneers of the Canadian camps have been shoveling and sweeping off ledges and with sacks and satchels of 'picture rock' fairly laden with leaf gold, have descended upon New York with vast areas of the untrodden wilderness for sale. Asking prices run into the tens of thousands for ground that is only claimed to show quartz outcrops. Samples said to have come from the bottom of the 60-ft. hole on the Timmins property, formerly known as the Hollinger group, show enough gold to run into fabulous values. None, save the long shot gambler, who delights in desperate chances, considers the purchase of Porcupine claims seriously, but the fact remains that none of the engineers who have examined the ground and the surface showings feels that the discovery should be turned down. Geological conditions are reported to be such as to warrant a request for suspension of judgment.

The bill to establish in the Department of the Interior a Bureau of Mines, has been reported out by the Senate Committee on Mines and Mining with favorable recommendation. The scope of the bill, or rather the work which it is intended the Bureau shall take up, is outlined in the committee's report. None who has the good of the mining industry at heart, will object to the broad lines laid down to be followed by the proposed Bureau of Mines. If through its efforts progress in the science of metallurgy can be gained, and relief from the much complained of exactions of the smelters be afforded to the individual and small operating companies, it will be cause for great rejoicing.

There is another element, however, that enters into the making of the condition described in the committee's report. A mines' act that will compel a rigidly true statement of financial conditions in the prospectus of every mining company, that will forbid the use of the advertising columns of the press for flamboyant, misleading, and untruthful advertising of mining companies, and that will forbid the use of the mails to the promoter who is seeking to mulct would-be investors, that will enforce the making of monthly or quarterly reports, both as to financial and physical conditions, and will insist upon such reports being made intelligible to the lay mind, is equally needed.

Declaration of the recent quarterly dividend by the Phelps-Dodge company, has attracted some attention to this concern's record. Since the incorporation of Phelps, Dodge & Co., in 1908, there has been returned to the stockholders $7,250,000, equal to 14½% on the company's capital of $50,000,000. If this rate is maintained for seven years the company will have returned to the shareholders the entire capital stock. The estimated production for 1909 of the Copper Queen mine is 134,000,000 lb. copper, making this mine the largest single producer in the country. In 1909 the company paid $6,000,000 in dividends. While it is not likely that production for the current year will surpass last year's figures, any material improvement in the copper market will permit of a considerably better showing.

It is believed here that there will be some important consolidations at Cobalt in the near future. The Kerr Lake and the Crown Reserve, two of the most important dividend payers of the camp, are said to be negotiating for a merger. The Mason Valley Mines Co., operating at Yerington, Nevada, has reorganized with an increase of capital stock from $1,000,000 to $2,500,000; an issue of $1,000,000 of 6% ten-year first mortgage gold bonds has been authorized. The bonds are issued in denominations of $500 each, convertible at par. The control of the Guanajuato Amalgamated has been sold to the Securities Corporation, Ltd. The figure realized for the interest transferred has not been made public. The Guanajuato Amalgamated's mill is one of the most complete in the camp, but it has never been a success in the hands of its former owners.

MEXICO.

Railroad Development. — Calumet & Sonora. — Lead-Zinc. — Pedrazzini.—Tigre, Sonora.—New Cananea Reverberatory.— Amajac, Jalisco.—Amparo.

The present year promises to be notable for railroad building that will benefit the mining districts of the Republic. Construction is in progress in many places, and a number of important lines are planned. The Southern Pacific is opening the rich Yaqui river region by the construction of its Yaqui river extension, and the main line is being built south through the Territory of Tepic, the construction forces being between the Santiago river and the City of Tepic. South of the Tepic capital the line will open the old Compostela district, famous for its heavy production during the colonial days. In the State of Oaxaca the Mexican Southern railway, now controlled by the National Railways of Mexico, is completing a branch to the Taviche district, and will proceed immediately with the construction of a branch to the Magdalena district. Richard Honey, a Mexico City banker, heavily interested in the State of Hidalgo, is building a railroad from Pachuca to Zimapán, in that State, and great activity is expected at Zimapán in consequence. Much mineral ground has been denounced there within the last few months. The Mexico Northwestern Railway Co., headed by F. S. Pearson, is closing the gap between Terrazas and Madera, in the State of Chihuahua, by the construction of 110 miles of road, and the line will place transportation facilities much nearer the old Guaynopa and Guaynopita mining districts, where many properties are under title. A branch of the Chihuahua & Pacific to Cusihuiriachic, a distance of 13 miles, is proposed by the Pearson company. Work has been started by the National Railways on 100 kilometres of railroad west from Durango to Llano Grande, and the line will be of benefit to some Durango mining sections. The Mexican Pacific Co., composed of Seattle and Victoria capitalists, is building a line to connect the Pacific ports of Acapulco and Zihuatanejo, in the State of Guerrero, and mining districts in the mountains back from the coast are interested. A railroad from Teziutlán to the Gulf port of Nautla, now being financed, will give the Teziutlán Copper Co. a direct outlet for its smelter products. The Coahuila, Chihuahua & Northwestern Railway Co., backed by Mexican City bankers, will build from Monclova, in the State of Coahuila, to the Chihuahua capital, through a territory now distant from transportation facilities. Silver-lead and zinc mines, coal-fields, iron deposits, salt lakes, and kaolin deposits will be tributary to the line. Charles Deering, of the International Harvester Co., is at the head of a syndicate that is financing the Cienegüita & Sonora Central Railway Co., organized to build across the Sahuaripa district of Sonora from Tonichi, on the Yaqui river extension of the Southern Pacific, to Yecorra. The Franco-British Syndicate has been organized by French and English interests to build from La Vega, on the National Railways, west through the State of Jalisco to the Pacific port of Chamela. The line will open the Ayutla, Bautista, Parnaso, Autlán, and Purificación mining sections. It is stated that English interests will extend the Torres & Prietas railway through the Barranca district of Sonora to a connection with the Yaqua river line of the Southern Pacific.

The property of the Calumet & Sonora Co., in the Cananea district of Sonora, is now ranked as one of the greatest lead-zinc mines on the continent. The ores run from 60 to 85%, and the development so far has placed a big tonnage in sight, and gives promise of great additional supplies. An incline shaft is down 400 ft. A mill of the Joplin type is handling about 100 tons daily and is giving satisfactory results. Regular shipments are made to Swansea, Wales. Due to the development of a large tonnage of milling ore, the Pedrazzini Gold & Silver Mining Co., operating important gold-silver mines in the Arizpe district of Sonora, has purchased additional equipment for its reduction plant, and expects to mill 50% more ore in future. The company is a steady shipper of high-grade ore, and is paying substantial dividends. The Noche Buena Sonora Mining Co., owning mines in the Yaqui river region, 25 miles from Tonichi, has purchased equipment for a small reduction plant, and will erect it immediatley. The company also owns placers on the Yaqui river, and plans to install equipment to handle 500 cu. yd. of gravel per day. D. L. H. Forbes, who had charge of the construction of the new 700-ton cyanide plant of the Esperanza Mining Co. at El Oro, is building the cyanide plant at the Tigre mine of the Lucky Tiger Gold Mining Co. There is a big accumulation of tailing that will be cyanided as soon as the plant is ready. The Tigre continues to develop exceptionally, and much rich ore is being shipped. A second reverberatory furnace, an exact duplicate of the one now in operation, is being erected by the Greene-Cananea Copper Company.

Deliveries of machinery for remodeling and modernizing the Amajac reduction works in the Hostotipaquillo district of Jalisco will be made within a few weeks. The reduction works are now the property of the Amajac Mines Co., which acquired them in connection with the Refugia, Animas, and Tres Estrellas mines. W. R. Ramsdell, a well known Jalisco operator, is at the head of the enterprise. The plant will handle 75 tons per day, and custom work will be done. The Amparo Mining Co., operating in the Etzatlán district of Jalisco, produced ₱122,557 in January and ₱121,759 in February. The company is paying dividends of 1% per month on $2,000,000.

The Oro Grande Mines Co., organized last year with a capital of $9,750,000 to re-open and work the famous old producers of the La Luz camp of Guanajuato, has placed orders for compressor plants and electric hoists preparatory to commencing operation. The compressors and hoists are to be installed within 90 days. The company has been placing stock since its organization. According to published weekly statements the ores, concentrates, and bullion shipped out of the Guanajuato district in February had a value of ₱1,055,000. Shipments in the first week of March reached a value of ₱275,000, the highest so far this year.

BUTTE, MONTANA.

Smoke Litigation — Butte Ballaklava Instal's New Electric Hoist. —Butte-Alex Scott Vein — Butte & Superior.—Corbin Mines

While business conditions have been disturbed again by the report that proceedings have been instituted to secure an injunction looking to the closing down of the Amalgamated company smelter at Anaconda there is a feeling in this city that no such action will be taken. The Amalgamated company claims that everything possible to do away with the smoke nuisance so called has been done at an enormous outlay but that no practical system by which the smokeless elements can be disposed of has yet been discovered. It is also claimed that the statements regarding the damage by the smelter's operation are greatly exaggerated. The new electric hoist for the Butte Ballaklava Copper Co. which arrived several days ago is in position and in working order. The hoist is the first deep sinking electric hoist to be erected in this district and takes the place of the electric hoist which has been in operation at the Butte Ballaklava for the past year. It will be driven by a 350 hp. General Electric motor. It has a capacity for sinking to a depth of 3000 ft., is provided with air brakes and clutches, and is one of the most complete. The Butte Ballaklava expects to increase its output to 4500 tons per day. A new head frame has been constructed, carrying two sheave wheels each 6 ft. diam. New steel ore bins capable of holding 700 tons of ore have also been built. The new hoist was built by the Lake Shore Machinery Co., at Marquette, Michigan. The Butte Alex Scott is considering constructing a concentrator. The principal work in the mine during the past few months has been on the 1400 ft. level. The vein, which is more than 40 ft. wide on this level, was intersected within a short distance of the shaft, and a drift about 100 ft. west opened an orebody about 18 ft. wide. Much of the ore is said to be of exceptionally high grade. The orebody has been proved on the 1200, 1000, and 800-ft. levels. The Butte & Superior during February shipped 6000 tons of ore to the concentrator at Basin that netted $3.75 per ton after paying mining, transportation, and milling charges. An auxiliary hoist is to be installed, and this will increase the tonnage to 450 tons per day, and at the same time decrease the cost of mining. The Boston and Alta new shaft is now down 605 ft., or some 42 ft. below the deepest workings of the old mine. At the 660-ft. level a cross-cut will be driven to the Alta and other veins. Several stringers of ore have been cut in the shaft. These vary from 1 in. to 1 ft. in width and carry from 3 to 4% copper, together with small amounts of gold and silver. A new electric air-compressor has been put in with a hoist capable of sinking to 1500 ft. Representatives of the H. L. Frank estate, owning a controlling interest in the Southern Cross mine, situated a short distance from Anaconda, positively state that the report that the United States S. R. & M. Co. has purchased the mine is untrue. At a depth of 250 ft. in the east drift at the Montana-Corbin mine the vein has widened to 2 ft., assaying 6% copper and 19 to 20 oz. silver. The dip is toward the shaft, and on the 400-ft. level this vein was intersected in cutting the station. On the latter depth the vein is 62 ft. wide between the walls, and contains numerous generous streaks of high-grade ore. The walls are well defined and identical with the Butte granite. In every way the formation is the same as that in the Butte district, the only difference being that valuable ore is found nearer the surface. Shipments will begin in a few weeks. The stock of the Corbin Metal Co. is to make its appearance on the New York curb in a short time. The property consists of 178 acres of ground.

At a special meeting of the stockholders of the Anaconda Copper Mining Co., March 23, it was decided to increase the capitalization of the company, and to offer to the following named companies the respective amounts herewith of the capital stock of the Anaconda Mining Co. in exchange for the properties owned by them: to the Boston & Montana, 1,200,000 shares; Red Metal, 500,000; Washoe Copper Co., 380,000; Butte & Boston, 300,000; Big Blackfoot Lumber Co., 300,000; Trenton, 120,000; Diamond Coal & Coke Co., 100,000; Parrott,-90,000; and Alice, 30,000 shares.

WASHINGTON

Bureau of Mines — Alaska Legislation and Railways — Coal Reserve.—Naval Oil Reserve in Oklahoma.—Land Surveys.

The Bureau of Mines bill which passed the House more than a month ago has been reported favorably to the Senate by the Committee on Mines and Mining. Before this action was taken the committee listened to arguments in favor of such a Bureau from D. W. Brunton of Denver, Colorado, president of the American Institute of Mining Engineers; E. R. Buckley, Rolla, Missouri, president of the American Mining Congress; H. D. Mannington, Columbus, Ohio, secretary of the Coal Operators' Association of Ohio; Samuel A. Taylor, of Pittsburg, Pennsylvania, secretary of the Pittsburg Coal Operators Association; W. D. Blair, secretary of the National Brick Paving Manufacturers' Association, and J. F. Calbreath, Jr., of Denver, Colorado, secretary of the American Mining Congress. As reported to the Senate the bill provides for a Director at $6000 a year instead of a Commissioner at $5000, and this adds that the Director shall be thoroughly equipped for the duties of his office by technical education and experience. Members of the committee insisted that the Bureau should be a scientific organization with a scientific man at its head, and that the place was not one for a politician. That phrase in the House bill which declares it to be the province and duty of the Bureau "to foster, promote, and develop the mining industries of the United States" was stricken out in order to keep the Bureau out of any phase of the work other than that of scientific investigation, although practically every bureau of the Government has a similar statement of purpose in its organic act. Section 5, which is an amendment, is as follows: "That nothing in this act shall be construed as in any way granting to any officer or employee of the Bureau of Mines any right or authority in connection with the inspection or supervision of mines or metallurgical plants in any State or Territory."

Alaska and her minerals still occupy a considerable share of public attention in Washington. The bill, which was introduced in the Senate several weeks ago by Albert J. Beveridge, of Indiana, creating a Legislative Council and conferring legislative powers upon the district, is not to be pressed to passage at this session. Considerable opposition arose and the bill was liberally amended. Then it was decided, in view of the chaotic conditions in regard to the mineral lands, to hold the matter over. That Alaska will continue to develop in the meantime is evidenced by the number of bills being introduced affecting the district. Henry W. Palmer, representative from Wilkesbarre, Pennsylvania, in behalf of Eastern capitalists, most of them from Philadelphia, has introduced a bill giving Government aid in the construction of a railroad, telegraph, and telephone line in Alaska. The line is to be known as the Alaska Great Northern railroad, and will begin at a point on the Gulf of Alaska, at or near the head of Valdez bay. James Wickersham, delegate from Alaska to Congress, has introduced a bill to extend the time for beginning construction of the Alaska Short Line railroad. Reed Smoot, Senator from Utah, has a bill which seeks to relieve the Copper River & Northwestern Railway Co. from license tax and tax on its property during the period of construction and for five years thereafter. A bill to create a national coal reserve in Alaska has been introduced in the Senate by George C. Perkins, of California. The bill provides for the reservation of 5000 acres of the best coal lands in the Katalla district, 5000 acres in the Matanuska district, 5000 acres in the Kenai peninsula, and 5000 acres in the Alaska peninsula. This bill was followed by another by Thomas P. Gore, Senator from Oklahoma, seeking the creation of a reserve fuel oil supply for the United States Navy. The bill authorizes the Secretary to acquire such land as is necessary adjacent to the oilfields of Oklahoma for the erection of tankage and the laying and gathering of such lines as will be necessary to purchase directly from the producers of oil, at a price as low as the market conditions and the demands of the Navy shall justify. One million dollars is asked by Richard A. Ballinger for public land surveys for the coming fiscal year.

General Mining News.

ARIZONA.

COCHISE COUNTY.

The Copper Queen company has been experimenting with 'Missouri' candles and Leyner drills.——The drift from the Holbrook shaft on the 200-ft. level to the Uncle Sam has been put into condition, the trolley wire is up, and a motor is now hauling all the ore from those two places.——At the Czar, on the 500-ft. level, a diamond-drill at a depth of 250 ft. entered a deposit of soft sulphide.——On the 1400-ft. level at the Lowell a drift runs for 800 ft. through a good sulphide ore, and a winze sunk on this level shows it is over 100 ft. deep. The Lowell shaft will have to be sunk to the 1600-ft. level in order to get under the orebody. On the 800-ft. level samplers discovered an orebody of high-grade oxide; of 35 samples taken the last one assayed 28%. ——The Sacramento shaft is now 1680 ft. deep. A drift is being run on the 1600-ft. level to get under the great ore body of the Lowell.

GILA COUNTY.

(Special Correspondence).—Work has been resumed in the No. 4 shaft of the Miami Copper Co. from the depth of 600 ft., where a temporary delay was due to lack of creosoted shaft timbers. On the 420-ft. level of the mine, tracks and switches are being laid for the motor cars. The ore-body above this level is practically ready for extraction by the 'caving and auxiliary raise' method. It is estimated that about 3000 tons can be extracted daily through the 420-ft. level. The steel frame for the machine shop is erected and work is begun for the concentrator building adjoining. The machinery for the power-house and machine-shop is expected soon.——The last two churn-drill holes put down on the Inspiration property, about 800 ft. south of the Scorpion shaft and 1600 ft. west of the Joe Bush shaft, passed through about 300 ft. of ore. The cross-cutting south on the 275-ft. level of the Scorpion shaft continues in ore 380 ft. from the shaft. Raising is the principal work in progress at the Joe Bush 400-ft. level. A new wooden head-frame at this shaft has been put in commission, and cages are now being installed. The 15-drill compressor in Keystone gulch is being given its first trial. It will operate four or five air-drills in the Joe Bush workings and two in the Keystone Gulch adit.——At a depth of 640 ft. a 4-in. seam of specular hematite, accompanied by some copper stain, has been encountered in the Williams shaft of the National Mining Exploration Co.——The Boston-Miami Copper Co., just incorporated, has taken over the property of the Boston-Miami Development Co., and the following officers were elected: H. F. Fay, president; C. J. Morrissey, secretary and treasurer. In addition to these two officers, the board of directors consists of George G. Endicott, Walter L. Frost, and James Gardner. Alton B. Dickerman is consulting engineer; F. W. Hoar is superintendent. About forty men are employed in churn-drill operations.——The churn-drill operations on the Schultze group of claims, in the southwestern part of the Miami district, have been discontinued.

Globe, March 19.

CALIFORNIA.

NEVADA COUNTY.

(Special Correspondence).—It is rumored that the Empire Mines Co. has made an offer for the Pennsylvania group. The latter is one of the best known properties in the district and has been a steady producer for a number of years. ——The main adit at the Fruitvale has opened 8 ft. of milling ore at a point 450 ft. from the portal. It is intended to install a compressor and machine-drills in the spring. Andrew Fitzgerald is manager. San Francisco and Oakland capitalists are interested.——The vein in the foot-wall of the 800-ft. level of the Champion has widened to 9 ft. Twenty stamps are dropping on ore from this point and 73 men are on the pay-roll. It is possible that the Home shaft will be sunk 200 ft. deeper to open the new vein in the Champion workings. The vein mills about $6 per ton.——The tunnel being driven on the Constitution vein is expected to intersect the Great Western vein within 100 ft. Adits on the Douglass and Cheyenne claims are being repaired. All of these properties lie in Willow valley and are owned by Peter Tautphaus, of San Francisco. Chinese lessees on the Jerry Goodwin placers, near You Bet, recently cleaned up $20,000 after working a few months.——It is stated that the Birchville mine will shortly resume activities.——A dispatch from New York states that negotiations for the acquisition of the Murchie mine by the United States Smelting, Refining & Mining Co. are under way. E. H. Wilson, former manager of the Sixteen-to-One mine is conducting affairs.——At the Golden State a vein of $13 ore is being developed. It contains a small percentage of copper.—— Wall Bros. are developing a promising auriferous deposit on the Shields ranch. It consists of a 100-ft. porphyry dike, between walls of granite and slate, and was formerly worked by sluicing.

Grass Valley, March 21.

TRINITY COUNTY.

(Special Correspondence).—Chapman Bros. have opened a new gravel channel above Junction City. The first clean-up gave 12 lb. of gold and the indications are that the channel is much more extensive than was expected.——Hennesey & Fulmore are working the Sherwood mine on a lease and have some high-grade ore. Skinner, Fields & Meckel are preparing to resume work on the Mountain Boomer. Options have been begun on several other properties in the Upper New River district. A find was recently made in the Yellow Jacket district on the opposite side of the mountain from the Yellow Jacket mine. The ore is of the same character as that in the Yellow Jacket. The small placer mines are working on full time with prospects of a good season's run.

Weaverville, March 21.

TUOLUMNE COUNTY.

(Special Correspondence).—A small but rich vein has been uncovered by cross-cutting to the hanging wall on the 650-ft. level of the Republican mine.——A large number of placer locations have lately been made in the Jawbone district, through which, it is believed, runs the rich channel that is being worked near Groveland. Coarse gold has been found in several of the claims. Some promising quartz veins are also known, and unusual mining activity is expected this summer.——The mill at the Dutch mine, which was recently partly re-constructed, has been given a trial run and will soon be in continuous operation, crushing ore from the 400, 600, and 800-ft. levels.——The Cleveland mine, situated two miles north of Tuolumne, and owned by J. Sivori and sons, has been bonded to G. E. Brown, of San Francisco.——A 10-stamp mill has been purchased for the Blue Lead group of mines, which are situated near the junction of Moccasin creek and the Tuolumne river, and operated by S. Bjorlen and C. H. Gustafson. The Blue Lead vein averages 5 ft. wide and assays from $5 to $10 per ton.——Work has been resumed in the Grizzly mine with a small force of miners.——Work has also been resumed at the entrance to the main adit of the Providence mine.——The Columbus mine, three miles northwest of Tuolumne, has been bonded.——Barrett Bros., who have driven an adit 150 ft. at their property two miles southeast of Confidence, have found a shoot of ore 6 ft. wide that assays $20 per ton.——Rich ore has been uncovered in the shaft at the old Oliver mine, near Steven's Bar, by Marcus Mullin and George Murphy, who are working the property under lease.——A hoisting engine has been installed at the Bismarck, and sinking is again in progress. The bottom of the shaft is in good milling ore.——The large restraining dam at the Little Gap gravel mine is nearing completion, and it is expected that mining operations will begin within a few days.——A contract has been let to drive the adit at the McCormick-McPherson mine, east of Jacksonville, an additional 100 ft.——Another body of fine ore has been opened in the south drift on the 500-ft. level of the Draper mine. The mill has been running day and night, with good results, but is now temporarily idle owing to the breaking of a cam-shaft. Thirty men are employed.——Operations have been resumed at the Black Oak mine, the new drum for the

hoist having arrived. Development will be commenced about May 1 at the Ryan mine, near Sugar Pine, recently bonded to J. C. Spangler, of New York.

Tuolumne, March 19.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence.) A body of smelting ore 2 ft. wide was encountered last week on the Charter vein operated through the LaMoe adit. A 10-drill compressor arrived the first of this week for the Bellevue-Hudson mine, situated on Columbia mountain. In the bottom of the shaft, down to a depth of 120 ft., a body of smelting ore 2 ft. wide has been found that is worth $380 to the ton in silver and lead. Work has been resumed in the raise from the Scepter adit to the Sunburst workings. Electric power has been secured and it is expected to complete the raise inside of 60 days. A body of mineralized quartz 18 ft. wide has been encountered in the C. & H. adit on Covode mountain. The find was made on the Surprise vein cut 130 ft. from the portal. Tests just made show 2.40 oz. gold and 4 oz. silver per ton.

Georgetown, March 18.

(Special Correspondence.) Work was put under way last week by the Gilpin Imperial M. Co., operations being conducted through the Newhouse adit. Three lode mining claims are controlled, the property was intersected 14,000 ft. from the portal of the adit.——The Little Mattie mill up Chicago creek is running night and day and a heavy tonnage of concentrate is being marketed. The Stanley mine will shortly be classed among the heaviest shippers in the county. In addition to tributors, James Bowden, the manager, is employing a big force of company men, work being centered on the second level. Returns of from $45 to $50 per ton are being realized.— Warren & Co., leasing on the third level of the Shafter mine, have found a streak of smelting ore that is from 6 to 10 in. wide and assays 9.80 oz. gold to the ton with 20% copper.

Idaho Springs, March 19.

GILPIN COUNTY.

(Special Correspondence).—The Gunnell mines at Black Hawk were sold last week to foreclose under a bond issue in favor of the Federal Trust Co. of Boston. The property was bid in for $300,000.——The Quaker City mine on Quartz hill has been taken under lease by a pool of local miners. The shaft, down 200 ft., is to be sunk another 100 ft., and day and night shifts will be employed.——Work is to be resumed on the Golden Sun property up South Boulder creek April 1; E. T. Butler, of Denver, will be in charge.—— The new shaft building on the Alps mine in the Nevada district is about completed.——D. S. Davis is employing a force of men in the development of the Russell mine. During the last week a 12-in. streak of copper-iron ore was uncovered on the 200-ft. level that will mill from $40 to $45 per ton in gold. There is also exposed a body of mill ore that is 4 ft. wide.——The Fifty Gold Mines Co. sold last week 107 oz. gold that brought $1800 at the Rocky Mountain National Bank.

Central City, March 17.

TELLER COUNTY.

The Cresson is worked on company account and production is on the increase.——Fred Johnson and his associates, principally Denver men, who have worked several years and spent thousands of dollars on the Pride of Cripple Creek property, on Ironclad hill, are reputed to have made one of the best finds in the district. A small ore-shoot was encountered some months ago and development was commenced in earnest. Only the ore mined in the course of development was shipped, but it gave splendid returns.

IDAHO.

IDAHO COUNTY.

Central Idaho is excited over discoveries near Elk City. The Harmon & Morrow claim is being examined by A. W. Harvey for J. C. Haas, of New York.——The Center Star group has been bonded to B. Binnard & Co., of New York, for $100,000.——Orders have been issued for the construction of 40 miles of the Gilmore & Pittsburg railway from Salmon City west.

MISSOURI.

JASPER COUNTY.

(Special Correspondence.) One of the largest purchases made in the district for some time is that of the Old Dominion Co., which has procured 660 acres of land in fee in the Joplin district and 700 acres of leases in Oklahoma, west of Seneca. Of this, 20 acres lies northeast of Turkey creek, where profitable mining has been carried on by several companies. A large amount of drilling and development was done here last year, and two shafts were sunk into a valuable orebody. Among the mines situated in the immediate vicinity are the old Dividend, the old Cardinal, the Green Dog, and the Kalitan. The rest of the land purchased lies between Wentworth and Ritchie. The plans for the new holdings involve the immediate development of the 20-acre tract along Turkey creek by drilling. The tract near Ritchie will be subleased under attractive terms to force its development. The company already owned a large acreage scattered over the district as well as many leases. The company is one of the largest and most active in the district.——The Green Dog Co., operating along Turkey creek, has after long development reached a good productive stage. The company now has three shafts in ore at 85 ft., where a 12 ft. face is opened. The orebody seems to be 300 ft. long and 35 ft. wide. The entire tract has been extensively mined for shallow mineral and the ground is honeycombed with old shafts and drifts. The old mill has been overhauled and almost doubled in capacity, now equalling 250 tons.

Joplin, March 17.

MONTANA.

MADISON COUNTY.

The Conrey Placer Mining Co. has contracted with the Marion Steam Shovel Co. for a new dredge. Construction is to begin April 15, and the machine is to be completed November 1. The hull will be 150 ft. long, 58 wide, and 13 deep. The bucket chain will contain 80 buckets of 15-cu. ft. capacity, each weighing 4200 lb. The dredge will have a stacker 130 ft. long, and two spuds each weighing 45 tons. The capacity is to be 300,000 cu. yd. per month, and 1050 hp. will be needed.

NEVADA.

CLARK COUNTY.

Late reports from Alunite confirm the news of an important discovery of high-grade ore. The company has stopped work and is giving out no information. It is known that rich sulphide ore similar in character to the Goldfield high-grade has been found. Robert T. Hill has been summoned from New York by wire.

DOUGLAS COUNTY.

An electric plant is to be installed at Minden by W. H. Metson and P. O. Chappelle, who control a water-power site. They have recently let a contract for a 1500-kw., 2200-volt, 3-phase, 60-cycle, 400-r.p.m. water-wheel type alternator; two 65-kw. motor-generator exciter set; a 65-kw. direct-connected exciter unit, and six 200-kw. 55,000/2200-volt oil-filled self-cooled transformers to the Allis-Chalmers Company.

EUREKA COUNTY.

The Buckhorn Mining Co. has a partly developed gold mine 28 miles southeast of Beowawe, and it is reported that a crushing mill and cyanide plant is to be erected on the property. F. J. Siebert is connected with the company.

HUMBOLDT COUNTY.

(Special Correspondence).—The National mining district, in which the town of National is situated, is 75 miles north of Winnemucca. The town is 7 miles south of the Oregon State line, at an altitude of 7000 ft., and has a population of about 400 people. Stages and automobiles are run daily between the two places. The richest ore was mined by Stall Bros., who had a lease on the group known as the National of Nevada, which produced about $150,000 in gold and silver last year. Returns from the Selby smelter show that 106½ lb. of ore yielded $8149; 188 lb. in another lot brought $10,719; 121 lb. returned $9531. A larger shipment, 2503 lb., brought $6858. The ratio of gold to silver in these shipments was 1 oz. gold to 1 oz. silver. The high-grade

came from a seam in the vein that was comparatively narrow, while the wider part of the vein carried gold associated with antimonial silver, and some cinnabar. This property was developed by a system of levels on the vein from the mountain side. Work has been suspended several months for a suit which is pending. Stall Bros. claim the right to an extension of their lease, which, they assert, was promised them by the former directors, the new board is trying t dispossess the lessees. Adjoining the property mentioned above is the First National, controlled by S. W. Gundaker and associates: still another is the National Consolidated, in which Seattle men are interested. Several lessees are at work on the latter, and they are reported to have cut the famous Charleston vein from which the high-grade ore of the camp was taken. The Radiator is under bond and lease to Cummings, Dwyer and O'Connel, who are said to have made a payment on the price named in the bond. A shaft is being sunk on the Workman group on Auto hill, by Phil Blume and associates, who have installed a gasoline hoist. The shaft is down 300 feet.

Winnemucca, March 20.

LYON COUNTY.

(Special Correspondence).—The Nevada Copper Belt railroad, built by the same interests which control the Nevada-Douglas Copper Co., extends from Wabuska to Mason, a distance of 14 miles, the latter being 2 miles southwest from Yerington, and 1½ miles east of the Mason Valley mine. This line is being extended, the route running 8 miles south of Mason, through a pass into Smith valley, thence north 10 miles to the Nevada-Douglas mines, which include the Ludwig. A gasoline motor car, for passenger traffic, operates between Wabuska and Mason. The smelting plant, the construction of which is being planned, is an enterprise of the Mason Valley Copper Co., which has selected a site one mile north of Wabuska. It is assumed that this smelter will treat ore from all the mines of Yerington district.——The Nevada Mining, Reduction & Power Co. is operating a mine and an 18-stamp mill at Silver City, and is erecting a 40-stamp mill and cyanide plant at Rock Point, close to Dayton. The structure is of steel. Herman Davis and W. B. Sayers, of Dayton, are active in the management.

Yerington, March 19.

NYE COUNTY.

(Special Correspondence).—The orebody recently opened in the lower workings of Montgomery-Shoshone is good, but lacks the sensational richness with which it has been credited. The mill is running steadily. Most of the ore is coming from the glory hole, with about 250 tons per month from the Polaris.——The Goldfield Reduction Co. has entered the market for the buying and treatment of local ores. ——Most of the machinery has been installed at the Bonnie Clare mill, and it is expected to have the plant in operation within 30 days.——The tunnel of the Bullfrog Gold Centre Co. is in 610 ft. and will be driven to 6500 ft. Four veins have been intersected.——The Nevada ore mill at Beatty has been completed. The initial run will be made on a carload of Pioneer ore. ——The machinery for the Eclipse mill has arrived. It is expected to commence crushing within a few days.——The Sunrise Pioneer lease on Pioneer Con. estate has opened 10 in. of rich ore. At a depth of 220 ft. the main vein has been cross-cut 20 ft. and runs into milling grade.——The shaft on the Pioneer lease is being sunk to the 400-ft. point. Fifteen to twenty tons of ore worth about $100 per ton is being produced daily. A like amount assaying $15 to $20 is being placed on the dump.——The Gillespie and Dougherty leases on the Jim Butler are developing shipping ore. The shoots run about 1 ft. wide. Two machine-drills are used on the Gillespie lease.——The Montana-Tonopah company has secured options on the After-all, North Star, and Miriami claims.——W. H. Bond has opened a strong vein on Bare mountain. It is said to run 50 ft. wide, about 20 ft. assaying $40 per ton. It was uncovered at a depth of 2 ft.——The Manhattan Thanksgiving has opened a 5-ft. vein at a depth of 450 ft. assaying $20 per ton.

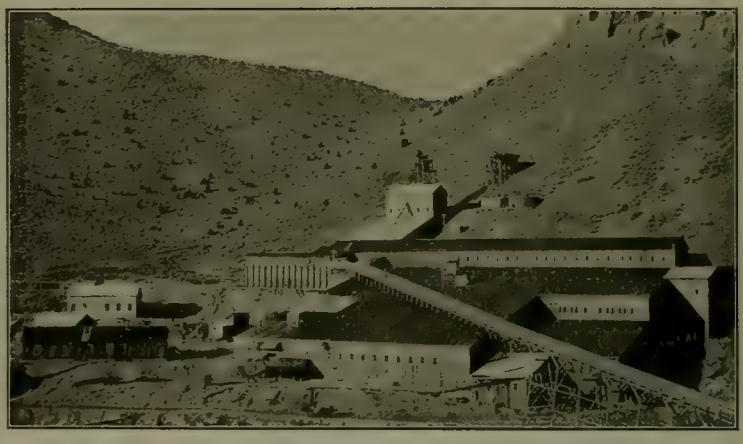
Rhyolite, March 17.

(Special Correspondence).—Round Mountain now has a larger reserve tonnage than ever before. The monthly bullion returns are about $25,000 to $40,000. Quarterly dividends aggregate $260,000 to date.

Round Mountain, March 19.

STOREY COUNTY.

(Special Correspondence).—The Charles Butters Co., Ltd., which purchased the Monte Cristo claims in Seven Mile canyon, below Virginia City, expects to open the orebody thereon and build a surface tramway from that property to the mill. The 160-ft. shaft is to be sunk deeper. This company is still operating on the Chollar and Potosi as lessees, and will begin shipping again from these workings April 1. Recent work there consists of a winze that was sunk 133 ft. below the 218-ft. level. The Butters cyanide plant has resumed work on the Ophir tailing, which contains gold and silver worth from $3 to $6 per ton. At present 150 to 200 tons per day are being treated. Later the company's 20-stamp mill will be started to concentrate the ore from the Chollar and Potosi leases. S. M. Stone is general superintendent.



Butters Plant, Virginia City.

Virginia City, March 21.

NEW MEXICO.

SIERRA COUNTY.

(Special Correspondence).—The Morrison crusher recently installed at the Keystone property has begun work and a cyanidation plant is to be built. Most of the machinery is on the ground. An experimental treatment plant will be built also for testing other ores.——The station at 200 ft. in U. S. Treasury shaft No. 1 is about to be cut. The Gold Reserve group is being examined for Alabama people.——Jobe & Son, operating the Eureka near the Keystone, have 15 men at work and have ordered lumber for bunk-house and other buildings.——The U. S. Treasury company will build a telephone line from Chloride to shaft No. 1.

Chloride, March 19.

SOUTH DAKOTA.

LAWRENCE COUNTY.

The Homestake is running full, and recently hoisted 5292 tons in 24 hours. The regular monthly dividend has been declared.

WASHINGTON.

FERRY COUNTY.

(Special Correspondence).—During February the Republic Mines Corporation shipped 15 carloads of ore, and other lessees shipped two from the Lone Pine No. 4, both belonging

to the Pearl Consolidated Mining Co. The Tom Thumb mine, owned by the Midget Gold Mining Co. and leased with an option to purchase by The New Republic Co. has been sold. The New Republic Co. recently elected a new board of directors with R. I. Howard as vice-president and general manager. The prospects in the Southern Republic mine are quite encouraging. Samples assay from $2 up to $40 per ton. The Ben Hur mine is sending four carloads of ore per week to the Granby smelter at Grand Forks, British Columbia.

Republic, March 14.

OKANOGAN COUNTY.

(Special Correspondence.) The Palmer Mountain Tunnel & Gold Mining Co.'s directors are planning to liquidate, dismantle the plants, and dispose of the material on hand, minority stockholders object. The necessary capital has been secured and work will be resumed immediately on the Golden Chariot mine on Kruger mountain. The main hoist will be installed and the shaft will be sunk 200 ft. deeper. The shaft follows the vein, which maintains an average width of six feet.——The Molson Mining Co. has sunk a shaft on the Poland China mine 135 ft. and is driving both ways.——Work on the Jim Hill group, on Copper mountain, near Chesaw, will be suspended until quarters can be built for a larger force. The shaft has been sunk 91 ft., and three drifts have been driven, finding ore of excellent quality. An adit will be started farther down the hill, to be eventually 11,000 ft. long. A short wagon road is under construction, connecting with the Grant road.

Conconully, March 18.

STEVENS COUNTY.

(Special Correspondence.) A new gasoline hoist is being installed at the Swamp King mine, near Orient. The shaft has exposed a 5-ft. vein of free-milling ore.——The Napoleon mine is again in operation. The British Columbia Copper Co. is expected to begin soon the construction of a smelter about two miles north of Godfrey, on the Kettle river, for the reduction of Napoleon ore.——The Orient Gold Mines, Ltd., has been incorporated, with a capitalization of $1,500,000. The incorporators are Frank Ansley, A. B. Railton, and Charles J. Johnson, of Spokane.——W. J. Caplin, of Orient, with J. S. Payne, H. E. Wadsworth, and E. J. Merrin, of Spokane, have organized the Orient Mystery Gold Mining Co., to operate the Eagle, Mohawk, and Mystery claims, near the head of Pierre lake.——The Germania Mining Co. has spent $250,000 during the past four years on its property near Deer Trail. The company owns two quartz claims, on which tungsten ore is mined, and a section of land, all patented. This company, financed by the Krupps, of Essen, Germany, is now employing 60 men on its tungsten property.

Colville, March 19.

WISCONSIN.

Geological students from the University of Wisconsin have been visiting the zinc mines near Hazel Green, Cuba, and Livingston.

MEXICO.

CHIHUAHUA.

The Rio Plata Mining Co. has declared a 2% quarterly dividend. The balance of the indebtedness on the property has been paid out of earnings. The mine is situated in the southwestern part of Chihuahua, 85 miles across the Sierra Madre from Sanchez on the Kansas City, Mexico & Orient railway, which will run within 20 miles of it when completed. It was discovered six years ago by Rudolfo Cruz, who sold to the present owners.——Concentrate assaying 1000 oz. silver, is being shipped by pack-mules to the railroad. Since the present owners took charge about 700 tons of concentrate have been shipped as well as silver bars from the cyanide plant. The output at present is approximately 1,000,000 oz. annually.

OAXACA.

(Special Correspondence).—The famous San Juan case has been settled. By a unanimous vote of the Federal Supreme Court, C. A. Hamilton has received confirmation of the decision of the lower court. This places Mr. Hamilton again in possession of the property, with, least to demand accounting for the proceeds of the mine. Cave he is being examined as to tonnage, grade of ore and treatment methods with reference to a proposed custom mill. A corps of engineers of the National Lines of Mexico is making surveys beyond Tlacolula toward Tehuantepec and the line to Tlacolula is now being extended from Oaxaca.

The recent failure of the I. S. Banking Co. with the possibility of a long delay before any settlement is effected caused a number of mines to close.

Oaxaca, March 17.

SONORA

(Special Correspondence). The La Dura Mining & Milling Co. operating the Gloria and Prieta mines at La Dura on the Yaqui river, has sunk a 1040 ft. vertical shaft at the Prieta and 1300 ft. incline at the Gloria. Both properties are producing high grade silver ore, with a little gold, copper, lead, and zinc, though the latter is so trifling that the company has never been penalized for its excess in shipments to the smelters. The country rock is andesite, and the ore is found in a quartz gangue. At the Gloria the ore dips about 60°, and the fissure is very regular, but at the Prieta a second series of faults has left the ore in terraces. The force that caused the second faulting operated when the vein was comparatively flat and raised the central portion above the terraces on both sides. In following the slips down from one body to the next the management has found that there is approximately 6 in. of gouge for every 25 ft. of displacement, and in this way can roughly determine the position of the ore which now has a dip of from 10 to 15°. A later cross-faulting has broken the vein slightly, though not enough to seriously affect mining operations. The water in the Prieta only amounts to 1800 gal. per 24 hr., although it is several hundred feet below the level of the Yaqui river. There is a concentrating mill on the property, the capacity of which varies from 60 to 100 tons per day, according to the grade of the ore. Both mines are equipped with hoists and compressors which were packed in on mule-back. A German make of air-drill is used, the bit being Z-shaped, and the effect is more one of boring than drilling by percussion. The work is done largely by contract with Mexican laborers or Yaqui Indians, who sort the ore underground. They are excellent judges of the grade of ore, and sort to within an ounce or two of what the contract calls for. In other portions of the work only the drilling is done by contract, the laborers receiving 20 centavos per foot for machine-work and 37½cv. for hand-drilling. The hand-drillers sharpen all their own steel, and the machine-men use a file on their bits till the gauge is completely gone, when the company's blacksmith sharpens them. Wood costs the company ₱5 per cord of 4 by 6 by 6 ft. delivered at the mine, and must weigh at least 1500 kg., or the contractor is docked. It is all hardwood and makes an excellent fuel for steam and domestic use.

La Dura, March 13.

PHILIPPINE ISLANDS.

The Stanley dredge on Paracale river is handling 1500 cu. yd. per day and getting about 60 oz. gold per week, according to John Gillies.——George Laduc has organized a company to work the Australiano and Navotas claims in the Mambulao and Paracale districts.——The Paracale Gold Dredging Co. has begun work on a number of quartz claims recently optioned.——R. E. Kent is now foreman for the Benguet Consolidated. Mr. Kent had extended experience in the Rocky Mountain States, but came to the Philippines from Korea, where he was with the Oriental Consolidated. ——Prospectors have left Manila for Surigao, the Cogayan River district in Misamis, and other points in the neighborhood of Iligan, Llanoa district, where placer deposits are attracting attention. The gold now in the native diggings is coarse. Nuggets worth ₱50 to ₱100 are occasionally found.——American prospectors have found placer deposits in the Nueva Ecija, province of Luzon. The gravel contains 30 to 80c. per cubic yard as far as prospected, and 10,000 acres are involved. Of this, 1500 acres has been tested and found to contain 33 to 62c. per cubic yard. The ground is adapted to dredging.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

J. F. KEMP was at Butte.

J. R. FINLAY was in San Francisco this week.

RALPH ARNOLD was in San Francisco this week.

W. SPENCER HUTCHINSON has returned to Denver.

WILLIAM W. ROSE was in San Francisco last week.

LLEWELLYN HUMPHREYS, of Salt Lake, is in the East.

J. M. CALLOW has returned to Salt Lake from the East.

D. J. KELLY, of the Kelly Filter Press Co., is in Mexico.

S. F. SHAW has been recently examining gold mines in Alabama.

E. A. ZEISLOFT, of Shoshone, Idaho, has removed to Vale, Oregon.

H. G. GILKERSON has taken new offices in the Boston Bdg., Salt Lake, Utah.

ROBERT H. RICHARDS has returned to Boston from a professional trip to New York State.

W. G. ADAMSON, of Winnemucca, Nevada, is expected back from Philadelphia by April 1.

O. H. PACKER is at Santa Rosa as an expert witness for the Cecelia Magnesite Mining Company.

FRANK BURNS, of the Arkansas & Arizona Copper Co. at Jerome, Arizona, has gone to Guanajuato, Mexico.

S. H. BROCKUNIER arrived in San Francisco from Wheeling, West Virginia, and has gone to Graniteville, California.

W. G. EBERHARDT, of Ridgefield Park, New Jersey, was recently in Humboldt county, Nevada, on examination work.

C. A. FISHER has resigned from the United States Geological Survey to enter private work in partnership with Ralph Arnold.

KARL P. SWENSEN sailed for Nanking, China, on the *Korea*, March 21. Mr. Swensen goes to take a position in the School of Mines of Nanking University.

R. B. LAMB has returned to New York from Costa Rica, where he has been making examinations for C. L. Constant Co., and is immediately going to Chihuahua, Mexico.

F. G. CLAPP delivered a paper on March 9 before the Geological Society of Washington on 'A Proposed Classification of Petroleum and Natural Gas Fields Based on Structure'.

WILLIAM R. JEWELL has returned to San Francisco from the Midway, Maricopa, and Devil's Den oilfields, where he has been making examinations for the General Land Office.

Obituary.

GEORGE E. WOODBURY died in San Francisco on March 17. Mr. Woodbury was one of the prominent figures in the mining activities of the West for many decades. He devoted his energies and mechanical talents to the development of milling methods, and particularly to concentration. He made improvements in the Frue vanner that received wide approval, and he also invented a riffle-table concentrator that acquired a good reputation. He was one of the 'old school' of whom but few remain.

L. VOGELSTEIN & Co. give the following figures of German consumption of foreign copper for the month of January 1910:

	Tons.
Imports of copper	15,273
Exports of copper	523
Consumption	14,750

as compared with consumption during the same period in 1909 of 11,237 tons. Of the above quantity 13,993 tons were imported from the United States.

THE RIO PLATA MINING CO., March 8, declared a quarterly dividend of 2%, payable to shareholders of record March 19.

Market Reports.

LOCAL METAL PRICES.

San Francisco, March 24.

Antimony	12—12¾c	Quicksilver (flask)	49½—50½
Electrolytic Copper	15¼—16¾c	Spelter	7- 7¼
Pig Lead	4.95—5.00c	Tin	36—37½c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Mar. 17	13 19	4.41	5.61	51⅜
" 18	13.19	4.38	5.59	51⅜
" 19	13.19	4.38	5.56	51½
" 20	Sunday.	No market.		
" 21	13.19	4.38	5.53	51¾
" 22	13.19	4.38	5 53	52⅛
" 23	13.19	4 38	5.53	51⅞

ANGLO-AMERICAN SHARES.

Cabled from London.

	Mar. 17. £ s. d.	Mar. 24. £ s. d.
Camp Bird	1 7 6	1 8 0
El Oro	1 8 3	1 8 0
Esperanza	2 17 6	2 16 3
Dolores	1 8 9	1 8 9
Oroville Dredging	0 10 0	0 10 0
Mexico Mines	8 10 0	8 18 9
Tomboy	0 8 1½	0 18 1½

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, March 24.		Closing prices, March 24.
Adventure	7¼	North Butte	38¼
Allouez	47	Old Dominion	61
Atlantic	9	Osceola	100
Calumet & Arizona	70½	Quincy	87
Calumet & Hecla	600	Santa Fe	2
Centennial	19¼	Shannon	13½
Copper Range	74¼	Superior & Pittsburg	13¾
Daly West	9¼	Tamarack	65
Franklin	17	Trinity	8
Greene-Cananea, ctf	9⅝	Utah Con	30½
Isle Royale	20	Victoria	4
La Salle	15¼	Winona	9¼
Mass Copper	6	Wolverine	132
Mohawk	60	Wyandot	2½

(By courtesy of J. C. Wilson, Mills Building.)

SOUTHERN NEVADA STOCKS.

San Francisco, March 24.

Atlanta	$ 15	Mayflower	$ 4
Belmont	2 80	Midway	36
Booth	15	Montana Tonopah	95
Columbia Mtn	7	Nevada Hills	50
Combination Fraction	47	Pittsburg Silver Peak	73
Daisy	10	Rawhide Coalition	26
Fairview Eagle	12	Rawhide Queen	18
Florence	2.05	Round Mountain	49
Goldfield Con	8.32	Sandstorm	4
Gold Kewenas	8	Silver Pick	10
Great Bend	3	St. Ives	20
Jim Butler	17	Tonopah Extension	95
Jumbo Extension	42	Tonopah of Nevada	7 82
MacNamara	39	West End	45

(By courtesy of the San Francisco Stock & Exchange Board.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, March 24.		Closing prices, March 24.
Amalgamated Copper	77¼	Miami Copper	22¼
A. S. & R. Co.	82⅝	Mines Co. of America	½
Boston Copper	18⅝	Montgomery-Shoshone	⅞
B. C. Copper Co.	67⅛	Nevada Con.	23⅛
Butte Coalition	24⅜	Nevada Utah	1¾
Chino	14½	Nipissing	10⅜
Davis-Daly	3⅛	Ohio Copper	4¼
Dolores	6¼	Ray Central	3⅜
El Rayo	2⅞	Ray Con	21¼
Ely Central	1¼	South Utah	2¾
First National	4	Superior & Pittsburg	13¾
Giroux	9⅛	Tenn. Copper	32½
Guanajuato Con	1⅛	Trinity	8½
Inspiration	8½	Tuolumne Copper	3¼
Kerr Lake	8½	United Copper	7¾
La Rose	4½	Utah Copper	47⅛
Mason Valley	1¾	Yukon Gold	4⅜

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS

CONVEYANCE OF MINERALS—RIGHT TO SURFACE.

The grant of coal or the conveyance of a coal mine, under the surface, carries with it the use of the surface so far as it is necessary to carry on mining operations.

Gordan *v.* Park, (Mo.) 117 Southwest 1163, April '09.

OIL AND GAS LEASE—VESTED ESTATE.

The interest of a lessee in oil and gas under a lease by which oil and gas in certain described premises are granted to him with the right of entry for drilling purposes, becomes vested on the discovery of oil and gas.

Ramage *v.* Wilson, (Ind.) 88 N. E., 862, June '09.

ENJOINING OPERATION OF MINE.

Injunction will lie to prevent a mine owner from carrying on his mining and persisting in a mode of mining which endangers the support of the surface, and thereby endangers the safety of railroad tracks on the surface.

Southwest Missouri R. Co. *v.* Big Three Min. Co., (Mo.) 119 S. W. 982, June '09.

LOCATION OF MINING CLAIM.

Under the United States statutes possessory title to a mining claim can only be acquired by a valid location. An essential of possessory title to a mining claim is the discovery of minerals thereon. Where the locators of two association claims, which overlapped, were sinking shafts at the same time, the first to discover mineral has priority of right, although the location was staked after the other, if made openly and peaceably.

Hanson *v.* Craig. 170 Fed. 62, May '09.

OPERATION OF COAL MINE—SUPPORT OF SURFACE—WAIVER.

Where a deed by which mineral rights were conveyed to another stated that it was mutually agreed that the grantee should not be responsible for injury to the surface resulting from removing the minerals, the grantor thereby waived his right to recover damages for injury to the surface caused by operating the mine. The implied right of the surface owner to support does not alone determine the rights of the parties; but the instrument by which the conveyance of the minerals is made controls where it makes definite provisions as to the rights of the parties.

Paull *v.* Island Coal Co., (Ind.) 88 N. E. 859, June '09.

MACHINERY FOR DRILLING OIL AND GAS WELL NOT A FIXTURE.

Machinery placed on lands leased for gas and oil purposes do not become permanent fixtures nor parts of the freehold because of such annexation to the land as was necessary to develop the premises according to the terms of the lease; and even on a forfeiture of such lease, such machinery does not vest in the lessor. But where such a lease authorized the lessor to remove the fixtures at any time, the right was said not to be unlimited as to time, but the lessee was only entitled to remove such machinery within a reasonable time after the expiration of the lease.

Perry *v.* Acme Oil Co., (Ind.) 88 N. E. 859, June '09.

COAL LANDS—RIGHT TO COAL REMOVED DURING DEVELOPMENT WORK.

Under the United States statutes a qualified person who, in response to the Government's invitation, enters upon public lands in search of coal deposit and who expends time, labor, and money in an honest effort to open and develop a coal mine when found, and with the intention of purchasing the lands according to the statute, if the coal discovered proves to be such as to give character and value to such land, was said not to be a trespasser, but on the contrary was in the exercise of a privilege conferred by law and entitled to such coal as was taken out and removed as an incident only to the reasonable prosecution of that work.

Ghost *v.* United States, 168 Fed. 841, March '09.

Publications Received.

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS

RECONNOISSANCE OF THE GYPSUM DEPOSITS OF CALIFORNIA. By Frank L. Hess. U. S. Geol. Surv., Bull. 413. Pp. 36, ill., index. Washington, 1910.

A brief but helpful report accompanied by a map of localities and a chapter by George Steiger on errors in chemical analysis of gypsum.

PROGRESS OF THE MINERAL INDUSTRY OF TASMANIA. By W. H. Wallace. Pamphlet. Pp. 20. Hobart, 1909.

This report was made by the Secretary of Mines to the Minister and covers the quarter ended September 30, 1909. The total value of the output was £404,729 with blister copper £157,639 and tin ore £111,579, in the lead.

THE FIRE TAX AND WASTE OF STRUCTURAL MATERIALS IN THE UNITED STATES. By H. M. Wilson and J. L. Cochrane. U. S. Geol. Surv., Bull. 418. Pp. 30. Washington, 1910.

A careful and valuable study of a source of loss of $456,485,000 in the United States in 1907. Nearly one-half the value of all new buildings constructed in a year are destroyed by fire. The subject is certainly deserving of study.

TRANSACTIONS AUSTRALASIAN INSTITUTE OF MINING ENGINEERS. VOL. XIII. Pp. 213, ill. Melbourne, 1909.

This modest little volume indicates that the Australasian Institute is doing a large amount of excellent work. The seventeen papers included range from the presidential address on Professional Idealism by C. F. Courtney to a discussion of Kalgoorlie stoping methods by J. Cheffirs, with many good things between.

IOWA GEOLOGICAL SURVEY, VOL. XIX. ANN. REPORT. 1908. Samuel Calvin, State Geologist, James H. Lees, Assistant State Geologist. Pp. 806, ill., index. Des Moines, 1909.

This volume contains a general resumé of existing information regarding the coalfields of Iowa. The last preceding report on this subject was that forming Vol. II of the present series, and was prepared by C. R. Keyes and assistants in 1893. Since then information regarding the stratigraphy of the State has advanced materially, but, perhaps, improvements in technology of coal testing and coal using have made equal progress. Both lines of research are well represented in this volume, Frank A. Wilder, Henry Hinds, and A. Dixon, discussing fully the results of the tests made at St. Louis in co-operation with the United States Geological Survey. The report is an excellent general summary at the same time that it contains much information that is new and valuable.

IRON ORES, FUELS, AND FLUXES OF THE BIRMINGHAM DISTRICT, ALABAMA. By E. F. Burchard, Charles Butts, and E. C. Eckel. U. S. Geol. Surv., Bull. 400. Pp. 204, ill., index, map. Washington, 1910.

The report sketches the general geology of this region, discusses the origin and geologic relations of the iron ores, and describes the numerous deposits. The methods of mining and prospecting are also described. In the section on fuels the available quantity and the composition of the coking coals are discussed, as well as the methods of coking and the character of the coke. The limestones and dolomites that are used as fluxes are also briefly considered. Since 1894 Alabama has held third place among the iron-mining States and in 1909 produced more than 4,000,000 long tons of ore. Of this total product the Birmingham district produced over 3,000,000 tons. Practically all this ore is made into pig iron in the Birmingham district, in which there are 29 coke furnaces. The ores, broadly considered, are of two kinds—red or Clinton ore and brown ore. Seven-eighths of the ore mined in the district is red ore. It is estimated that 500,000,000 tons of the red ore is available for mining by present methods—a supply that will last more than a hundred years. The report is a valuable and welcome addition to the literature of the iron industry.

Colorado Mineral Production in 1909.

Figures showing mineral production in Colorado for 1 909 by counties are given below. They are for the year ended December 31 and are furnished by T. J. Dalzell, State Commissioner of Mines.

COLORADO	GOLD		SILVER		LEAD		COPPER		ZINC		TUNGSTEN		TOTAL
Name of County	Fine Ounces	Value	Fine Ounces	Value	Pounds	Value	Pounds	Value	Pounds	Value	Tons	Value	
Boulder	7,829.636	$ 161,838.58	49,362.50	$ 25,621.68	412,538	$ 17,627.75	11,498	$ 1,391.38	.....	.....	1,100	$396,000.00	$ 602,479.39
Chaffee	1,464 559	30,272 43	34,617.68	17,828.10	531,805	22,724.15	560,579	67,830.06	1,292,189	$ 71,070.40	.....	.....	209,825.14
Clear Creek	23,423 435	484,162.40	457,671.50	235,700.82	2,990,034	127,764.15	237,762	28,769.20	757,680	41,672.40	.....	.....	918,068.97
Custer	617.296	12,759.50	14,594.95	7,516 40	41,718	1,782.61	577	69.81	89,600	4,928.00	.....	.....	27,056.32
Dolores	1,127.951	23,314.75	107,381.41	55,301.42	463,360	18,799.37	30,449	3,684.32	686,206	37,741.00	.....	.....	138,840.86
Eagle	2,642.587	54,622.27	123,875.51	63,796 88	147,770	6,314.21	221,169	26,761.48	458,336	25,210.90	.....	.....	176,504.71
Fremont	23.757	491.05	313.27	161 33	6,906	294.91	926	112.44	.....	.....	.....	.....	1,058.87
Gilpin	45,708.737	944,799.60	214,084.64	110,253.59	663,337	28,344.00	499,560	60,446.76	.....	.....	.....	.....	1,143,843.95
Grand	45.620	942.96	3,596.77	1,852.3	.....	.....	.....	.....	.....	.....	.....	.....	2,795.30
Gunnison	5,218.039	107,860.86	30,454.66	15,684.15	419,723	17,934.75	4,762	576.20	525,000	28,875.00	.....	.....	170,930.96
Hinsdale	264.184	5,460.68	73,825.88	38,020.32	100,692	4,302.57	544,663	65,904.22	.....	.....	.....	.....	113,687.79
Lake	67,465.398	1,394,509.78	3,340,589.84	1,720,403.76	14,122,282	603,445.10	5,031,576	608,820.70	28,020,259	1,541,114.24	.....	.....	5,868,293.58
La Plata	6,160.845	127,344.86	74,871.70	38,558 92	2,980	127.33	392	47.43	.....	.....	.....	.....	166,078.54
Mineral	5,440.185	112,448.62	911,222.47	469,279.57	9,052,061	386,794.56	14,346	1,735.86	1,926,33	105,948.58	.....	.....	1,076,207.20
Ouray	145,686.412	3,011,338.14	341,904.90	176,081.02	2,708,369	115,728.60	805,605	97,478.56	21,358	1,174.69	.....	.....	3,401,801.01
Park	26,889.970	555,816.68	101,900.42	52,478.71	2,234,181	95,466.55	49,646	6,007.16	585,945	32,227.20	.....	.....	741,995.30
Pitkin	64.328	1,329.66	653,237.06	336,417.08	12,630,028	539,681.10	21,705	2,626.66	717,851	39,481.80	.....	.....	919,536.30
Rio Grande	.....	.....	654.35	336.98	245	10.46	.....	.....	.....	.....	.....	.....	347.44
Routt	90.284	1,866.17	20.81	10.71	.....	.....	.....	.....	.....	.....	.....	.....	1,876.88
Saguache	12.586	260 15	2,864.71	1,475.3	102,226	4,368.11	3,268	395.12	.....	.....	.....	.....	6,498.76
San Juan	34,076.241	706,355.90	848,669.42	437,064.75	9,841,112	420,510.71	1,566,524	189,549.40	1,345,927	74,025.98	.....	.....	1,827,506.74
San Miguel	112,222.111	2,319,631.03	1,361,966.54	701,412.76	4,909,422	209,779.60	478,437	57,891.88	1,005,376	55,295 6.	.....	.....	3,344,010.95
Summit	20,461.175	422,932.48	97,160.86	50,037.53	3,303,134	141,142.91	3,833	463.80	4,296,000	236,280.00	.....	.....	850,867.02
Teller	664,727.943	11,466,226.58	63,203.70	32,549.90	36,720	1,569.04	668	80.82	.....	.....	.....	.....	11,500,426.34
Total	1,061,663.279	$21,946,684.13	8,908,045.54	$4,587,643.34	64,720,646	$2,765,511.72	10,087,950	$1,220,641.95	41,728,107	$2,295,045.85	1,100	$396,000.00	$33,211,527.32

Note.—In the above table the calculation is on the average market price of the minerals for the year.
Gold, 20.67; Silver, .515; Lead, .04273; Copper, .121, Zinc, .055. The Zinc figured on actual speiter recovered.

Commercial Paragraphs.

T. H. PROSKE recently shipped two 25 ft. D 24 Ajax drill sharpeners to the India Government for use on irrigation projects in India.

THE ROBINS CONVEYING BELT CO. has moved its general offices to the Park Row Bdg., 13 Park Row, New York. The branch office at 30 Church street will be discontinued.

THE DENVER ENGINEERING WORKS CO., Denver, Colorado, announces that L. G. E. Bignell, at one time manager of the Salt Lake office, and recently manager of the El Paso office, has been appointed sales manager at the Denver office; L. P. Hammond, former sales manager, having resigned to take a similar position with the Central Colorado Power Company.

THE SULLIVAN MACHINERY CO. reports that it is installing four of its tandem Corliss compound steam and two-stage air-compressors for the Mason & Hanger Co., at Cornwall, New York, where the above company has a contract for one of the siphons or tunnels for the New York Board of Water Supply. Each of the above units has a capacity of approximately 2500 cu. ft. of free air per minute, so that the completed plant will furnish 10,000 cu. ft. of free air per minute.

THE PACIFIC TANK & PIPE CO. is the name under which the business and manufacturing plants of the National Wood Pipe Co. and the Pacific Tank Co. have been consolidated. The officers and employees of both concerns have been retained, and all contracts and obligations will be assumed by the new company. The largest pipe and tank factory in the world has just been completed at Portland, Oregon, which, with the two factories at San Francisco and Los Angeles, gives most excellent facilities for execution of all orders. It is certain that the high standard set by the two companies in the past will be maintained by the consolidation.

THE HARDINGE CONICAL MILL CO., New York, last July placed one of its 8-ft. Hardinge mills on trial with the Calumet & Hecla Co., of Michigan, to be operated in competition with Chilean mills. The result of a six months' trial is the adoption of the Hardinge mill and the signing of a contract between the Hardinge Conical Mill Co. and the Calumet & Hecla Co., whereby the latter company controls the right to manufacture and use the Hardinge mills in all its plants. General Manager MacNaughton writes that the Hardinge mill is the "best fine-grinding device they have ever gotten hold of." This statement coming from such a critical source is a thing of which the Hardinge company is justly proud. Another company in the same district, after three months' trial, has accepted a mill, and has entered an order for a further installment. In one instance fine slime grinding was required, and in another a coarser concentrating product was desired. Now a third company has placed an order, and a fourth has signified its desire to follow the lead of the others. In all instances the Hardinge mill is doing the work formerly performed by Chilean mills of different designs.

Bone ash for assay work, according to a booklet issued by the DENVER FIRE CLAY CO., of Denver, Colorado, should be manufactured especially for that purpose, since grades available for case-hardening and other purposes are not suitable for assaying. This company began manufacturing bone ash in 1876. Only the cleanest carefully sorted bones are used. The bone ash made by this company is marketed in three grades, X, XX, and XXX, put up in 25, 50, and 100-lb. boxes and 500-lb. barrels, all securely lined to prevent loss from leakage. All three grades are made from the same quality of bones, but they differ from each other in the fineness of particles. Grade X is the coarsest, XX somewhat finer, and XXX the finest. Bone ash is not graded by mesh, as material of uniform size will not make a satisfactory cupel. Material of varying degrees of fineness must be present in natural proportions in order that the interstitial spaces be practically filled. Thus the occlusion of air and moisture is minimized, aside from absorption. A cupel made of such material will be homogeneous and will work without cracking. Practically 75% of the X grade will pass a screen aperture of 0.0147 in. (approximately 40 mesh), the XX 0.0091 in. (approximately 60 mesh), and the XXX 0.00675 in. (approximately 80 mesh). These sizes cover the general requirements of a perfect cupel.

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EDITORIAL.

NEVADA, long known as the silver State, is now constantly claiming attention by reason of discovery of rich gold ore. The region around Battle Mountain, in Lander county, has attracted especial attention this year, and we are glad to present this week a brief description of Kimberly, written by Mr. Jay A. Carpenter of the Mackay School of Mines at Reno. The district is obviously one which, like the proverbial rat-hole 'will bear looking into', though for entirely different reasons.

CHEMISTS are already preparing for the eighth International Congress of Applied Chemistry which is to meet in the United States in 1912. At a meeting held in New York, representatives of the Association of Manufacturing Chemists, the American Chemical Society, American Electrochemical Society, and the Society of Chemical Industry, a preliminary organization was effected with B. C. Hesse, 90 William street, New York, as secretary. All working chemists are invited to take part in the organization of the Congress and suggestions, which may be sent to the secretary, are invited.

APPARENTLY the set-back which the silver miners received when the Indian Government suddenly placed an additional import tax upon silver will not be lasting. The prompt recovery in the price showed that the East Indian must have silver, even though the price be raised 10 per cent, as it has been by collecting a duty of four annas per ounce. It is also pointed out that temporary reduction in the price of the metal always provokes an immediate response in the shape of increased exports from China. This soon necessitates a sharp demand for silver to cover such foreign receipts of Chinese merchandise. Thus the effects are compensating. The momentary decline in the price of one-fourth cent per ounce is nothing more than a reflex of current market demands.

INSURGENCY has been rampant of late, and achieved a notable result in the reorganization of the House Committee on Rules at Washington, with the exclusion of the speaker. The new committee is sure to be more amenable to public opinion and yet is not too large to be effective. In the vote determining the matter only one California Congressman voted against the speaker. Things may be different in another Congress, as Mr. Hiram Johnson, the 'insurgent' candidate for Republican nomination for Governor, is making a brilliant and effective canvass. One of the humors of the present situation is the condition in Illinois, where the progressive Governor, Mr. C. S. Deneen, recently made a strong plea

for party harmony in addressing a meeting of Republican editors. The humor lies in the fact that in this State it was the old guard which bolted the causus, and united with party opponents in order to prevent enactment of progressive legislation promised in the platform. Bolting is a serious crime until your side is in the minority, and then it becomes "a patriotic duty." This is another way of saying that human nature is much the same in 'stand-patters' and 'insurgents'. The truth is that the public is coming to care less for fidelity to party as applied to an organization or a group of leaders, and more to fidelity to a party program. This is as it should be and will work out for better government.

TENNESSEE is to have a State Geological Survey, and has made excellent choice in selecting Mr. G. H. Ashley for Director. Mr. Ashley is a graduate of Cornell and Stanford Universities who has had extended experience in connection with the Arkansas, Indiana, and United States Geological Surveys. He is a specialist in the geology of coal and has made important contributions to that subject. He will find in Tennessee an excellent field. Broad foundations for geologic work were laid there half a century ago by Mr. J. M. Safford. The Civil War interrupted this, as it did much other important work, and in recent years Tennessee has seen her neighbors outstrip her in official scientific work and in development. Under Mr. Ashley both the scientific and the economic features of the geology of the State are sure to be properly studied and presented.

CONE CLASSIFIERS have come rapidly into use, replacing the old fashioned wooden pyramidal spitzkasten and spitzlutten. They are more efficient because the length of their overflow, which is three times as large as that in the usual pyramidal classifier, reduces the velocity of the stream in inverse proportion and better settling is secured. Their use with peripheral overflow launders naturally involves central inflow. The various difficulties met in maintaining a constant flow with this form led to the development of the Caldecott diaphragm cone described elsewhere by Mr. Walter Neal. It has been principally used on the Rand and previous descriptions have been based on work in South Africa. The account of results obtained with it in Mexico will therefore be especially welcome to metallurgists.

TONOPAH is to be re-surveyed geologically. The original mapping of the district was done by Mr. J. E. Spurr, for the United States Geological Survey. His work has received many compliments and was indeed a masterly study of an exceedingly difficult area. It undoubtedly did much to guide development. Being made when the mines were shallow and the deeper horizons were still unexposed, there naturally is now much to be seen which could then only be guessed. Mr. J. A. Burgess, geologist for the Tonopah Mining Company, Mr. E. M. Jenney, and others have raised important questions regarding principally the intrusive or extrusive character of certain lower rocks. Promptly, and with a commendable spirit of co-operation, the leading companies, the Tonopah, the Montana Tonopah, the Belmont, and the Midway have joined in inviting Mr. Spurr to re-study the district at their expense; all of which is a pleasant recognition of the value of expert advice and a compliment to Mr. Spurr.

LOST-MINES are a sort of negative asset to an enterprising mining district. The 'burnt cabin' mines, and the 'peg-leg' mines, and others of like attractive appellation, keep fresh the glow of romance, and exert their lure upon the minds of impressionable capitalists. The Bulletin of American Republics reminds us of the lost mine Panama, the ancient Tisingal, which still eludes the searcher on the slopes of Chiriqui. Gold mines have played an important rôle in Darien and at other points on the Isthmus. Now that the Tisingal legend has been polished anew speculators will certainly look more eagerly in that direction.

Coal-Land Prices.

Coal-land prices were raised materially this year by the Department of the Interior on the basis of new valuations made by the Geological Survey. The Spokane branch of the American Mining Congress has passed resolutions objecting to this and pointing out that the increased sum must ultimately be paid by the consumers of coal, who will naturally be the people living in the Western States. It is entirely true that the increased price at which the land is held will finally enter into the price of the coal as delivered, but the ultimate consumer is likely to buy the coal for less if the land be held for the new price than if the old rate of ten and twenty dollars an acre had been maintained. At the latter the land was rapidly passing into the hands of speculators. At the new rates the ownership remains with the Federal Government up to the time that there is a real demand for the coal; then it becomes profitable to buy the land and mine. While the Government holds the land there is no accumulating interest charge, and so far there has been no argument to the effect that the new prices were more than the real value. When speculators hold the land interest charges accrue and prices are, naturally, fixed at the highest possible limit. It is customary to buy coal land, bond it for as much as an optimistic bond buyer can be induced to stand, and then load the enterprise with sufficient stock to absorb any possible profits above the interest charge. It will be cheaper in the long run if the Government hold the coal lands, parting with them only as coal is actually needed. This would be true even if it were necessary to issue public bonds against the land. The Government can always borrow money at a less rate than can an individual, and in the future price of coal interest charges are sure to be important. Fortunately the Government does not need to issue bonds in order to hold the lands and there is no need to resort to a supposititious case. Sharp discrimination should be made between purchase of public land for actual present-day development and for speculation. The new prices do not hinder the one but they do, and properly, discourage the latter.

Patents and Progress.

Inventors are no longer content to be considered long-haired luckless visionaries. The International Congress of Inventors, founded in 1906, and now including over a thousand members, announces that its first annual convention and exposition of patents and models will be held at Rochester, New York, June 13 to 18. Both the convention and the exhibition are sure to be interesting. Americans have been especially proud of their inventive genius and have looked on the patent office as almost as sacred as the Constitution. It has long been apparent, however, that there is need of, and room for, much improvement. At present it is necessary to try out a patent in the Courts before it is regarded as having stability, in the face of the fact that a patent at least purports to be a guarantee by the Government of protection to the holder. There is no special patent court of appeals, though one is now proposed, and suits brought in different Federal courts at times lead to conflicting decisions. The United States Supreme Court is too busy to consider many appeals. The result is that one who devises and markets a valuable invention is sure to face long and expensive litigation where the money available for fighting is at least as important as the merits of the case. In the meantime users of the device are exposed to the peril of unknown and punitive royalties against which the 'guarantee' of the manufacturing company is often inadequate, for the excellent reason that it is ordinarily a limited liability corporation. These various difficulties are grave, the more so since many of them are unnecessary. In Germany, for example, the examination before a patent is issued is so thorough, including notice to all possible contestants, that practically the Government stands back of every patent issued, and contests for infringement are rare. So excellent are the German laws in this regard that some wise American patentees take out German patents merely to get the benefit of the examination. In Australia it has been recently proposed that a single patent shall cover improvements as well as the original invention, and that a man must not declare another production to be an infringement unless he justifies his assertion at once by taking legal action; otherwise the person reflected upon may claim damages and get them without other proof. These are only a few of the controverted questions regarding patents. It is said there are over 250,000 inventors in the United States alone. Certainly they number up into the thousands, and by united action they should be able to focus public opinion on the faults of our present system and formulate proper remedies. Good work already has been done in insisting on a sufficient increase in the force of examiners to bring the work up to date and in preserving the models it was proposed to destroy. Other equally important matters may be readily taken care of by a little effort. Mark Twain's Connecticut Yankee, who did so much to make King Arthur's court interesting to other than lady-like readers of Tennyson, established a Patent Office early in his administration. In that our best loved philosopher recognized that the desire to invent is fundamental to progress.

The Geological Society.

The Cordilleran section of the Geological Society of America held its eleventh annual session at the University of California last week. There was a good attendance and much interest. Among other papers were those of Mr. J. C. Branner on the work of white ants (which it seems are not ants at all) in tropical countries, and the origin of some peculiar modern limestone deposits in central Brazil. Earthquakes in relation to fault-planes formed the subject of a careful analysis by Mr. H. O. Wood, while Mr. Willard Johnson showed excellent pictures of topographic effects due to recent displacement in Owen's Valley. Mr. J. A. Burgess and Mr. A. S. Eakle described the chlorides, iodides, and bromides of silver found in the Tonopah mine. These rare forms are believed to have been secondarily derived from original silver sulphide through the action of descending brines concentrated by evaporation of the waters in which the overlying Siebert lake beds were laid down. Mr. E. W. Hilgard recalled studies made forty years ago of mud lumps at the mouth of the Mississippi, and showed their bearing on the mud-blister which is now interfering with the open passage so long maintained by the Ead's jetties. Mr. J. C. Merriam gave an account of excavations in the Rancho La Brea beds at Los Angeles and of the animals which met death in the sticky asphalt. His paper illustrated how even the dry bones of paleontology may be made alive when the subject is handled by a master who has also a bit of humor. The paleontologists were prominent at the meeting and held a separate session Saturday morning. Paleontology has long received marked attention in California. If we remember correctly it was a paleontological investigation which precipitated the original row upon the Stanislaus. At Berkeley, however, no "chunks of red sandstone" were thrown; nothing in fact harder than certain specific and generic names.

The Cordilleran Section of the Geological Society of America was organized in 1899 and has proved a vigorous branch of the parent Society. The latter was organized in 1888 and includes as fellows nearly all the professional geologists of the United States, Canada, and Mexico. At that the Society is still sufficiently small for most of its members to be personally acquainted, and it has been an effective agency for promoting and criticising geological investigations. The management of the Society has been uniformly good. Two meetings a year are held, a library is maintained, an annual volume of bulletins is printed in excellent shape, and yet, with low dues, a substantial surplus has been built up and securely invested. The Cordilleran is the only local section yet organized. A Mississippi Valley section has been discussed, however, and in a territory so large as America, local branches are sure to prove necessary as well as useful. In the meantime, to serve the needs of specialists in paleontology, a separate but affiliated society has been organized, the president serving as vice-president of the parent body. Some of the larger engineering and professional societies might study with profit the conduct of the Geological Society of America.

BY THE WAY.

Edmund Halley, says Mr. G. F. Becker in a recent number of *Science*, was a very great man. He was not only the first to predict correctly the return of a comet, that which is now known by his name, but also—before Newton had announced his results to anyone—arrived at the conclusion that the attraction of gravity probably varied inversely as the square of the distance. While these and other important achievements of his are well known, it seems to have been forgotten that Halley devised a method of determining the age of the ocean from chemical denudation. Halley recognized that the method as he proposed it was almost impracticable, but writing as he did twenty-eight years before Lavoisier's birth, he could hardly have guessed that accurate analyses of river waters, whose solvent action he so clearly describes, would ever become not merely possible but easy. It is very interesting to note that Halley's reasoning is strictly 'uniformatarian' while he recognized the tendency involved to a maximum estimate. Subject to this same limitation (extended to other features besides an original saltness of the sea), Mr. J. Joly's method of determining the rate at which the accumulation of salt in the ocean takes place from the analysis of river waters is perhaps the most important means now available for an estimate of the antiquity of the stratified rocks, because it is the simplest and least open to question. A great amount of work has been done of late years on the composition of river waters, much of it incited by Mr. Joly's memoir and undertaken with the purpose of improving the data for such a determination of the age of the ocean. Within a few months it will be practicable to make known the results of a revised estimate founded upon data far more ample than those at the disposition of Mr. Joly eleven years ago. Mr. F. W. Clark is now engaged in preparing this estimate. Halley's paper 'On the Cause of the Saltness of the Ocean, and of the Several Lakes that emit no Rivers; with a Proposal, by means thereof, to discover the Age of the World', is briefly abstracted below:

"There have been many attempts made, and proposals offered, to ascertain from the appearance of nature, what may have been the antiquity of this globe of earth; on which, by the evidence of sacred writ, mankind has dwelt about 6000 years; or according to the Septuagint above 7000. . . . This inquiry seeming to me well to deserve consideration, and worthy the thoughts of the Royal Society, I shall take leave to propose an expedient for determining the age of the world by a medium, as I take it, wholly new, and which in my opinion seems to promise success, though the event cannot be judged of till after a long period of time; submitting the same to their better judgment. What suggested this notion was an observation I had made, that all the lakes in the world, properly so called, are found to be salt, some more, some less than the ocean, which in the present case may also be esteemed a lake; since by that term I mean such standing waters as perpetually receive rivers running into them, and have no exit or evacuation. Now I conceive that as all these lakes receive rivers, and have no exit or discharge, so it will be necessary that their waters rise and cover the land, until such time as their surfaces are sufficiently extended, so as to exhale in vapor that water which is poured in by the rivers; and consequently that lakes must be larger or smaller, according to the quantity of the fresh they receive. But the vapors thus exhaled are perfectly fresh; so that the saline particles brought in by the rivers remain behind, while the fresh evaporates; and hence it is evident that the salt in the lakes will be continually augmented, and the water grow salter and salter. Now if this be the true reason of the saltness of these lakes, it is not improbable but that the ocean itself is become salt from the same cause, and we are thereby furnished with an argument for estimating the duration of all things, from an observation of the increment of saltness in their waters. For if it be observed what quantity of salt is at present contained in a certain weight of the water, of the Caspian Sea, for example, taken at a certain place, in the driest weather; and after some centuries or years the same weight of water, taken in the same place, and under the same circumstances, be found to contain a sensibly greater quantity of salt than at the time of the first experiment, we may by the rule of proportion, make an estimate of the whole time wherein the water would acquire its present degree of saltness. And this argument would be the more conclusive, if by a like experiment a similar increase in the saltness of the ocean should be observed: for that, after the same manner as aforesaid, receives innumerable rivers, all of which deposit saline particles therein; and are again supplied by the vapors of the ocean, which rise from it in atoms of pure water, without the least admixture of salt. But the rivers in their long passage over the earth imbibe some of its saline particles, though in so small a quantity as not to be perceived, unless in these their depositories after a long tract of time. And if, on repeating the experiment, after another equal number of ages, it shall be found that the saltness is further increased with the same increment as before, then what is now proposed as hypothetical, would appear little less than demonstrative. But since this argument can be of no use to ourselves, it requiring very great intervals of time to come to our conclusion, it were to be wished that the ancient Greek and Latin authors had delivered down to us the degree of the saltness of the sea, as it was about 2000 years ago; for then it cannot be doubted but that the difference between what is now found and what then was, would become very sensible. I recommend it therefore to the society, as opportunity shall offer, to procure the experiments to be made of the present degree of saltness of the ocean, and of as many of these lakes as can be come at, that they may stand upon record.

"If it be objected that the water of the ocean, and perhaps of some of these lakes, might at the first beginning of things, in some measure contain salt, so as to disturb the proportionality of the increase of saltness in them, I will not dispute it; but shall observe that such a supposition would by so much contract the age of the world."

Geology Applied to Mining.

By T. A. Rickard

*Mining is an ancient industry, geology is a young science. Man had hardly ceased to be cousin to the ape and tiger when he began to dig the ore from which to obtain the metal required to fashion his primitive implements. But human beings had developed all the essentials of that complex mode of life we term civilization before the search for minerals was aided by accurate knowledge.

Geology was cradled in Lyell's 'Principles', first published in 1830. Lyell gave form and substance to an earlier recognition by Hutton, that the present is the key to the past, that the unknown can only be deciphered in terms of the known, that the earth is "her own interpreter" to those willing to study the testimony of the rocks. Thus Lyell gave a great impetus to the systematic study of geology; he did more, he gave powerful aid to the establishment of the central doctrine of evolution, as enunciated by Darwin, Spencer, and Huxley. From that time geology became something more than a hobby for amateurs, it became an integral part of natural philosophy. But as developed in England the young science was mainly concerned with stratigraphy and paleontology; as yet its economic function was not realized, except in a few beginnings of investigation into the nature of ore deposits, by De la Beche, Henwood, Fox, and Phillips.[1]

In Germany, Werner laid a foundation for genetic principles and advocated ideas that influenced an entire generation of observers. He held that mineral veins, no less than dikes of eruptive rock, were the result of chemical precipitation from the ocean. Thus he was as extravagant on one side as Hutton was on the other, for the latter regarded both kinds of veins, that is, lodes and dikes, as due to the introduction of igneous material. Hutton and Werner each grasped a truth and halved it by a generalization. Werner's theory was made known in 1791, the English translation appearing in 1809. Fifty years later Von Cotta published a treatise summarizing the theories of the Freiberg school, based upon the observations of the Erzgebirge. He emphasized unduly the importance of the fissure-vein as a type of ore deposit, and thereby became godfather to many narrow conceptions of ore deposition. In 1878 Von Groddeck recognized numerous types and broadened the fundamental principles.

Another wave of scientific interest in the subject was created by the publication, in 1882, of Sandberger's thesis advocating the theory known as 'lateral secretion'. At the close of his essay he stated: "Those who desire to refute the leaching theory will find it necessary, after providing for purer material, to carry out chemical investigations extending over years. Nothing is to be gained by objections not resting upon chemical facts." Thus the chemical study of ore deposits was accentuated as against the physical and structural. Sandberger imputed the ore in veins to the results of leaching from the immediately encasing rock. His views were narrow; they were combated successfully by Stelzner and Posepny.

The study of ore deposits for a hundred years owed its progress to German research. In England the detection of fossils and the correlation of strata absorbed the attention of geologists to the exclusion of investigation into the nature of the mineral aggregates that are the object of mining. Indeed, not only did geology give the cold shoulder to mining but when geologists condescended to be interested in mineral deposits, they made blunders highly perplexing even to those willing to accept scientific aid. Thus Murchison rashly enunciated the generalization that the Silurian rocks were particularly favorable to gold veins, basing this broad statement on his knowledge of the Ural region; and when gold was discovered in Australia in slate and sandstone of Silurian age, he congratulated himself on the confirmation of his dictum. Later, he interpreted the scanty data at his disposal as warranting "the inference that deep mining in the solid quartz rock is usually unprofitable." No wonder the miner looked askance at the geologist, so that there was a lack of co-operation between the young science and the venerable industry. Moreover, the idea obtained in England that geology stooped to commercialism when she concerned herself with mining.

The notion long persisted that science suffered by becoming utilitarian; the geologist deemed hunting for fossils more becoming than the search for ore; and this tradition in effect prevented English geologists from attempting to unravel the complexities of ore occurrence. A notable example is afforded by the Geological Society. This organization was founded by the fathers of modern geology, and in its records will be found the presentation of the principles that constitute the very foundations of the science to which the Society is dedicated. Yet the sum total of information concerning ore deposits to be found in the journals of the Geological Society is negligible. Englishmen as geologists occupy a position second to none; as contributors to the study of ore deposits they are nowhere. And this result is not due to the want of subjects for investigation nor to the lack of an important mineral industry, for in the last hundred years the mining districts of Great Britain and Ireland have afforded plenty of opportunity and adequate incentive for the economic application of geology. No; I impute the poverty of result entirely to the fact that men of culture have deemed it undignified to make commercial use of scientific knowledge. Only within the last ten years have we been able to point to useful work in this branch of science by Englishmen, among whom I may name Hatch, Gregory, Halse, and Maclaren.

Thus Englishmen founded geology and Germans started the systematic study of ore deposits; but it was in America that economic geology won proper recognition. To the United States Geological Survey we owe much pioneer work in this department of human knowledge. From its inception under Clarence King, in 1879, the Survey has given the warm

*The Le Neve Foster Memorial Lecture, delivered at the Royal School of Mines, London, on March 4, 1910.

[1]De la Beche contributed some excellent observations on the tin lodes of Cornwall; so did Le Neve Foster and Richard Pearce.

grasp of friendship to the miner: and during the last thirty years the scientific men of the Survey have contributed an entire literature on the systematic study of ores and metals as found in nature. In monographs, reports, and bulletins innumerable, the officers of the United States Geological Survey have published detailed descriptions and profoundly suggestive conclusions covering most of the mining districts developed within the wide borders of the American continent. The area involved and the diversity of conditions illustrated have been such as to check narrow views; on the contrary, the variety of ore occurrence has afforded a liberal education to the American geologist, and he has used his opportunity with untiring industry and consummate skill.

Another factor helping the development of this intensely practical branch of geology was the American Institute of Mining Engineers, a society directed by Rossiter W. Raymond, himself a mining geologist of wide experience and a speaker of rare versatility, who did much to bring together official geologists and mining practitioners, so that the meetings of the Institute afforded excellent facilities for the free exchange of ideas on a subject interesting alike to the geologist and to the engineer. The Transactions of the Institute became a valuable library of economic geology, and to it the leaders of thought were prompted to contribute their mature convictions.

Thus at three particular periods, in 1886, 1893, and 1900, a general discussion was incited in America by the publication of papers embodying the new ideas formulated by geologists of international reputation. In 1884 S. F. Emmons published his monograph on Leadville; this voluminous treatise on a rich and famous mining district was issued by the Geological Survey; it was an exceptionally successful effort to unravel the underground structure of a region complicated by many faults, and it gave information of immediate use to those in charge of mining operations. This monograph was a superb vindication of the value of geology in mining. The evidence gathered by Emmons led to much fruitful discussion in the Transactions of the American Institute, and in 1893 prompted Posepny to contribute a treatise based largely on his own study of the Pzribram mines and those of Transylvania. Up to that time the theories of Sandberger had in various guise found favor among mining geologists, that is, the conception of ore deposits as being derived from the wall-rocks of veins by means of the solvent action of waters moving laterally. To this interpretation of the facts disclosed by mining, Posepny opposed systematic observations the effect of which was to elucidate the basic idea that neither the lateral, the ascending nor the descending waters were to be credited with the work of ore deposition—not any one of these phases of the circulation, but the whole of it, as modified by varying conditions at successive periods.

So far, progressive knowledge had come mainly by induction from facts, but an exceptional development of scientific enquiry was illustrated in 1900 when Van Hise contributed a brilliant essay, which was essentially a deductive reasoning from physical and chemical principles. His suggestions proved illuminating along new lines of thought and stimulated fresh investigation. He took the underground circulation of water as one connected manifestation of natural energy, and from a comprehensive review of the literature then available he emphasized two conclusions: (1) sulphide ore is generally deposited by ascending water; (2) secondary enrichment is effected by descending water. Simultaneously with this pronouncement concerning the origin of the richer parts of lodes, Emmons and Weed published papers explaining how copper deposits became enriched at moderate depth by precipitation of the metal leached from near the surface by descending waters. From lodes of copper the idea of secondary enrichment was applied to deposits of other metals, so that the formation of bonanzas in general became better understood. This, of course, was a great step forward, for it gave the miner a clue to the discovery of rich ore, which is the main object of his search.

Thus, at last, geology in relation to mining reached a point where the most uncompromising utilitarian could not refuse to recognize its commercial value. Starting as the science of amateurs, geology in its economic phase had become the technology of money-makers. And was it debased thereby? Rather let us say that the science was now ennobled by giving help to those who labor in the mine and quarry; from the heights of philosophy, geology had stooped to be of service to humanity, and by so stooping had herself been raised to greater honor.

Before summarizing the conclusions now deemed worthy of acceptation, it is necessary to refer to two of the latest ideas concerning the genesis of ore deposits. While the American geologists were occupied in analyzing the effect of water action, a Norwegian investigator, Vogt, was making a careful enquiry into the differentiation of magma—the molten matrix, which, on cooling, becomes the substance of rock. Vogt came to the conclusion that the normal terrestrial water-circulation underground played only a minor part in the primary origin of ore deposits, however much that water-circulation may have effected the later concentration of ore from such portions of the magma as were rich in metals. Kemp applied this idea and showed how the greater number of deposits containing gold, silver, and copper ores, are near igneous rocks, with which he believed them to be genetically connected. Meanwhile, Spurr had become impressed with the evidence of segregation in gold veins, and announced a radical departure from accepted theory by describing the gold-bearing quartz veins of the Yukon as representing the last stage of magmatic segregation. Thus quartz veins are held to be the silicious product of a process that in its final phase is marked by a magma so attenuated as to resemble heated water charged with silica and other mineral matter, including gold. This theory led to researches into the physical effects of metamorphism at the contact of igneous with sedimentary rocks, and yielded evidence of the mineralogic changes induced by intense thermal action. It was shown, by Lindgren, Kemp, and Weed, that the sedimentary strata are made porous by metamorphism, which may be compared in its effects to the results produced by burning a clay into a brick. The derivation of ore from magma and the activity

imparted to the underground water-circulation by vulcanism were new ideas highly suggestive to geologists and pointed to fresh lines of observation.

Thus attention was directed to the igneous rocks as agents in ore deposition and stress was laid on the part played by magmatic waters as against the exclusive agency of meteoric waters that is, the water originating at surface from rainfall. In 1903 an attempt was made to apply these new ideas in the classification of ore deposits according to their genesis, whereupon a lively debate ensued before the Geological Society of Washington. This discussion was inconclusive, as might be expected, for we do not know enough concerning the origin of ore deposits to warrant any final classification. But the attempt exhibits the dark places in our knowledge and serves to distinguish between what we know and what we think we know. Thus science progresses.

This discussion concerning the parts to be allotted, on the one hand, to igneous rocks and the magmatic waters associated with them, and, on the other hand, to the meteoric waters and the vadose circulation, led to a clear appreciation of the importance of an ore-forming agency hitherto not recognized by economic geologists. In successful opposition to Posepny, Van Hise, and other authorities, it fell to Kemp to turn the whole trend of speculation and to demonstrate that magmatic waters must be the carriers of the metallic compounds constituting ore deposits. His essay, entitled 'The Rôle of the Igneous Rocks', published in 1901, drew attention to the dryness of deep mines, "the general absence of water in the rocks below moderate depths, except in regions of expiring vulcanism," and the distribution of mining districts as related to the distribution of igneous rocks. Attention was drawn thereby to the 'water-level' in mines and the state of diffusion of water in rocks. In 1900, in 1904, and again in 1908, I directed attention to the significance of the evidence afforded by deep mining. Usually when the earth's exterior is penetrated by a shaft the ground is dry until at a shallow depth, varying from 50 to 300 feet, water is struck.[2] Other shafts in the vicinity will fill with water at about the same depth, so that a 'water-level' becomes recognized. Below this level the water entering a shaft or a pit increases in volume until a maximum is reached at six or seven hundred feet. On resumption of sinking, if the water entering the shaft be collected and pumped to the surface, the influx of additional water decreases until at 1000 ft. or thereabouts, the ground appears to be dry, that is, no water is visible, although the dusty rock will be found on analysis to contain 3% water. This is the general experience of mining all over the world. Local variations, due to seasonal changes and rock structure, are observed, but they only serve to emphasize the general conclusion that vertical openings into the earth's crust do penetrate below the reservoir or accumulated store of the water fed by rainfall. In effect, we have a 'water-zone', as against the universal ground-water formerly assumed to exist to an indefinite depth. for example, Van Hise mentions 10,000 metres as the limit and he actually speaks of "the sea of ground-water." Others have set even less definite bounds to the extension of the water that is supposed to saturate the rocks in which deposits of ore are formed.

Obviously, the distribution of water is a vital factor in the processes by which ore is deposited in lodes and veins. To the miner, whose operations are restricted, the belt of ground-water will appear as a zone relatively deep; to the geologist, who views the matter on a larger scale, the zone will appear as a blanket, the top of which is smooth, while the bottom is extremely irregular. Under the water-zone is a region of dry rock, and somewhere below it, at a variable depth, is the source of the magmatic water, the final product of differentiation and the result of chemical changes within the earth. This magmatic water does not rise by reason of gravitative stress nor is it connected with the ground-water; there is a hiatus between the source of the magmatic water and the reservoir of meteoric water; so that the older conception of rain falling upon and into the earth at one place and circulating downward until induced, by heat and pressure, to ascend at another place, is now no longer tenable, save in a limited sense. We have a blanket of cold meteoric water, then a region of dry rock, penetrated by fractures, which give passage to the deeper upwelling thermal waters of magmatic origin. From the surface the meteoric waters descend and accumulate at the water-zone, to be returned to the surface in the form of springs and artesian flows. The hot magmatic waters ascend through fractures made by movements due to volcanic action and through fissures caused by readjustments of the earth's exterior, until they reach the upper, almost superficial, zone of cold water.

Geologists have assumed that the mineral-carrying waters from the depths can pass through rocks saturated with water without losing their identity, that is, they have failed to recognize a fundamental factor in the problem of ore deposition. We might as well imagine a mountain stream entering a morass, passing through the morass, and issuing at the lower end without change of character. Indeed, the water-zone has many points of similarity to a morass, for it is a tract wherein both reducing and oxidizing conditions variously prevail, owing to the presence of organic matter on the one hand and of entrained oxygen on the other. Thus it is apparent that the work of the miner has yielded information of the greatest significance in any theory of ore deposits; in short, inductive inference from facts serves to discipline deductive reasoning from scientific principles.

(To be Continued.)

[2] Of course, these figures are given mainly for the purpose of illustrating facts, and of elucidating the idea based upon them. The ground-water may be struck at grass-roots, as in seasons of excessive rainfall, and it may not be reached for a depth of 500 ft., as in the arid tracts of Arizona. On the other hand, the bottom of ground-water may exist anywhere from 500 to 2500 ft., according to the climate, the rock-structure, and the fissured character of the ground. Moreover, I am dealing with igneous and metamorphosed rock-masses; in sedimentary strata the bedding planes will regulate the descent of water, so that the water-zone is difficult to recognize in coal mines. By omitting figures and confining myself to glittering generalities, it would be easy to escape criticism; but I am willing to risk criticism, hoping to clarify a fundamental conception governing the distribution of ground-water.

Kimberly, Nevada.

Written for the MINING AND SCIENTIFIC PRESS
By JAY A. CARPENTER.

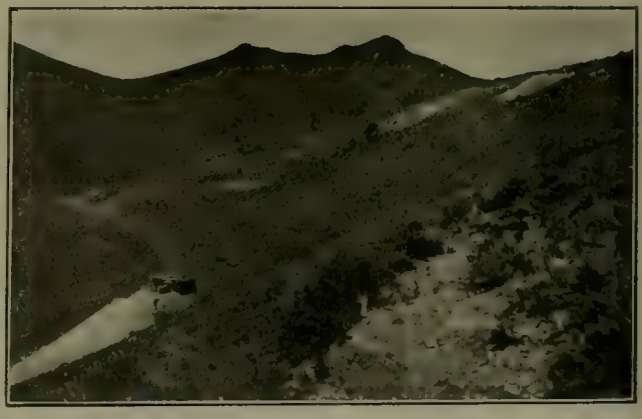
The mining camp of Kimberly which has sprung into prominence in the last few months, is in the Battle Mountain district. This district is receiving considerable attention on account of favorable showings of copper, lead, gold, and silver ores, the result of development work carried on consistently for many years. The presence of iron ores and limestone in addition to the copper ores offers favorable conditions for smelting. There have been small but

Kimberly, Nevada.

steady shipments of carload lots of gold and silver ores to the Utah and California smelters. However, it remained for the discovery of Bannock with its rich free-gold ores on the very surface to attract marked attention to the district. Bannock has settled down to solving the question of the depth and nature of its ore deposits, and attention is now centering upon the camp of Kimberly.

Kimberly is 18 miles southeast of Battle Mountain, 10 miles of this distance being over valley road and the last 8 being a steady climb up a winding canyon. The camp, consisting of several large frame buildings, cottages, and tent-houses, lies at the intersection of two gulches at an elevation of 6500 ft., while the mine workings are along the crest of the ridge to the west, and 300 to 400 ft. higher. For years the few prospectors' huts at this convenient watering place on the country road were known as Marble City. An abandoned stone hut and a 40-ft. inclined shaft dates back of the memory of any local resident, perhaps back to the days when the wealth of Austin allured the prospector to the mountains of Lander county, for the ore in the incline shows a high lead-content and a high ratio of gold to silver, while the free-gold surface-showings were evidently undiscovered. In 1907 prospectors encouraged by the surface 'pannings', discovered wire-gold in places not over 300 ft. from the old shaft. Other discoveries along the crest followed, and in 1908 the camp had a lively boom, being known as Hilltop. Although 1908 was a dull year, the control of the stock in the two main companies was quickly placed under option at fancy figures. On both properties development was limited to the main discoveries. On the Hilltop property a large open-cut was made in following the gold stringers, and exceedingly rich ore was shipped in small lots. A tunnel at a depth of 70 ft. failed to find rich ore, and the option was dropped. On the Independence claim of the Philadelphia Western Mining Co.'s ground an incline shaft following the vein was sunk 180 ft., connecting with a 265-ft. tunnel. From this work about $15,000 in rich shipping-ore was taken from one lease. However, the promoters lost their option through holding for too high a figure. These failures caused the camp to recede from public notice.

The owners, able to keep but a few miners at work, divided their ground into lease-blocks, and many of the men went from day's pay to leasing, attracted by the surface-showings. When a miner can guide his work by a few minutes with mortar, pestle, and pan, and a few encouraging colors are found, his energy is unrelenting and his faith unbounded. It is the showing made by these lessees that has brought the camp again to public notice. They have found high-grade ore in several leases on the two main properties and on a claim 1500 ft. to the west, and they claim to have opened large quantities of milling ore. Already the control of the Hilltop and Independence groups of claims, and the Golden Rule claim to the west, have been contracted under option to one group of capitalists, who are now rushing the construction of a 20-stamp mill, and are building wagon-roads to the dumps and working places. The mill-site is a half mile west of the town in a gulch between the Hilltop ridge and the Golden Rule claim. Water for milling is to be obtained by pumping from Indian creek some 3000 ft. down the gulch. The 20 stamps



Main Workings on Independence Claim.

are to be followed by amalgamating plates, and concentrating tables. The ore will readily yield 90% by this treatment, over 80% being obtained by amalgamation. Cyanidation of the tailing will hardly be attempted on account of the probable low value and a small copper content. The building of the mill and the short life left to the leases have stimulated work, and the camp has a thriving appearance.

The general geology of the district is that of prominent ridges of quartzites and silicious shales, much faulted and irregular in strike and dip. The general strike is north and south and the dip 45° or greater

to the west. The quartzite occurs both as an easily fractured light colored variety, and a very massive, dark variety. The quartzite is formed of corroded quartz grains which have been largely replaced by a mixture of secondary quartz and sericite. The quartzite has evidently been subjected to considerable metamorphism since its formation. On the Hilltop ridge are wide dikes of an altered andesite, having about the same strike but less dip than the quartzite. This material is so badly weathered that it is only in some of the fresher specimens that a few of the lime-soda feldspars remain sufficiently unaltered to be recognized. The other original minerals have disappeared. At present the feldspars are replaced by sericite and kaolin while pyrite and quartz make up the remainder of the rock. A diorite porphyry also outcrops at the east base of the ridge, and can be traced through the camp and a half mile to the eastward. This diorite is a fresh looking rock, though altered. It contains large porphyritic crystals of andesine. Outlines of mica and hornblende remain, but the original minerals have been entirely replaced by chlorite, magnetite, and calcite. Tourmaline crystals are present and this unusual association may indicate a slight amount of contact-metamorphism. At some distance from the camp are prominent ridges and masses of granite. At the south end of one of these ridges, 3½ miles to the east of the camp, is the Grey Eagle mine, an old lead-producer.

Four miles to the west, on the north flank of Blue Dick, a prominent peak, is the quartzite ridge from which the Dean mine extracted a large amount of milling ore through a period of years. On an intermediate ridge is the Maysfield property, an old producer. On the Hilltop ridge the quartzite is also the ore-bearing formation. The ore of the camp in general is fractured quartzite, cemented with quartz, and carrying free gold. The veins or orebodies as a rule are rather sharply defined from the quartzite, but are irregular in width and course, the course being in general parallel to the bedding plane of the quartzite. The wide dikes of the andesite are barren except for a small but constant gold content. The only appearance of the andesite in connection with the ore is in the form of tongues in the veins.

There are interesting variations from this general description. On the Hilltop open-cut the gold occurs in a coarse state, directly in the dark brown quartzite, with little or no apparent vein-formation. At times well crystallized covellite is found associated with the gold. On one of the leases on the Independence group is the odd occurrence of minute leaf gold and tourquoise lying together on the fracture faces of the quartzite. On the main workings of the Independence claim lead minerals are closely associated with the ore, occurring both as cerussite and galena. The cerussite is well disseminated through the ore, while the galena is segregated. The richest gold seams lie next to the galena, but not in the galena itself. As a whole the district is interesting, and the advent of capital for deeper development will give the mines a fair trial. The rock determinations for this article were made by J. C. Jones, assistant professor of mineralogy in the Mackay School of Mines, at Reno, Nevada.

Diaphragm Cones and Tube-Milling.

Written for the MINING AND SCIENTIFIC PRESS
By WALTER NEAL

Numerous references have recently been made to the invention of W. A. Caldecott known as a 'diaphragm cone'. As all of these have referred to work done on the other side of the world, a brief description of the apparatus as used in the mills of the Cia. Minera Las Dos Estrellas, and some experiments made with it as a thickener before tube-milling, will be of interest.

The apparatus is described by its inventor as a "classifier of the conical type * * * kept filled

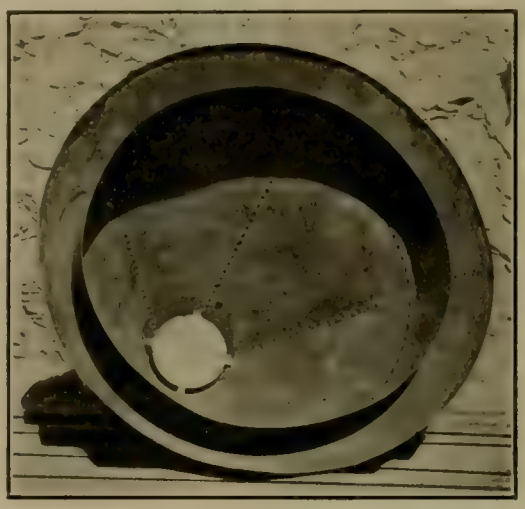


Fig. 1. Filler Cone.

nearly to the top with sand, and an essential patented feature of its successful operation consists of an internal serrated or notched horizontal disc-diaphragm near the bottom."*

As used at Dos Estrellas it consists of a circular sheet-iron plate, supported toward the apex of an ordinary cone-classifier by two straps riveted to the plate, and having their ends riveted to the sides of the cone, leaving an annular space between the plate and the sides. The width of this annular space, and the height of the diaphragm above the apex of the cone, vary with the size of the cone and the tonnage and character of the pulp. So far as my experience goes these points are best determined experimentally although with sufficient data, doubtless some approximate formula could be deduced. A cast-iron plug-cock at the apex provides a means for regulating the underflow.

When starting operation this cock is closed, and the pulp is turned into the cone. Sand is allowed to collect until it is within about 10 in. of the overflow. The cock is then opened enough so that thick sand may issue at the same rate that it settles out of the thin pulp flowing into the cone.

The settled sand, on account of its thickness,

**Journal* of the South African Association of Engineers, Dec. '08.

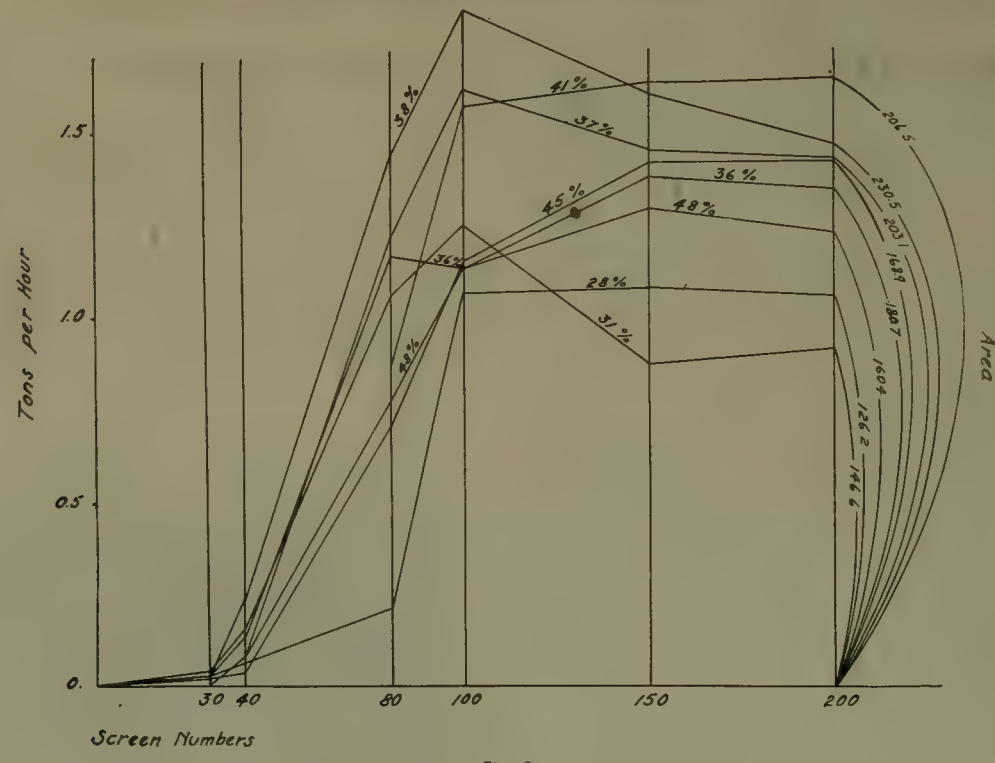


Fig. 2.
Test on Best Thickness of Tube Mill Feed.

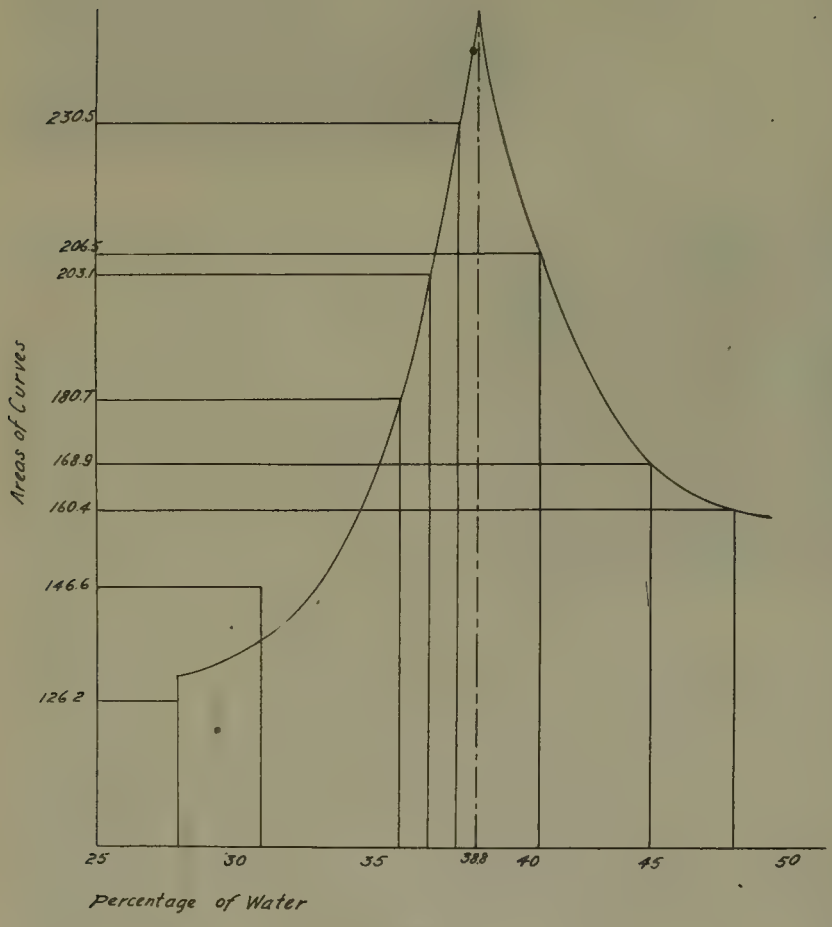


Fig. 3.
Test on Best Dilution of Tube Mill Feed.

issues from the spigot in a stream of low velocity but of large area. The pulp entering the cone above, drops its heavier particles, thus automatically renewing the bed, and the valve at the apex is regulated so that the level of the bed neither rises nor lowers. Should the bed of sand drop too low a break occurs, and thin pulp issues from the spigot, the same as in a simple cone. The remedy is to close the cock and allow the channel to pack with sand again. Should the spigot, on the contrary, not be opened sufficiently, the bed of sand will rise to the rim of the cone and a sandy overflow will result.

It will be seen from the above that the apparatus does its best work on large cones where the level of the bed of sand has sufficient vertical variation to allow for slight fluctuations in the feed, without dropping too low and breaking through, or rising so high as to cause an overflow of sand. A steady feed is, of course, desirable. Where the

fall in a mill is sufficient to allow for the installation of large cones it is my experience that it is better to allow a sandy overflow which may be passed through a sand-return cone without a diaphragm. On large cones, 9 ft. or more in height, but little trouble is experienced, and with the underflow once properly regulated and a steady feed established, the cone will run for hours, giving a slime-clear underflow and a sand-clear overflow with no attention whatever. Due to the large aperture of the underflow nothing smaller than a gunny sack will stop it up.

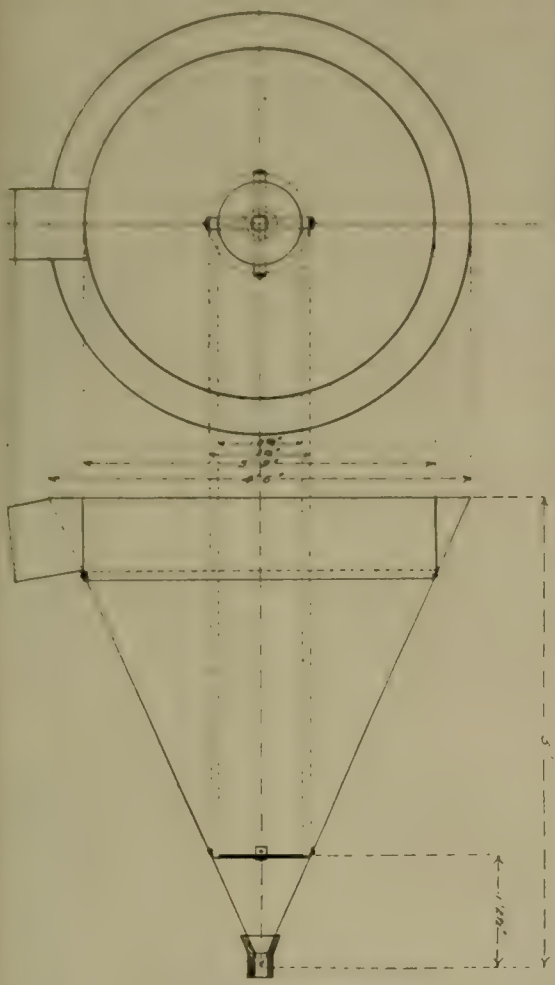


Fig. 4. Five-foot Diaphragm Cone.

The experience at Dos Estrellas has been that the the diaphragm cone does better work when given a heavy feed than when given a light feed. For instance, a tube-mill thickener 8 ft. high by 7 ft. diam., did its best work (without diaphragm) with underflow bushed down to a ½-in. pipe-nipple and receiving 150 tons of ore per day (16 mesh) direct from the batteries, having a dilution of about 9 to 1. The same cone, when fitted with a diaphragm 16 in. above its apex, did its best work when receiving about 250 tons of the same pulp per day. The reason is that the thick sand underflow ran steadier through the larger aperture required for the greater tonnage than through the smaller one. Probably change in the proportions of the diaphragm would improve matters on the smaller tonnage.

The underflow consists of remarkably clean sand. In the case of the cone mentioned above the underflow through the ½ in. nipple carried from 15 to 20% through a 200 mesh screen, whereas the average underflow, after installing the diaphragm, carried from 3 to 5% passing a 200-mesh screen. This is, of course, a great advantage when thickening for tube-milling, since no one likes to pay for power to grind pulp finer than 200 mesh, while coarser sand is actually going into the slime-tanks. The underflow from the diaphragm cones contains from 28 to 30% moisture.

When the diaphragms were first installed at Dos Estrellas great grinding efficiency was anticipated on such extremely thick pulp. The results, however, were disappointing, being no better than had been obtained on pulp with 50 to 55% moisture. Experiments were then started to see where the trouble lay, and as the pulp appeared to be too thick for efficient grinding, to determine at just what dilution the tube-mill would do its best work.

The tube-mill used was of the Gates type, made by the Allis-Chalmers Co., and had an inside diameter of 5 ft., and a length of 24 ft. The effective diameter is reduced about 6 in. by the 'El Oro' liners used. The mill ran at 26 rev. per min. The thick sand from the diaphragm was fed into the mill through a small sheet-iron launder passing from below the cone to the trunnion of the mill. In order to feed the sand at varying degrees of dilution for purposes of experiment, a water hose was laid in the feed-launder, and the required amount of water allowed to run into the mill along with the sand. The mill was allowed to run long enough for conditions to adjust themselves within it, and during the experiments samples were taken at five minute intervals of the heads and tailing. A determination of the tonnage crushed per hour was also made at the middle of each experiment by weighing the amount of wet pulp discharged by the mill in a measured time. Having the specific gravity of the tailing, the dry tonnage crushed per hour could be calculated from this.

Sample	Specific Gravity	Tons per Hour	On 30 mesh	On 40 mesh	On 80 mesh	On 100 mesh	On 150 mesh	On 200 mesh	Through 200 mesh
1N	1760	4.7	0.5	1.5	12.5	33.5	35.0	1.0	16.0
1T			—	0.5	9.5	16.0	34.0	2.0	38.0
2N	1708	4.6	1.0	3.0	28.5	19.0	28.5	3.0	16.0
2T			—	0.5	10.0	15.0	36.5	2.0	36.0
3N	1627	5.4	0.5	3.0	32.5	15.0	33.0	4.0	12.0
3T			—	1.0	13.5	15.5	28.6	4.5	37.0
4N	1.605	5.1	—	2.0	36.0	13.5	30.5	3.0	9.0
4T			—	0.5	13.5	18.0	33.5	3.5	37.0
5N	1524	6.1	0.5	4.5	34.0	19.0	29.0	3.5	9.5
5T			—	0.5	10.0	11.5	33.5	6.0	38.5
6N	1.546	5.4	0.5	1.5	20.0	24.0	35.0	3.5	15.5
6T			—	0.5	5.5	11.0	34.0	4.0	45.0
7N	1498	4.5	0.5	1.0	18.5	20.0	38.0	5.5	16.5
7T			—	0.3	4.0	10.0	32.0	5.5	48.0
8N	1453	5.0	—	2.0	27.5	21.5	34.0	3.0	12.0
8T			—	0.5	13.5	14.5	30.5	4.5	36.5

Table 1.

The results of sizing tests on these samples are shown in Table 1. The figures in Table 2 were obtained by subtracting the total percentage remaining on any mesh in the tailing from the total percentage remaining on the same mesh in the heads. Thus in test No. 1 is obtained for 30-mesh $0.5 - 0 = 0.5$; for the 40-mesh $1.5 + 0.5 - 0.5 = 1.5$; for 80-mesh $0.5 + 1.5 + 12.5 - (0.5 + 9.5) = 4.5$, and so forth. Table 3 was obtained by multiplying the percentages shown in Table 2 by the actual tonnage per hour. It thus shows the actual amount of pulp formerly too coarse to pass through each mesh, but which was made to pass through it during the process of grinding. Table 3 supplies the ordinates for the curves in Fig. 2. The included areas of the curves in Fig. 2 are shown, plotted as ordinates in Fig. 3, as giving some sort of a basis of comparison of crushing efficiency.

Test No.	Percent Water	Tons per Hour	On 30 mesh	On 40 mesh	On 80 mesh	On 100 mesh	On 150 mesh	On 200 mesh
1	22	22	0.5	1.5	4.5	2.0	25.0	22.0
2	20	20	1.0	5.5	25.0	21.0	18.0	20.0
3	26	26	0.5	2.5	21.5	21.0	25.5	26.0
4	28	28	1.5	—	24.0	31.5	28.5	28.0
5	29	29	0.5	4.5	28.5	38.0	31.5	29.0
6	30	30	0.5	1.5	16.0	29.0	30.0	30.5
7	31	31	0.5	1.0	15.5	25.5	31.5	31.5
8	24	24	0.5	1.5	15.5	—	25.0	24.5

Table 2.

On 30 mesh	On 40 mesh	On 80 mesh	On 100 mesh	On 150 mesh	On 200 mesh
0.024	0.071	0.212	1.06	1.08	1.06
0.046	0.161	1.06	1.24	0.87	0.92
0.021	0.135	1.16	1.13	1.38	1.35
—	0.077	1.22	1.61	1.45	1.43
0.025	0.228	1.45	1.83	1.60	1.47
0.027	0.081	0.865	1.57	1.63	1.65
0.022	0.045	0.697	1.15	1.42	1.42
—	0.075	0.775	1.13	1.30	1.25

Table 3.

These tables clearly show the ideal dilution to be in the neighborhood of 39% moisture. It is surprising to note what a marked difference in grinding, a comparatively small difference in dilution makes, and it immediately suggests that not enough attention has been paid to this point in the past. To bring the matter home in another way it may be stated that approximately three tube-mills working on 39% pulp will do the work of four mills working on 36 or 48% pulp.

It is probable that the 'critical dilution' would vary at different plants on account of different ores and various makes of tube-mills, but certainly the matter is worth investigating. Undoubtedly it is more than a coincidence that V. B. Sherrod, experimenting with tube-mills at the Guerrero mill, Real del Monte, finds that "the grinding efficiency increases with the percentage of solids in the feed up to about 55 or 60%."* My acknowledgments are due to A. Quartano for his skill and care in carrying out the experiments herein described.

*_Informes y Memorias_ del Instituto Méxicano de Minas y Metalúrgia, December 1909.

CACHANI MINES, ECUADOR.

Written for the MINING AND SCIENTIFIC PRESS
By H. P. GORDON.

Some years ago I received, installed, and operated a hydraulic mining plant in Ecuador for an American company. It seems that the farther off and the more inaccessible a mine is the more glamour is attached to it in consequence, an dthe keener some people are to chase after it. This particular mine was a large Government concession. Mark that word 'concession'; it is still used everywhere througout the Spanish American republics. The mine was one degree north of the equator; had been worked by the Spaniards; previous to that by the Indians; and perhaps some of the gold furnished to Pizarro came from this very place. Golden fish-hooks lost by the Indians and recovered from the rivers, were shown to every visitor who came into the country. All of this was part of the 'glamour' used by promoters. Those fish-hooks could not be bought at any price; they were too valuable for catching another kind of fish.

The Cachani mines were near the coast, at an elevation of about 300 ft. above sea-level. It rained to some extent every day in the year except a so-called 'dry season' of three weeks, when it only rained at night. The gravel lay in bench-deposits formed by the present rivers, and had been nearly worked out by the Spaniards. After a year's time the American company concluded that there was not enough in sight to warrant moving the plant.

Geologic thermometry is now attracting attention and was discussed by Fred E. Wright at the Boston meeting of the Geological Society of America. In ordinary thermometry, temperature is defined by the expansion of a perfect gas, and is expressed in terms of fixed units, determined by the freezing and boiling points of water under standard conditions. Temperatures are ascertained practically by means of thermometers which, although they differ greatly in type, are all based on some property which varies in a definite way with the temperature. In geology temperatures are of fundamental importance, particularly the temperature to which rocks were heated in past geologic ages and under inaccessible conditions. Points on the geologic thermometer scale must, therefore, be historical points, to be determined primarily by the permanent effects which such temperatures have produced on the rocks and rock components, and which are clearly marked even at lower temperatures. The factors which may serve to furnish points of this nature are, especially: melting temperatures of stable minerals and of eutectics, inversion temperatures of minerals, temperature limits beyond which monotropic forms cannot exist under different conditions of pressure, also stability ranges of enantiotropic forms and of minerals which dissociate or decompose at higher temperatures, also temperatures beyond which certain optical or physical properties are changed permanently. These factors can be and are being determined by modern laboratory methods, and are in turn directly applicable to the study of rocks. The data now available on the geologic thermometer scale indicate that the establishment of such a scale is feasible.

Plotting Co-ordinate Surveys.

Written for the Mining and Scientific Press
By J. J. Bacsich

The device for plotting co-ordinates consists of a 45° triangle graduated on the two edges at right angles to each other to any required scale. In the figures are shown triangles graduated so that 1 ft. = 240 and 500 ft. respectively, others are readily available. The graduated edges are about 6 in. long.

By a proper assumption of the distance apart of the co-ordinate lines their representation on the plan will be contained within the graduated edges of the triangle. For example, using the 1 to 240 triangle the co-ordinate lines must be 100 ft. apart, and hence represented on the plan 5 in. apart; the 1 to 250, 100 ft., or 4.8 in.; the 1 to 500, 200 ft., or 4.8 in.; the 1 to 2500, 1000 ft., or 4.8 inches.

In the following discussion the axes of co-ordinates are assumed to be as represented in Fig. 1. Suppose the plotting is required on the horizontal plan

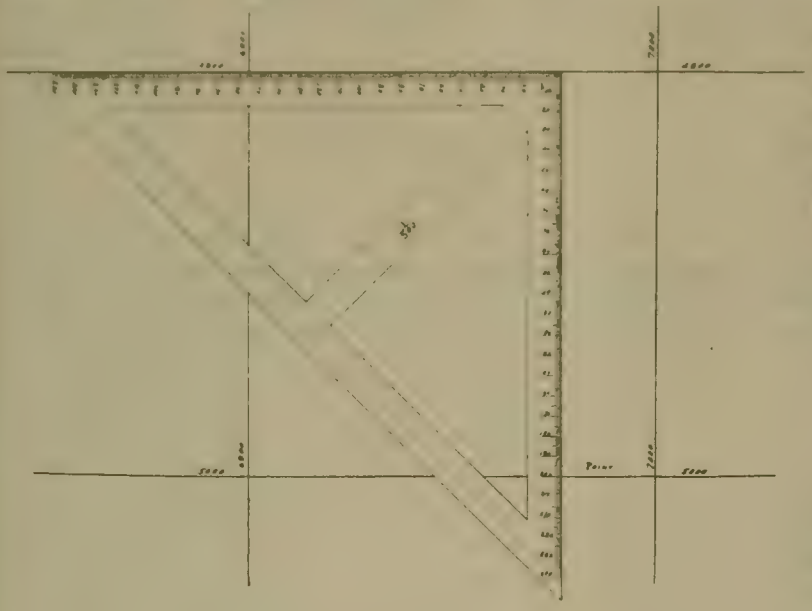


Fig. 2.

(scale 1 ft. = 500 ft.) of the stations whose co-ordinates are

	X.	Y.	Z.
309	6953.30	4995.06	1283.24
310	6978.09	4982.28	1280.64
311	6997.73	4975.30	1281.64
312	7059.39	4959.85	1285.29
310a	6976.75	4969.72	1251.65
310b	6974.15	4961.79	1241.71
310c	6975.36	4955.56	1235.55
210	6963.14	4897.66	1185.99
211	6975.96	4892.15	1185.45
212	7068.83	4866.98	1186.47

To plot Station 309, place the graduated triangle 1 to 500 on the plan (see Fig. 2) with one graduated edge coinciding with the line Y = 4800; then move so that the 153.30 (6953.30 – 6800) division coincides with the line X = 6800; then at the 195.06 (4995.06 – 4800) division on the other edge, prick a point; this will represent on the plan the position of Station 309. The other stations are plotted similiarly (see Fig. 4). As a check, place the graduated triangle so that the 195.06 division on one edge coincides with the line Y = 4800, and prick a point at the 153.30

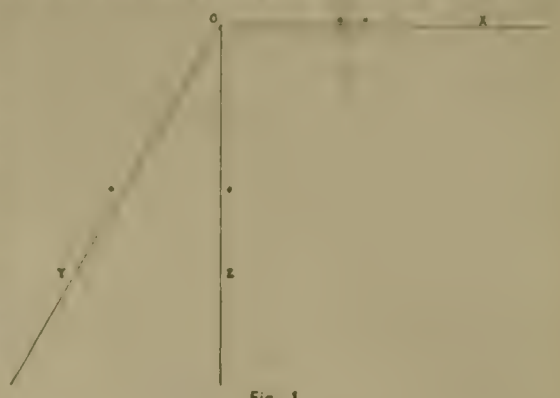


Fig. 1

division on the other edge. The two points should coincide. On any vertical plane or section the Z ordinate may be plotted similarly.

The graduated triangles above described may be employed in various ways. For example, suppose it is required to transfer the lower drift and part of raise represented in Fig. 4 (scale 1 to 500) to a plan (scale 1 to 240) (see Fig. 5). In Fig. 4 the 1 to 500 triangle is placed as indicated, in this instance with the 160 division on one graduated edge coinciding with the line X = 6800; the Y ordinates (4800 + 189.50) and (4800 + 195.50) of the points of intersection of the contours of the drift with the graduated edge of the triangle are read off: in Fig. 5 the 1 to 240 triangle is placed as indicated with the 60 (160 – 100) division on one edge coinciding with the line X = 6900; then points are pricked at divisions 89.50 (4800 + 189.50 – 4900) and 95.50 (4800 + 195.50 – 4900.) The triangles are moved convenient distances of 5 or 10 ft. and the Y ordinates read off and transferred as before. The points thus indicated are joined showing a contour similar to that of Fig. 4. Again if a projection is required on the vertical plane through Stations 210, 211, of the raise connecting 210 and 211 (see Fig. 3) (scale 1 to 240), then assuming in this plane that 210 is at 0 ft. horizontal distance, the other stations are at horizontal distances (measured off from Fig. 3).

Station.	Feet.	
210	0.00	
310c	59.00	(projection on plane 210, 310)
310b	65.00	" " " " "
310a	73.50	" " " " "
310	86.00	

and for 310 the graduated triangle 1 to 240 is placed with the 86 division on one edge coinciding with the

line $Z = 1200$, a point pricked at division 80.64 (1280.64 – 1200) (obtained from station co-ordinates listed above) on the other edge. The other stations are plotted similarly. From the notes taken when the transit was set under the several stations the contour is sketched in and the desired section is as shown in Fig. 6.

These triangles save considerable time in plotting,

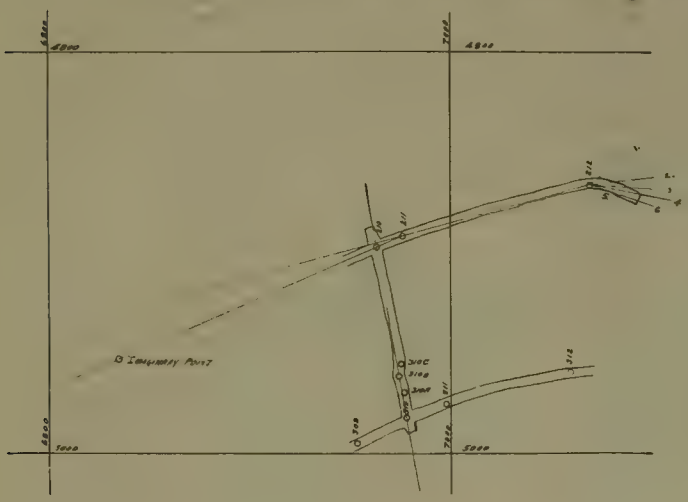


Fig. 3.

are accurate, and do not soil the plans, as there are no erasures to be made.

The device for plotting drifts is represented in Fig. 7. It consists of a protractor about 8 in. diam., graduated to 20 min., and numbered to correspond to those instruments whose numbering of graduations on the horizontal circle is from right to left. *B* is a slot in which *C* can be freely moved. *D* and *E* are scales graduated as desired; in this instance *D* is 1 to 500 and *E* 1 to 240. *F* is a hole in the slide *C* with the centre on the line through the centre *O* of the protractor and 0°. Line *G* passes through *F* and serves to indicate the distance along *D* and *E* of the centre of hole *F* from *O*. *H* is an upright, shown in section at *I*, through which passes vertically a fine needle. This needle is exactly over the centre of the protractor. The application is as follows, supposing the notes for the drift survey are: instrument, under 212; backsight, 211; foresight, drift.

	Horizontal angle.	Slope distance, ft.	Vertical angle.	
1.....	157°20′	4.75	90°	
2.....	188°40′	12.00	90°	
3.....	198°40′	18.00	90°	
4.....	206°40′	26.00	90°	
5.....	213°30′	10.00	90°	
6.....	213°30′	25.00	90°	Offset right 2 ft. Offset left 3 ft.

A line is drawn through 212 and 211 extending beyond 211; the protractor is then placed on the plan; the needle point pressed down through 212, and then revolved until 157°20′ is indicated, the slide moved to indicate 4.75 ft. in this instance on the scale 1 to 500. A mark is then made through the hole in the slide. This mark represents a point in the contour of the drift; similarly for the other points. When point 6 is plotted the off-sets indicated are made and the several points joined, thus showing the outline of the drift (see Fig. 3).

If when using this protractor the two stations are very near together, to secure accuracy the best plan is to find the co-ordinates of an imaginary point in the extension of the line through the two stations before drawing the reference-line through the two stations. For example, suppose the transit were set under 211, with the backsight 210, then proceed as follows:

Station.	X.	Y.
211	6975.96	4892.15
210	6963.14	4897.66
Difference	12.82	−5.51
Multiply by 10.....	10	10
Subtract from	128.20	−55.10

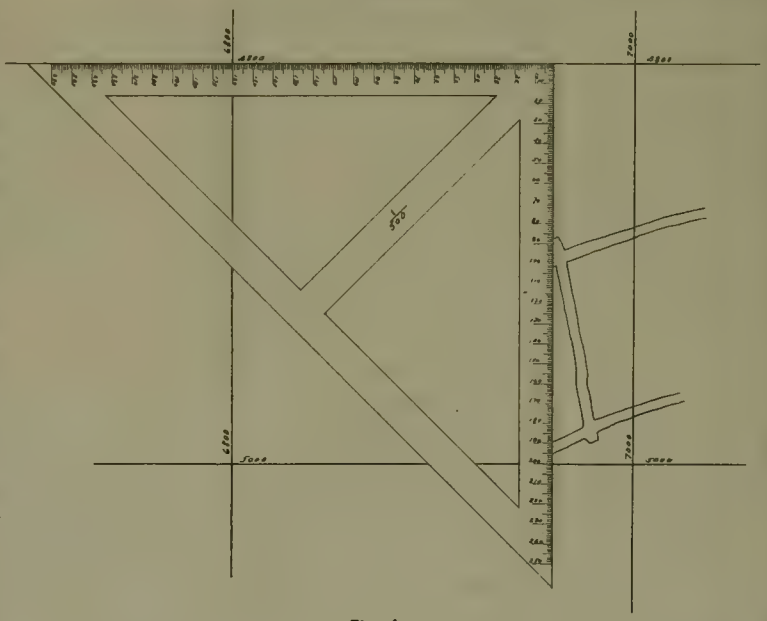


Fig. 4.

210	6963.14	4897.66
Co-ordinates of the imaginary point	6834.94	4962.76

Plot this point (see Fig. 3) and then draw a line through it and 210 or 211. To eliminate erasure as much as possible the line need be drawn for a short distance only, near the edge of the protractor. For distances less than half the length of the slide, that is, less than 2 divisions of 1 to 500 scale or 2 ft., after the horizontal angle has been indicated, the needle may be removed, and the slide moved to the required distance.

Perhaps a clearer idea regarding the use of the device for plotting stopes (which I prefer to designate the 'plotting protractor') will be given by describing briefly the method of surveying and plotting stopes to which it is applicable. The transit or theodolite is set up under a station, a sight taken to another station, the plates being clamped at 0°; the lower plate is then clamped and the upper unclamped and sights taken to the most prominent points of projection and recession of the face of the stope; these points being chosen about half way between the hanging and foot-wall of the stope, or preferably on the line of trend of the vein being stoped. The horizontal angle, the slope distance, and the vertical angle for each point, are recorded. By means of a table of latitudes and departures, or natural functions, or by logarithms the slope-distances are reduced to the horizontal; then on the plan, usually of a scale of 1 ft. = 240 ft., the horizontal angles are laid off and then the horizontal distance for each angle. The points thus determined are joined, thus forming the horizontal projection of the contour corresponding to that of the face of the stope. This contour, with that of the preceding survey, or in conjunction with the contour of the upper drift, or that of the lower drift, or of both, determines the horizontal projection of the area stoped. This area multiplied by the secant of the angle of dip is the slope-area corresponding to the area stoped. The dip is usually ascertained by sighting to a point on a rod at the same vertical distance above the foot-wall as the axis of the instrument, and held at a point in the line of dip as near as can be judged, and some distance from the transit. The vertical angle is read, giving the angle of dip; or the dip may be taken off the vertical section of the raise or winze from which the stope is being developed.

The method above described for surveying stopes in conjunction with the plotting protractor, and the methods to be described for determining the dip is a very advantageous one for all classes of stopes (flat, vertical, those with uniform dip and strike, or varying dip and uniform strike, or varying dip and strike, and those on a conical surface. The advantages lie in increased accuracy, a saving of time (as the notes of a stope survey can be plotted in one-fourth the time ordinarily required, at the same time dispensing with all laborious reductions) and the cleanliness of the plans, as few if any erasures are necessary.

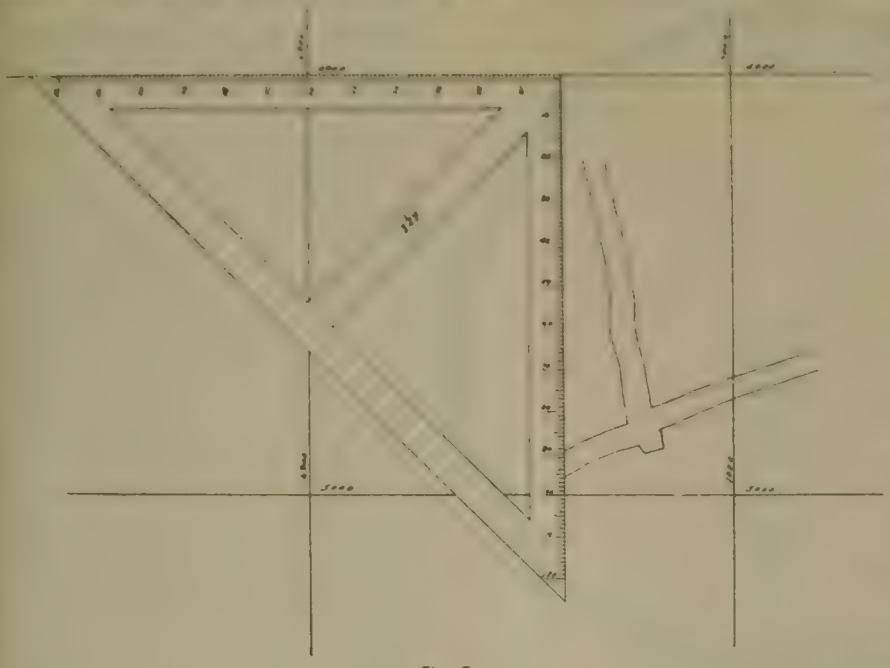


Fig. 5.

The 'plotting protractor' (see Fig. 8) consists of a protractor *A* about 13 in. diam., graduated to 20 min.: 10 min. being easily estimated; numbered from left to right, as indicated, with two sets of figures, one set black and the other set red, 180° in advance of the black, the object of which will be explained subsequently. This method of numbering is used in conjunction with those instruments whose graduations are numbered from right to left. *B* is a quadrant, independent of the main graduated circle,

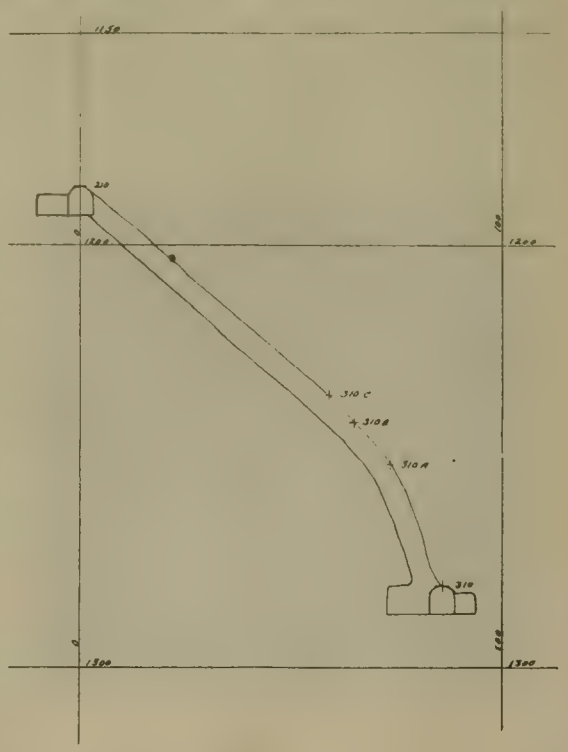


Fig. 6.

graduated to 20 min., and numbered with two sets of figures, one from 0 to 90° and return to 180°, the 0° division being opposite the 90° red, and the 270° black of the main circle. This set of figures is used

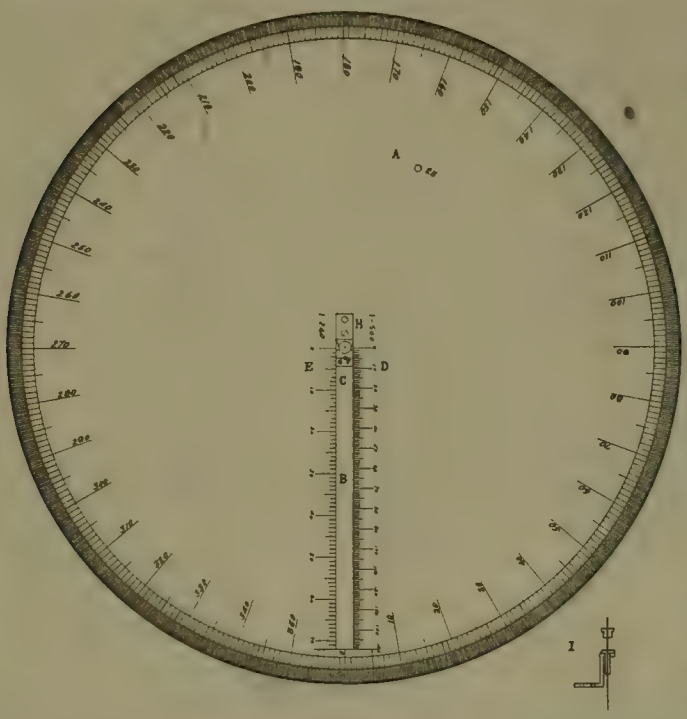


Fig. 7.

in conjunction with those instruments whose vertical circle is numbered 0 to 360° from right to left and whose verniers read 90 to 180° when the telescope is level. The other set of figures is from 0 to 90°, the 0° division being opposite the 0° black and 180° red of the main circle. This set of figures is used in conjunction with those instruments whose vertical circle

Fig. 8.

is numbered from 0 to 90°, to the right and left from 0°, and whose verniers read 0° when the telescope is level. *C* is a graduated scale (in this instance 1 to 240) and represents the slope-distance; *D* is a graduated scale (1 to 240) and placed at right angles to the line passing through *O*, the centre of the protractor, and 0° black of the main circle, and fastened to the slide *E*, which is movable along the guide *F*, so that the *O* division is always on line *O* 0°b. *G* is an upright through which passes vertically a needle *H* directly over the *O* division on scale *D*. This needle upon being pressed down makes a small mark on the surface of the paper and upon the pressure being released is returned to its usual position by a spiral spring. *I* is a fine needle over the centre of the protractor, and when not pressed down is retained free from the paper and also from dropping out when the protractor is not in use by a small flat spring. *A* corresponds to the horizontal graduated circle of the transit, *B* to the vertical, *C* to the measuring-tape, and *C*, *D*, *IH*, is a right triangle in which *C* is the hypotenuse or slope distance, *D* one leg or vertical distance, *IH* the other leg or horizontal, and *HIC* the angle representing the vertical angle of elevation or depression. By this mechanical arrangement slope-distances can readily be reduced to the horizontal, and vertical distances determined without recourse to tables. As an illustration, suppose that the slope-distance is 100 ft., the vertical angle 30°; move scale *C* until 30° is indicated on *B*, then slide *E* until the edge *D* indicates 100 ft. on *C*, then read off on scale *E* 50 ft., the vertical distance; *HI* is the horizontal distance, and is determined by revolving *C* to line *O*, 0°; 86.6 ft. is then read off as the horizontal distance.

To check *D*, that is, to ascertain if it be at right angles to line *O*, 0°, move scale *C* until 60° is indicated on *B*, then *E* until the edge of *D* indicates 100 ft. on *C*, then read off 86.6 on the vertical scale; then revolving *C* to line *O*, 0°, read off 50 ft. If there is any difference in the readings obtained by using 30 and 60°, *D* may be shifted by means of the screws by which it is fastened to *E* so that the *O* division is on line *O*, 0°, and also so that it is at right angles to line *O*, 0°. The upright may also be adjusted by means of the screws by which it is fastened to *D* so that the point of the needle when pressed down indicates *O* on scale *D*.

(To be Continued.)

The Haiditarod placers, which were discovered in the summer of 1909, may prove to be more important than those on the headwaters of the Innoko, according to the United States Geological Survey. Placer gold has also been found on Otter creek, which flows into the Haiditarod. Sufficient prospecting appears to have been done in this region to indicate the presence of a pay-streak 50 to 70 ft. wide, in which the gold is rather uniformly distributed. The information at hand indicates that these placers lie in what would be an extension of the Innoko auriferous zone.

Tres Hermanas Mining Distict, New Mexico.

By Waldemar Lindgren

*About 25 miles south of Deming, New Mexico, and 10 miles north of the Mexican boundary the small group of mountains known as Tres Hermanas rises from the general level. The lead and zinc mining district is in the northern part of the group. The mines have been known for many years and have yielded a moderate production, possibly $200,000, principally from the Cincinnati vein and from the lead deposits in limestone near the zinc mines.

The predominating rock is a granite-porphyry, which forms the central peaks and is intruded in Carboniferous limestones, which occupy the foothills. Possibly the rock is more correctly to be classified as a quartz syenite porphyry. The northern foothills at the zinc mines consist of bluish-gray fossiliferous limestones of lower Carboniferous age dipping northwest at low angles. At the junction with the granite porphyry contact metamorphism is noted.

The lead deposits consist of normal fissure veins in granite-porphyry and typical contact-metamorphic deposits of lead and zinc in limestone near the contact with porphyry. Little work has lately been done on the veins, which are situated about one mile south of the zinc mines. The Cincinnati vein, owned by the Golden Cross & Eagle Co., is the largest producer, and is said to have yielded $100,000. It is stated to be a narrow vein in porphyry, rich in lead and gold. The ore was found within 100 ft. from the surface. Some ore has also been shipped from the Yellow Jacket vein, which is reported to be an extension of the Cincinnati. The Hancock vein, owned by C. E. Burdick, of Deming, is also said to be a narrow vein in porphyry, up to 8 in. wide. The shaft on this vein is 400 ft. deep. About 1000 tons of rich lead ore, with some gold, is said to have been shipped.

The zinc mines are situated at the northern base of the first porphyry hills. Old surface workings indicate places where formerly galena ores were mined. In 1904 attention was attracted to a heavy white massive or crystallized material occurring plentifully in the old workings and it was found to consist of carbonates and silicates of zinc. The property, which consists of five claims forming a compact group, was worked by Thurman & Lindauer, of Deming, in 1905, and a considerable number of carloads of ore were shipped to Mississippi Valley smelters. Some difficulty was experienced in obtaining ore of the requisite high percentage, and the systematic and careful development that the property seemed to deserve was not undertaken and it was practically idle in 1906 and 1907. Another group of claims adjoining the property on the northwest is owned by Deming men and some ore containing zinc and lead was shipped in 1906. The railroad freight from Deming to the smelters is $5 per ton, and the hauling to the station costs $2 per ton. Ore containing 29% of zinc was paid for by the smelters at about $11 per ton, and 37% ore yielded approximately $16.50, obviously the lower grade left but little profit. The developments are slight, consisting of a few shallow inclines and surface cuts.

The traveler approaching Tres Hermanas from the north first encounters a low broad limestone ridge, separated from the higher and more abrupt hills of porphyry on the south by a low gap. The principal zinc mines lie on the west side of this gap. At the principal workings there is a small hill with limestone which lies flat on the top, but bends to dips of 20° on the north, west, and south. The actual contact with the porphyry south of the gap is not well exposed, but near it the limestone contains several well defined dikes, and in one place a projecting broad tongue of porphyry distinctly cuts across the strata. Contact metamorphism is clearly manifest, the affected zone being in places over 1000 ft. wide. The principal complex of limestone northwest of the gap is, on the whole, not metamorphosed, but even here, more than half a mile north of the contact, a few thin beds of garnet rock and coarsely crystalline limestone are noted. In the gap the crystalline limestone prevails, with intercalated beds of pure garnet rock and hornfels, the latter evidently representing a contact-metamorphosed lime shale. Some of the strata exposed here contain well preserved specimens of *Spirifer* and *Fenestella* and look like limestone, but, in fact, the rock consists very largely of garnet. The principal zinc workings, about 2000 ft. west of the gap, are in limestone, in which the only sign of alteration consists of bunches of wollastonite.

The deposits contain oxidized zinc minerals and some galena; they lie in part parallel with the stratification, but in part they follow short and ill defined nearly perpendicular fissures and veins cutting across the beds and varying in strike from northwest to southwest. The ores also in places form irregular bunches in the limestone. Several small deposits of the two latter classes are present on the main limestone hill, in many of the prospect holes sunk there, but have not yet been proved to be of value. A short distance north of the principal gap, oxidized zinc ore occurs in kidneys and bunches between beds of coarsely crystalline limestone and garnet rock. A vein-like deposit striking N. 60° E. and standing nearly vertical also contains zinc ore at this place. Many of the prospect holes in the area of most intense contact metamorphism in the gap or immediately east of it have also given assays high in zinc. The principal developments, about 2000 ft. west of the gap, consist of surface pits and small shafts with irregular workings. Here the oxidized zinc ores occur in the greatest abundance, in part parallel to the strata, in part along a vein with west-northwest strike. Little intelligent prospecting had been undertaken in 1905, the deepest hole having attained only 35 ft. from the surface. The ore grades into limestone, and great care must be exercised to avoid mixing with barren material. A few green stains are the only indications of copper minerals found. Possibly exploration may develop more of this metal in beds at greater depth.

*Abstract from 'Contribution to Economic Geology', 1908, U. S. Geol. Surv., Bull. 380.

Sources of Error in Analyses.

Written for the MINING AND SCIENTIFIC PRESS
By R. C. BENNER.

Some of the common mistakes which occur in the chemical laboratory are due to incorrect calibration of weights and volumetric apparatus. Many chemists take for granted that anything which is stamped by the manufacturer as weighing a gram, or holding a litre, must necessarily do so. But weights once correct may have become incorrect by wear or corrosion by fumes from the laboratory. The better class of weights made by a reliable manufacturer will, in most cases, be sufficiently accurate for any work that the analyst is likely to undertake. Cheap weights should not be used for work where accuracy is required, not only on account of their probable inaccuracy, but also because of the ease with which they corrode and change weight. Gold and platinum-plated weights should be used, and in order to be sure of their accuracy, should be tested against one another, against a standard weight, or, still better, if very accurate work is to be done, they should be calibrated by the Bureau of Standards at Washington, D. C.

Testing of weights is easy and can be accomplished as follows: It is necessary first to determine the sensitiveness of the balance used in testing the weights. Sensitiveness of a balance is the number of scale divisions displaced by the pointer when a weight of one milligram is placed on the pan. All of these determinations are made by the method of swings, which is sufficiently accurate for the purpose in hand. Let the divisions on the ivory scale be numbered from left to right of the zero point (Fig. 1). The point of rest is then found by setting the

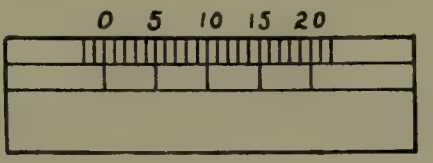


Fig. 1.

balance in motion and, after the first two or three swings, the extreme position of the pointer is recorded, taking an odd number of readings, say three to the left and two to the right. The results are arranged as follows:

Left.	Right.
1.3	19.9
2.0	19.6
2.3	2 | 39.5
3 | 5.6	19.7
1.9	1.9
	2 | 21.6
	10.8

The point of rest at this particular time is thus 10.8. The point of rest with one milligram on the right-hand pan is next determined in the same manner as when there is no weight on the pan. Suppose that the result obtained is 7.6. The difference between the two points will give the number of scale divisions that one milligram will displace the pointer. This is the 'sensitiveness' of the balance. This is used in the following manner for the determination of the weight of an object. The object to be weighed is placed on the left-hand pan and balanced to the nearest milligram, by placing the weights on the right-hand pan. Suppose that when 10.561 gm. is the weight placed on the right-hand pan, the point of rest is determined to be 13.01. One milligram is now added by means of the rider and the point of rest found to be 10.30. The sensitiveness for this load is the difference between these two readings, that is, $13.01 - 10.30 = 2.71$ scale divisions. The true weight is then computed from these data in the following manner. Subtract the point of rest of the balance without a load from the point of rest with the load, that is, $13.01 - 10.80 = 2.21$ scale divisions. This gives the number of scale divisions that the point of rest with the load differs from the point of rest of the balance. The ratio between this value and the sensitiveness gives the weight it takes to move the pointer 2.21 scale divisions or the amount to be added or subtracted from the observed weight 10.561. For example: $1 : X :: 2.71 : 2.21$. Here $X = 0.78$ mgm. to be added to the observed weight. $10.561 + 0.78 = 10.5618$ grams, the true weight of the object weighed. The sensitiveness of the balance as a rule varies slightly with the load, so that it is better to determine the sensitiveness for a series of weights once for all. 1, 2, 5, 10, 20, and 50-gram weights are those generally taken. The zero point for accurate work, such as the testing of weights, should be determined at the beginning and at the end of each weighing, taking the mean of the values thus obtained.

In most sets of weights there are one 50, one 20, two 10, one 5, three 1, one 0.5, one 0.2, two 0.1, one 0.05, one 0.02, two 0.01-gram weights and also a rider which is used in making weighings which are carried out farther than 0.001 gm. In testing such a set of weights, the assumption is made that the sum of the larger weights is equal to 100,000 milligrams, and then each is compared with the other members of the set in the following manner: The 50-gram weight is tested against $20 + 10 + 10 + 5 + 2 + 1 + 1' + 1''$. By this method of double weighing these are compared with one another, that is, comparing, and then changing the weights about. Those which were on the right-hand pan are placed on the left-hand pan and those which were on the left are placed on the right-hand pan and the weighing repeated. In this manner it makes no difference if the two balance arms are not of equal length. If the absolute value is desired a standard weight is necessary.

Example: Left. Right.

(1) 50 gm. + 0.15 mgm. = 20 + 10′ + 10″, etc.

(2) 20 gm. + 10 + 10′ etc. = 50 gm. + 0.30 mgm.

from which we get by averaging

$$50 \text{ gm.} \frac{0.15 \text{ mgm.} + 30 \text{ mgm.}}{2} = 50 \text{ mgm.} + 0.22 \text{ mgm.}$$
$$= 20 \text{ gm.} + 10 + 10' \text{ etc.}$$

or

$$50 \text{ gm.} = (20 + 10 + 10' \text{ etc.}) - 0.22 \text{ mgm.}$$

When the other weights are compared in a similar manner we obtain the following table:

$$50\text{ gm} = 20 + 10 + 10' \text{ etc} + X \text{ mgm}$$
$$20\text{ gm} = 10 + 10' + Y \text{ mgm}$$
$$10'\text{gm} = 10 + Z \text{ mgm}$$
$$5 + 2 + 1 \text{ etc} = 10 + M \text{ mgm}$$

In these equations X, Y, Z and M can be either positive or negative. Remembering that the sum of all of the weights is assumed as equal to 100,000 mgm. we obtain from the preceding equations,

$$10 + 10 + X + 2Y + 4Z + 2M = 50 + 20 + 10 + 10' \text{ etc} = 100{,}000 \text{ mgm.}$$

transposing and dividing by 10

$$10 = 10{,}000 - \frac{X}{10} - \frac{2Y}{10} - \frac{4Z}{10} - \frac{2M}{10}$$

$$\text{now let } \frac{X}{10} + \frac{2Y}{10} + \frac{4Z}{10} + \frac{2M}{10} = N$$

By means of the equations above, we obtain the following values of the larger weights. Those of the smaller are found in exactly the same manner.

$$10 = 10{,}000 - N$$
$$10' = 10{,}000 - N + Z$$
$$5 + 2 + 1 + 1' + 1'' = 10{,}000 - N + M$$
$$20 = 20{,}000 - 2N + Y + Z$$
$$50 = 50{,}000 - 5N + X + Y + 2Z + M$$
$$= 50{,}000 + 1\ 2X$$

If the operations are carried accurately 1 2X + Y + 2Z + M - 5N should be equal to zero.

Although graduated glassware is as likely to be incorrectly calibrated when it comes from the manufacturer as are weights, it is not nearly as likely to become inaccurate by use, for the reason that weights lose their accuracy unless carefully protected from all fumes. When the glassware is once correctly standardized, the standardization is practically permanent for ordinary purposes. In glassware, as in case of the weights, it is not necessary that any graduated instrument should have a definite volume, but all instruments used in the same laboratory should be calibrated against one another. It is also desirable that the glassware should be calibrated with the set of weights which is used with them. The volumetric glassware commonly used consists of burettes, pipettes, measuring flasks and graduated cylinders.

The flask to be graduated is usually one which the manufacturer has already calibrated and must be checked, or one which has been made for the purpose, having a long cylindrical neck about 17 mm. diam. It is first cleaned with a solution of potassium bichromate in concentrated sulphuric acid, so that when the flask is filled with water and allowed to drain no drops will be left clinging to the sides of the flask; then it is dried thoroughly and balanced on one pan of a balance that will carry a load of 1.5 kg. or more on each pan and be sensitive to one decigram. A kilogram weight is then placed on the opposite pan and the flask is filled with distilled water at 17.5°C. until the weight on the opposite pan is balanced. All drops of water above the meneseus are wiped off with a piece of filter paper and equilibrium restored by adding or removing a few drops of water with a thin glass tube of small bore. This being accomplished, a piece of gummed paper with a straight edge is placed around the neck of the flask so that its edge is tangent to the bottom of the meneseus. The flask is emptied, dried, and the operation repeated as before, the average of three readings being taken as the correct one.

A pipette when it is calibrated should be cleaned in the same way as the flask. When clean, a long narrow strip of paper is pasted along the neck of the pipette. The pipette is now filled with distilled water at 17.5° C. from any ordinary pipette that may happen to be at hand, and the position of the meneseus noted in the paper. A glass stoppered bottle is now placed on the balance and the contents of the pipette allowed to flow into it, the last drop being removed by touching the side of the flask with the end of the pipette, always repeating the operation of discharging in the same manner. The flask is then stoppered and weighed. If the weight is too much or too little, a larger or smaller amount is measured into the pipette and the bottle weighed as before and another mark noted on the paper. This is continued until the correct amount of water is obtained. This volume of water is then weighed three times and the average taken as correct. The mark is etched on the glass with hydrofluoric acid.

Burettes are most conveniently standardized after the manner of Ostwald. The apparatus needed is shown in Fig. 2. The small pipette and the burette

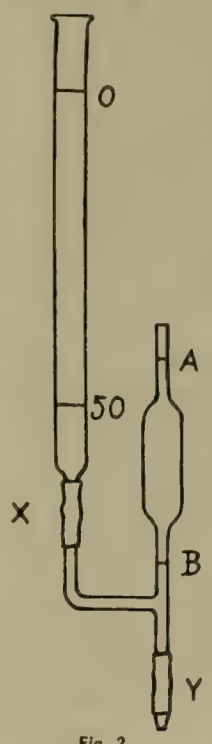


Fig. 2.

are cleaned with the chromate sulphuric acid mixture. After cleaning, the small pipette is filled with distilled water exactly to the mark at A by pressing the glass bead in the rubber tube at X; Y is opened and the water allowed to run into a tared beaker until the lower mark at B is reached (the pipette should always be drained a minute before the final reading is taken). This water is weighed, the whole operation repeated two or three times, and the mean taken as the correct content of the pipette. Fill the burette to 0 and the pipette to B with water at a constant temperature, not necessarily at 17.5°C., press X, allowing the pipette to fill to A, always draining one minute before the reading is taken. Then discharge the pipette to B by pressing Y, allowing to drain one minute as before. The reading on the burette, if it be calibrated correctly, should of course check with that on the pipette. The readings are usually repeated after the burette has been checked throughout its length. From the readings thus obtained it is easy to construct a curve from the average readings as abscissae and the total corrections as ordinates.

Antimony may be separated from other metals contained in an alloy by taking advantage of the fact that the Sb oxides obtained by the treatment with HNO_3 are rendered completely insoluble in HNO_3 by heating to 125 to 150° Centigrade.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Oriental Trade and American Shipping.

The Editor:

Sir—Anent Thomas T. Read's views of the relations between trade and transportation, as mentioned in your issue of February 5, one phase of this relation will probably be remembered by San Francisco merchants of 30 years ago. Until the Southern Pacific was opened through Arizona the British engrossed the trade of Sonora. As soon as the road was opened American goods, notably cottons, drifted down on pack trains. They were so much better and cheaper than the British cottons then sold in Sonora that about the time they reached Hermosillo the Guaymas merchants found their staples unsalable. Eventually these samples of 'peace on earth and good will towards men', as I was told by one of the firm of Cabrera & Romá, were taken away from Guaymas by the British factors to be vended where American transportation facilities did not preclude their sale.

There are few who do not know that our control of the railroads leading into Canada and Mexico has given us more than half the imports of those countries, or that the enforcement of our coasting laws as to the trade of Hawaii and Porto Rico gives us 80 to 90% of the imports of those islands. On the other hand, we sell the Philippines between 16 and 17% of their purchases with the carrying trade between them and this country open to the competition of the world. In the meantime the four lines of foreign tramps our Government employs to carry its freights to the Philippines, discriminate against Mr. Read's ability to get American goods in Tientsin. The Germans, whose subsidizing of a steamer line to the Far East is too notorious to be denied, not only beat us in the literature on the subject, but as Mr. Read shows, in their delivery of goods. England, as is well known, does not subsidize its shipping, but according to Henniker Heaton's often quoted letter to the London *Times* the P. & O. S. S. Co. is paid £365,000 annually, or $4880 per day, 'for carrying the mails'. Our sales to the Orient, including India and China, but excluding French Indo-China and the Philippines, averaged for the three years ended with 1906, $47,500,000, while England averaged $315,000,000, a pretty fair trade-return for an annual expenditure of $1,780,000.

An incident in our cotton trade with the Philippines seems to have escaped general notice. On February 26, 1906, an amendment was made to the Philippine tariff of which the 'Altruistic' Ide (afterward a receiver for Knickerbocker Trust Co., of New York), said (see Report of Philippine Commission, 1906, Part I, p. 63, and Part III, p. 14), "by changes in the cotton schedule of the Philippine tariff such as to increase the price of cotton goods in the islands for the benefit of manufacturers of cotton goods in the United States, changes which were made discriminative in such a way as to exclude foreign manufacturers and thereby enable American manufacturers to fix their own prices," etc. In 1907 we sold the Filipinos 13.6% of their cottons, while the United Kingdom and its dependencies sold them 52.5. In 1908, however, we sold only 8.5 and England 55.8. In 1909 our sales were again 8.5%. The result has not justified the expressed fear of discriminations in favor of American manufacturers.

This result may be ascribed to the fact that the United States Government, by its policy, gives ample employment to British ships and withholds employment from American ships, putting it in the power of our rivals to so manipulate freight rates as to transfer that trade to manufacturers in Great Britain. This has been done in other instances. The excess for 1908 in the sales of British cottons of over three and three-quarter million dollars, sufficient to support 7000 to 8000 people, must have been eminently satisfactory to British farmers, manufacturers, and middlemen, with all those in any way dependent upon them. But no American, farmer or otherwise, except those who dare not admit it, received any benefit.

An examination of the tables in the Bureau of Statistics, 'Statistical Abstract of Foreign Countries', Washington, 1909, particularly of Table 2, will show conclusively that when we control the means of transportation our share in the sales of commodities is satisfactory. When the demand for our commodities is great enough, our rivals will put on lines of steamers to curtail our market. Incidentally it will be noticed in the 'Abstract' referred to, that of the total Turkish imports (my remarks on which Mr. Read thought 'ridiculous'), we sell to that country about one-quarter of one per cent. If we get concessions there, as is now hoped, rivals will put on lines of freighters to make freight rates satisfactory to European producers, but no passenger lines that might encourage greater personal knowledge of Turkish wants.

The readers of the MINING AND SCIENTIFIC PRESS may be assured that this fight against American shipping is not solely a fight to retain all of the $250,000,000 which we pay yearly to foreign over-sea carriers; it is a fight to keep us from access to those small markets in which the largest percentage of profits is made. And no narrative of bad packing can rub this out. Mr. Read's skepticism as to the 'possible advantage' accruing from the betrayal of the interests of this country, will excite a smile from those who have read of the sugar trust's swindling, and have noticed the support both political parties gave the late Henry Havemyer. A somewhat similar case, of special interest to the Pacific Coast, lies in the statement made lately, that the coal lands of Alaska have been saved to the people of the United States, that is to say, their development has been indefinitely postponed. Now comes Arthur Brownell in the *Outlook* who says: Our navy on the Pacific burns approximately 400,000 tons of coal annually, most of which comes from Wales. The development of our Alaskan coalfields would save the Government about $4,000,000 per year. For the sake of that will the Alaskan coal-

fields be developed? No, they will be reserved for future generations of the American people, and all the foreign carriers will help to sustain the policy. In the meantime San Francisco and the active Pacific Coast will be prevented from adding to its wealth thereby through manufacturing.

EDWARD P. NORTH.

New York, March 8.

Alfred James' Annual Cyanide Letter.

The Editor:

Sir—In your issue of February 26, I notice two letters by E. M. Hamilton and John M. Nicol, respectively, in which they take exception to certain statements made by Alfred James in his annual cyanide letter. I am quite in sympathy with both these gentlemen. While at Kalgoorlie, Western Australia, I presume I handled a larger tonnage than any individual manager in that district with the Dehne filter-press. The combined tonnage of the following mills was all handled by that press: The Great Boulder Perseverance Gold Mining Co., Ltd.; The South Kalgurli Gold Mining Co., Ltd.; The Hannan's Public Crushing Co., Ltd. These three properties had a combined tonnage of over 35,000 tons per month, all handled in the Dehne press.

My experience, which covered a period of over eight years, taught me that you could not secure a perfect wash with it. This was particularly true where the product going to the Dehne press was not carefully classified. The cakes chaneled and there was more or less gold in solution thrown out with the sand or tailing. This prompted me to investigate the Moore vacuum filter and with its use I had the tailing from most of the mines in the Kalgoorlie district tested, extracting gold with the Moore vacuum filter by simply washing discarded tailing from the dumps of all the mines in the district. I had a great number of tests made by A. J. Wyly under my personal direction. We improvised a small unit of the Moore vacuum filter, but the results were all most satisfactory and showed conclusively that the washing of an unclassified product was more efficaciously done in the Moore filter than a classified product in the Dehne press. The amount of gold in solution in the tailing from the Moore filter was uniformly low, and I know of no filter where the washing is so perfectly done. I am satisfied that there is no comparison between the Dehne filter-press and any of the submerged types of vacuum filters now in use. All of these vacuum filters are superior in every way as to costs and efficiency to the Dehne, and it is for this very reason that George Moore invented and introduced the first successful vacuum filter at the Mercur mill in Utah, U. S. A. The facts brought out by the numerous tests made with the Moore vacuum filter at Kalgoorlie were never published, but copies of results were given to all the managers on the Golden Mile. And the reason why so many Dehne presses are in use today in Westralia is because the installation of these presses was effected at great expense. English conservatism, in this case resulting in extravagance, has since kept them in use.

RALPH NICHOLS.

Gilmore, Idaho, March 8.

Gold Mines of Tibet.

The Editor:

Sir—Imagination is a great gift, but its use in technical journals should be tempered with discretion, if not with knowledge. This thought is brought to mind by a perusal of an article in your issue of February 12, entitled 'Gold Mines of Tibet'. The encyclopedic information of the first three columns I will not venture to criticise; it seems exhaustive and eclectic, but the geographic and other information of the last two paragraphs strains my credulity to the utmost. I have seen nothing like it since the publication of Gelett Burgess' 'Map of Bohemia'.

When the writer tries to identify Tibet and Siberia and mentions the tundras of the former, it is bad enough; but when he goes on to mention "the Island of Liakoff, north of the Manchurian tundras" and speaks of the "Yukutsk fair," one suspects him of attempting to perpetrate some humorous hoax.

Everyone knows that a certain number of prehistoric elephants have been found imbedded in the ice in the northern *taiga* of Siberia and that objects carved from this ivory are to be purchased at the fair at Irbit, some thousands of miles west of Manchuria; and it also is generally known that the skeletons of several mastodons have been unearthed in the *tundra* of northwestern Siberia, as the result of prospecting for mines, and now rest peacefully in the museums. But when the author of the article in question says that "these tundras are in places full of the carcasses of elephants and rhinoceroses preserved in ice, both of them still yielding ivory of a marketable value," he is wafted away on the wings of his imagination quite beyond the range permissible in a technical journal. In stating that recently nearly a hundred carcasses were found practically in a single cluster, and that in 1898 no less than 80,000 lb. of fossil ivory were offered for sale at the 'Yukutsk' fair, he very nearly approaches Baron Münchhausen at his best.

JEROME B. LANDFIELD.

Binghamton, N. Y., March 1.

English in Our Technical Journals.

The Editor:

Sir—In your issue of March 5, Mark R. Lamb takes opportunity to file objection to a part of my letter to you, which appeared in your issue of November 13, 1909. Mr. Lamb's objection is based upon a fallacy; which itself is beside the point. I therefore wish to submit the following as more clearly defining my position.

Mining, smelting, cyaniding, etc., from the point of view of mere technique are mechanical operations; but the engineer, who investigates and directs the application of scientific principle, making these operations possible, is not a mere automaton, but a thinker. This view identifies him with technical philosophy. The discussion and interpretation of these mechanical operations forces him to assume the rôle of philosopher whether he would or not. This assumption recognizes him as a representative type of a species. As a result of the application of the law of selection, this representative type should produce the best that is in the species. I am sure that Mr.

Lamb is not ready to admit that careless thinking and careless writing is the upper limit of the capabilities of this type specimen. If this be the upper limit, the species is in need of re-classification. If there is room for improvement then it is plainly unfair to put the entire responsibility of revising and rewriting current technical literature upon the shoulders of the editors of technical journals. My letter was written in the spirit of constructive, not destructive criticism. It was not my intention to assume a scornful attitude, but it was my intent to call attention to an evident deficiency in one of the fundamental sciences of learning. I am convinced that to work with the determination to improve, even our best, shall result in broadening and deepening our knowledge of natural law to such an extent that the application of theory to practice shall become easier, thereby putting into our hands the knowledge of the better use of a most excellent tool. I have a further deep conviction that what is fittest shall survive, and I believe also that every man owes it to posterity to give to it the best of which he is capable, be that little or much. In other respects Mr. Lamb's objection is its own reply.

W. W. STRANGE.

Pony, Montana, March 13.

Pan-Americanism.

The Editor:

Sir—As a resident in Central America I venture to disagree with your editorial on Pan-Americanism of December 18. I do not think that the cause of revolutions can be so easily and lightly laid at the door of the grafting foreigner. Revolutions in Central America are simply the natural method used by the party that is out of power to eject the rival party. It is their way of electing a new government. The method appeals to the theatrical nature of the Latin-American, and the only way to cure him is to educate him out of it, by showing him what good government really is. The United States, as a great Anglo-Saxon nation, cannot afford to shirk its responsibility, but must take its share of the 'white man's burden'. As these turbulent little republics are as yet unable to be responsible for themselves, someone must be responsible for them, and for their behavior. Granted that the United States does not desire additional territory, nevertheless she must not wince under the insinuation of 'land grabbing' nor permit continual bloodshed and disorder under the protection of the Monroe doctrine.

SANGRE.

Managua, Nicaragua, February 10.

[We are glad to have the opinion of one resident in Nicaragua tending to exculpate Americans from responsibility for the recent upheaval. We are willing to concede that the revolutionary proclivities of the 'ins' and the 'outs' in Latin-America have offered superior opportunities to foreign corporations to entrench themselves by financing such demonstrations to the end of insuring a subservient administration. The revolutionary method was an evolutionary method in Spanish-America until it became the instrument of grafting foreign corporations. The stench of the asphalt case in Venezuela still offends all decent Americans, and the circumstances that brought on the revolution at Bluefields had more to do with the fruit business of American importers than with the personal ambitions of Nicaraguans. The ambitions might have been there, but the sinews of war had to arrive from the United States before the warrior-politicians found the courage to back up their convictions. The duty of the United States is clearly to protect the lives and property of all its law-abiding citizens, resident in foreign lands, and to do it with warlike emphasis when diplomacy fails, and its further duty is to refrain from pressing weak governments to pay the illegal claims of grafting corporations as too commonly it has done, sometimes with insufficient knowledge of the facts, and sometimes without regard to them. The sooner the Government at Washington adheres to these lines the sooner will revolutions in Spanish-American countries cease to be profitable.—EDITOR].

Silver on Filter Leaves.

The Editor:

Sir—While recently overhauling some vacuum filter leaves, which had been used in filtering silver-bearing solution from Tonopah ore, I noticed a metallic white plating or scale on exposed, that is, unpainted iron parts of the filter-leaf and where the paint was rubbed off. This occurred both in spots in the iron piping inside the canvas cover and also on the nails in the wooden head-piece. Selected portions of this scaly material proved to be silver, when tested. It would be interesting to know how much silver is deposited inside the solution piping in various cyanide mills of the United States, or in Guanajuato and Pachuca. Probably the total amount is not great, but it may still be more than most people think.

DONALD F. IRVIN.

Bodie, California, February 26.

Cyanide History.

The Editor:

Sir—I have read Alfred James' letter in your issue of September 25. I have nothing to withdraw from my letter on 'The Vacuum Pump in Cyaniding' inserted in your issue of July 3, and principally because I think the prolongation of this controversy is of no real interest, I have nothing to add to that letter.

JOHN S. MACARTHUR.

Glasgow, October 22.

[The delay in printing of the above letter has been due to our not understanding in the first instance that it was offered for publication.—EDITOR.]

Selenium in Washington.

The Editor:

Sir—The discovery of a selenium mineral in gold-bearing quartz from the Republic district, Washington, was announced by Waldemar Lindgren at a recent meeting of the Washington Geological Society. Selenide of silver has been known from this State for some years. I reported its occurrence in *The Engineering & Mining Journal* November 25, 1899.

M. H. JOSEPH.

Republic, Washington, March 21.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

The Mint does not buy gold dust or old gold in lots of less value than $50. Smaller quantities may be sold through brokers.

Leases granting the right to extract ore from a certain level of a mine involve the right of extraction to the next level above.

Mining locations may overlap previously acquired territory, whether patented or not, or whether the latter is agricultural or mineral, or whether the inclusion of such land is due to accident or design, or by the consent of its owner, or without such consent if peaceably done.

Bromine is obtained largely in Michigan as a by-product from the salt industry. It is also made in Ohio, Pennsylvania, and West Virginia. The total output is only about one million pounds per annum, the low price not stimulating a larger production. The bromine exists in the brine as the bromide of magnesia, the amount seldom exceeding two grams per kilogram.

Adobe is a name given to plastic clayey soil which has the property of setting when dry, without burning. The term is not properly applied to clay alone. In the semi-arid regions of the Southwest and Mexico such soils abound, and furnish the material for sun-dried bricks, also called 'adobes'. The plasticity of adobe soils is due to the same causes as that exhibited by ordinary clays.

Production of the St. John del Rey mines, in Minas Geraes, Brazil, for the first half of 1909 amounted to £197,495, from 96,021 tons of ore. The company owns the Morro Velho and Guyabá mines, in which ore reserves to the extent of over 1,000,000 tons have been developed. The plant consists of 120 stamps, and 7 tube-mills. It is the largest gold mine in Brazil, and has one of the deepest shafts in the world.

Cement-rock is a limestone containing such proportion of clay that, on being burned and then ground, it will develop the property of 'setting' when moistened. To produce a portland cement the material when burned should show a composition of approximately 62% lime (CaO), 20 silica (SiO_2), 6 alumina (Al_2O_3), and 7 ferric oxide (Fe_2O_3). The remaining 5% will consist of various substances, such as magnesia, potash, and titanic acid.

Nickel was produced in the United States in 1908, according to the United States Geological Survey, at Fredericktown, Missouri, from the ores of the North American Lead Co., and from one lot shipped by the Nevada Nickel & Copper Co., having mines at Bunkerville, Lincoln county, Nevada. Some nickel salts also were made by the United States Metals Refining Co., at Crome, New Jersey, from electrolyte solutions obtained in refining copper. The principal source of nickel, however, was ore imported from Sudbury, Canada, where the Orford Copper Co. and affiliated concerns have mines. The imports for the year were: nickel and nickel alloys, 227,584 lb., worth $86,905; ore and matte, 16,586,423 lb., $2,396,217; nickel oxides, 11,284 lb., $1483.

Sulphur Bank is the name of a famous quicksilver mine in Lake county, California. It is a classic spot for geologists because it presented the interesting phenomenon of ores in process of deposition from solution in a solfatara which was not entirely extinct. The cinnabar does not occur near the surface, but is found below the limit of oxidation, mixed with native sulphur. Marcasite is also present, with small amounts of gold. The property has been a large producer of quicksilver.

Paints for protecting iron-work should be made of pigment containing three different sizes of particles. Such a coating is much more impervious and durable than a paint containing one or two sizes of pigment particles only. This fact has been determined by careful tests by the scientific section of the Paint Manufacturers' Association. Researches conducted by Allerton S. Cushman show that certain paints promote corrosion of iron and steel, others are inert, while still others actually prevent corrosion.

Weights and measures should be used as below, according to a report adopted by the Institution of Mining and Metallurgy: (a) The word 'ton' to represent a weight of 2000 lb. avoirdupois (29,166.6 oz. troy). (b) The word 'gallon' to represent the Imperial gallon measure of 10 lb. of water. (c) Temperatures should be expressed in degrees Centigrade. (d) Returns of gold and silver should be expressed in terms of fine gold and fine silver, respectively, not as 'bullion'. (e) Gold contents of ores, etc., determined by assay, should be expressed in money values as well as in weights; and in this connection the value should be taken (as a convenient constant) at 85 shillings or $20.67 United States currency, per troy ounce of fine gold.

Halley's comet, according to W. H. Pickering, has been identified as a member of the solar system for over 2000 years, but certain characteristics of its orbit suggest that it has been with us at least ten or perhaps one hundred times as long as that. According to all accounts, it was a magnificent object at the time of the Norman conquest in 1066. Its head was equal to the full moon in size, and its tail increased to a wonderful length. Comets whose periods are less than one hundred years are called periodic comets, and nearly half of them have been observed more than once. At present they number forty-five, but only three of them are retrograde; that is, revolve in their orbits in the opposite direction to the planets. Halley's comet is one of these three, and as a result it will pass the earth with a very rapid motion. At that time the earth will be moving in its orbit at a speed of eighteen miles per second, and the comet in nearly the opposite direction at a speed of twenty-five miles. The relative motion is, therefore, about eighty times that of a cannon ball.

Special Correspondence.

NEW YORK.

Anaconda-Amalgamated.—Con. Arizona.—Granby Con. — Wettlaufer-Lorraine.—Markets Dull. — Copper Stocks. — Braden Copper.

The Amalgamated Copper Co. owns practically all of the stock of the various companies recently taken under control by the Anaconda with the exception of Red Metal, which is a holding company owning the direct title to the Butte Coalition properties and stock control of the Alice. The Amalgamated ownership in Anaconda, held previous to the increase in the capital stock, together with the additional stock which it will receive in exchange for its holdings in various companies, will give the Amalgamated about 3,075,000 shares of Anaconda, being a little less than three-quarters of the total stock issued while there will remain in the treasury of the Anaconda 1,780,000 shares. It is estimated that the Anaconda will have a copper production of more than 250,000,000 lb., which will be produced at something less than 9c. per lb., after crediting gold and silver profits and the net revenue derived from lumber and coal properties and railroad operations. On a 13c. copper market this production would figure a net profit of about $10,000,000 per annum. The new company's net quick assets are figured at about $25,000,000. It has been suggested that one of the main reasons for carrying through the Butte merger at this time is that the Amalgamated Copper Co., in the event of an adverse decision in either the American Tobacco case or the Standard Oil case by the Supreme Court of the United States, might find itself an outlaw; whereas the Anaconda Copper Co. is a Montana corporation and its direct operation of the Butte mines would not in any way render it amenable to the Sherman law. Upon this point will undoubtedly turn the eventual destiny of the Amalgamated's organization and its dissolution. The Consolidated Arizona Smelting Co. has just made a report of its financial condition, showing an issued capital of $8,167,475, with no debts; the cash balance on hand is $292,792 with accounts receivable of $52,437. The new company is developing its Bluebell mine near Humboldt, Arizona, and is said to have re-built and enlarged the old Humboldt smelter, and to have recently secured a contract to handle a considerable tonnage from the United Verde. The action of the Granby Consolidated Copper Co. has attracted a good deal of attention to the Boundary camp. This property has recently been examined by Otto Sussmann, of the American Metal Co., and while his full report has not as yet been made to the stockholders, it has been semi-officially announced that his report will show only some six million tons of ore available for stoping. This information, coupled with the announcement that the dividend of $2 which was expected to be declared in April will be deferred, was sufficient to cause a 33 point break in the stock. The American Metal Co. is the American agent for Merton & Company, Ltd., of London, and is an extensive dealer in copper and other metals. This concern is said now to be working in conjunction with Thomas F. Cole on the formation of a second consolidation of Butte properties to include the Butte & Superior, and the other principal zinc producers of the camp. The Silver Mines Exploration Co., through which the Lewisohns carry on their operations in Cobalt, has made its second payment on the Wettlaufer-Lorraine Silver Mines Co. Some market capital was made out a rumor that the option which the Lewisohns held, was to be allowed to lapse; the story was evidently without foundation. Eastern mining markets for the past few weeks have been exceedingly dull. The political situation is tense, and the action of the Supreme Court in the Standard Oil and American Tobacco cases is of so great importance that the markets have assumed a waiting attitude. Copper exports are expected to show a considerable falling off for March, but domestic deliveries will, it is anticipated, show a satisfactory increase over February. There will probably be no great decrease in the copper surplus shown by next month's figures, but the following 60 days should make such inroads into stocks that what remains will be only a safe margin. Pope Yeatman cables from the Braden Copper Co.'s mines in Chile, that the orebody of the Fortuna mine is much larger than previously estimated. Mr. Yeatman figures now 7,000,000 tons, averaging 2.94%, as against former figures of 4,500,000 to 5,000,000 tons, averaging 2.70%. William B. Thompson, of Thompson, Towle & Co., of New York, has returned to New York from a trip of inspection which included the El Rayo Mines Co., of Santa Barbara, Chihuahua, Mexico; the Inspiration Copper Co., at Globe, Arizona; the Mason Valley Mines Co., Yerington, Nevada. Mr. Thompson is enthusiastic over the prospects throughout the West and Southwest.

MEXICO.

Power at Pachuca.— Hostotipaquillo Mines Active. — Naica.

Rapid growth of the mining companies operating in the Pachuca district, and the far greater expansion which the near future will undoubtedly witness, have necessitated arrangements for immediate increase of power. The Compañia Electrica é Irrigadora of Pachuca, the present supplier of electric power to the camp, has available some 12,000 hp. only, which is generated in their hydraulic plant near Pachuca. While this is more than enough for the plants at present in operation, it will not be sufficient when the new plants are completed. The Mexican Power & Light Co., which draws its power from Necaxa, is putting in transmission lines from Mexico to Pachuca and hopes to complete them by July. The Compañia Electrica é Irrigadora has entered into a working agreement with the Necaxa company. It is probable, however, that some of the new companies will put in gas-power plants, as is contemplated by the Santa Gertrúdis company, as such power-supply has been demonstrated to be cheaper and more reliable for large plants than an independent electric supply. The Hacienda San Francisco at Pachuca which has only recently completed the installation of twenty stamps, is now preparing to add another twenty, together with concentration plant, re-grinding mills, and cyanide annex. The latter will consist of three large Pachuca agitation tanks and a Moore vacuum filter plant. The new Guadalupe 300-ton plant of the Santa Gertrúdis company has just started, but only with part of the plant, owing to an accident to one of the re-grinding mills. It is expected that it soon will be running at capacity. The mills operating in the district are now daily crushing about 1500 tons.

An important silver mining district of Mexico which is only now beginning to receive deserved attention, is that of Hostotipaquillo. The mines of this camp were worked originally by the Spaniards and later by Mexicans, but only to a small extent and superficially. The main reasons for them not attracting greater attention were the isolation and the cost of freight. There was also difficulty in treating the ores economically. The new Southern Pacific railway extension from Guadalajara now brings railway facilities within three hours by a wagon-road from the town, and a private electric railroad from Magdalena to Hostotipaquillo will soon give the camp still cheaper rates. In addition, the transmission of electric power from Guadalajara to Hostotipaquillo, which is now nearly completed, will give the mines cheap power and facilities for working upon a larger scale. The cyanidation of ores, after a preliminary concentration, has proved an efficient treatment. Previously non-payable ores containing 400 to 500 gm. silver per ton can now be treated at a good profit. The effect of these improvements has been a renewed interest in the district, and considerable inflow of capital for development. Several of these mines have treatment plants, and await the completion of the electric power-lines to commence crushing. The most important producers to date have been the Buena Vista mines to the north of the Santiago river, and which alone have shipped bullion worth about ₱4,000,000, the Castellana mines, situated about 20 miles to the northwest, which have a 50-ton mill and cyanidation plant, and the El Favor Mining Co., which now has a

100 ton mill and cyanidation plant awaiting electric power. The last named company has a large tonnage of low grade ore blocked that can be treated by cyanidation at profit. The Castellana mines, at present closed for development and electric power, have produced large amounts of rich ore from Spanish times to the present. Among the properties being developed at present are the Santa Domingo mines, Cinco Minas, La Dicha Mining Co., the Mala Noche mines, the Ventana mines, the Quebradilla mines, and others. The veins of the district are strong fissures, varying in width from 2 to 6 metres, and yielding good ore in depth. They have a general northwest strike and traverse andesite. The ores are quartz carrying iron and copper pyrite and a considerable percentage of manganese oxides with which the silver is partly associated. The whole district is well mineralized, and promises to become in the near future an important silver producing district. The gold associated with the silver in the ores varies from 1.5 gm. per kilogram of silver in the Castellana mines, to 12 gm. per kilogram of silver in the Buena Vista mines.

The Compañia Minera de Naica, owning the Dolores, San Francisco, Toledo, and other silver properties at Naica, State of Chihuahua, have just given their mines under option for ₱6,000,000 to Americans. These properties have been paying good dividends for many years, and the shares worth ₱300 at par, reached as much as ₱30,000 on the

Part of Jalisco, Mexico.

market some time ago. The capital of the present company is only ₱30,000. The San Carlos gold mine, situated in the extreme southwest corner of the State of Zacatecas, is starting its mill and cynidation plant, after four years of inactivity. During this time the mines have been under development, and have now a large tonnage of pay ore blocked. The mines paid good dividends in 1901, 1902, and 1903, but were closed in 1906 for lack of sufficient ore. The company (English) was then re-organized and development undertaken. This has turned out well. The plant, which consists of a 50-stamp mill with cyanidation annex, has been repaired and will commence crushing in a few days. It has a capacity of about 4000 tons per month. Mining business in general is greatly improving in Mexico, and new enterprises are being undertaken. The successful application of the cyanide process in the economical treatment of silver ores in Guanajuato and Pachuca, coupled with better financial conditions, is creating renewed interest in silver mines that under old methods would not pay to work. Two new plants are being erected in Zacatecas, one of which, a modern cyanide plant with a capacity of 70 tons per day, will treat solely the old tailing from the famous Veta Grande mines. The same causes which have so greatly increased the activity in the larger camps of Pachuca, Guanajuato, and Zacatecas, are gradually being felt in other districts of the Republic.

GOLDFIELD, NEVADA.

Combination Fraction.—Clermont Workings.—Florence Goldfield.

Of recent developments the most noteworthy have been discoveries of excellent bodies of milling ore at two widely separated points in the Combination Fraction mine. On the 285 ft. level the ore has been exposed near the old stopes and near the point where a good grade of product was mined formerly. The ground here is unstable, and, owing to the fact that the proper mapping of the early workings was neglected and much of the stoped area has caved, further driving on this level will be abandoned as unsafe and the orebody will be developed by driving back from the extension of the 300 ft. level. The more promising of the two new discoveries is at a depth of 500 ft. in territory heretofore unexplored, northeast of the shaft and directly on the strike of one of the richest Mohawk ore shoots. The ore was cut through diagonally and is apparently 15 ft. across with an average gold content above $30 per ton. A station has been cut at the 750 ft. level which will at once be driven to connect with the 750 drifts from the Clermont workings of the Consolidated. By the terms of an agreement existing between the Consolidated and Combination Fraction companies any possible disputes over apex rights are eliminated and each is entitled to the ore lying within its vertical boundaries. Conditions on the 1000-ft. level of the Clermont are highly gratifying. The orebody is shown to be of large proportions, excelling even, in marked degree, the excellent showing on the 900. Another recent development that is regarded as highly important is the opening of the main Mohawk ore-shoot on the 750-ft. level, and 150 ft. west of the Clermont orebody at that depth. The cross-cut passed through 8 ft. of milling ore, averaging about $30 per ton. Production from the Clermont has been increased and this shaft will ultimately be the avenue of output for at least one-half the product of these mines.

The Florence is breaking a comparatively small tonnage at present for the reason that a sufficient quantity of ore had been stored in the Little-Florence stopes to supply the mill during the period while the work of enlarging the main shaft from the 500-ft. level is in progress. This work was not begun until there was ample assurance that no delay or shortage could be occasioned and that the supply, conveyed from the Little-Florence shaft over the aerial tramway, was adequate for all requirements. On the Diamondfield Black Butte a cross-cut from the original company adit on the north of the hill has penetrated the ore-shoot opened farther east by lessees who have made several shipments. The old company shaft is being unwatered and from it a cross-cut will be driven to tap the vein 200 ft. below the adit level. The Grizzly Bear shaft is down 1050 ft. and a station is being cut at the 1020-ft. level from which the lessees will drive to the west for the Mohawk ore-shoot. Three shifts are working, employing machine-drills, and a new 75-hp. hoist has been installed. Some ore of excellent quality is being saved on the Nancy Donaldson where the drift on the 125-ft. level has been following a narrow vein containing seams of high grade. Assays from this vein in places have been as high as $500 per ton, and at several points the ore has widened to good dimensions. Ore taken from the croppings on the Nancy Donaldson has assayed above $3000 per ton, and the veins are unbroken and of good character.

Complete hoisting equipment has been ordered for the Queen shaft of the Queen Consolidated Mining Co., a merger of two organizations owning the Queen group, the Congo group, and a lease on the Atlanta where the original company shaft is being sunk to a depth of 750 ft. At present seven leases are operating on the Atlanta. On the Grizzly Bear claim of the Jumbo group the Grizzly Bear lease has cut a station at a depth of 1020 ft., and has started a cross-cut to the west in search of the Mohawk vein. The Annex lease on the Polverde is driving on the vein east and west at the 800-ft. level, and a raise from this level is following the shoot. Ore-bins have been installed, skip-pockets and a large station cut at the 800, and a 6-drill compressor is in operation.

FAIRBANKS, ALASKA.

Quartz Mining. — Pioneer Mine Leased. — Spaulding Ships. — Willow Creek Discovery.— Custom Mill Planned. — Placers Active.—Cleary Creek. — Little Eldorado. — Bonnifield District.—Circle.— Chandlar River. — Koyukuk. — Haiditarod.

Recent developments made by certain quartz properties have tended to increase interest. Reaction from the tunnel-site boom of last winter left the industry practically stranded, but faithful workers have shown this district to be promising. This winter there are more men engaged in development of prospects than ever before, and reports are uniformly encouraging. On Dome creek, W. S. Spaulding has mined several tons for a mill-test to be made at Fairbanks. His property is opposite No. 10 Above Discovery placer claim. The Pioneer Quartz Mining Co., which was first seriously to attempt development in this vicinity, has leased its property. The mine is on Chatham creek. A strong vein assaying well was followed down over 100 ft. before the mine was flooded a year ago. Since then, an adit has been driven for 150 ft., but was discontinued before the vein was found. No active work has been done lately on the Jupiter-Mars property, between Wolf and Chatham creeks. Mill-tests on rock from prospect holes sunk last year show $21 per ton in free gold. Samples from a stringer near the main vein recently gave assays of $146 per ton. The first full carload of ore shipped into Fairbanks arrived late in February. The shipment consisted of about 20 tons of rock sacked at the Spaulding property, at the head of Dome creek. Interest in this run and in quartz in general has grown since returns from the 5-ton shipment of ore to the Rush smelter at Tacoma were found to give $460 per ton. This shipment was from the Rhodes & Hall property, on Bedrock creek, and proves the assertion that the wall-rock on both sides of this lode will give a profit for milling. Cascaden & Crawford have a lease on a block of ground 100 by 50 ft. in the tunnel of the Rhodes & Hall property, and have a large amount of ore broken and sacked. The Tolovana Mining Co. is active. Its vein opened on Bedrock creek has proved to be high-grade, and a late discovery across the ridge bordering Willow creek shows high-grade rock carrying a large amount of free gold. A sample picked from a sack of ore sent into town with the intention of getting a minimum assay, gave returns at the Tanana assay office of $475 per ton. The owners feel that in this block of claims they have a valuable property. Drill-holes on the Bedrock claim have shown several lodes, hitherto uncovered, that assay well. Charles Crawford, holding a lease on the Tolovana Mining Co.'s lode on Bedrock creek, has now a 150-ft. tunnel in on the vein with a winze over 50 ft. deep at the end. In the winze water was struck and work temporarily abandoned. It exposed ore all the way, thus blocking out a large amount of high-grade rock. One hundred feet of backs in the tunnel are also available. Herchberger and partners now have a 4-ft. vein of rock that assays well. As far as development has gone the vein continues strong between well defined walls. Jackson and partners on the summit between Cleary and Fairbanks, have developed a vein of quartz that averages 2½ ft. wide. Though no assays have been made, the rock pans well and is similar to that of the Rhodes vein on Bedrock creek. Perhaps the best indication of faith in Tanana quartz is shown by the well founded rumor that a 10-stamp custom mill is to be built at Chena, eight miles below Fairbanks. It is understood that Falcon Joslin, president of the Tanana Valley railroad, plans this, and also to erect a plant to supply power for electric locomotives. Two new locomotives are to be brought in next summer. By extending the line up Pedro and Cleary creeks, the centre of the quartz district could be tapped and cheap transportation afforded.

Competent judges agree that more gold will be produced this season from the placers than last. A large amount of good pay is now on top in the winter dumps, while there will be work for probably 600 men this summer. Seventeen Goldstream and the adjoining Owl Association will be big producers. Cleary creek will easily be the banner producer this summer. Seven outfits are working on No. 4 and 5 Below, taking out dumps and preparing for summer work. This ground has long been closed by litigation. A quarter of a million dollars has been taken out this winter by two outfits on Ready Bullion, a tributary of Esther creek. Badoin & Lynn sluiced nearly all winter keeping steam-pipes in the boxes. Thirty shovelers were employed and the weekly clean-up was $10,000 to $15,000. They have now discontinued operations as their block of ground is worked out. In the Badoin & Lynn lease and the Gardner lease pay was found to stop at a big 40-ft. vein. As the gold is rough and full of quartz, it is probable this is the chief source of pay. The head of Little Eldorado is showing well at present. Thompson, Scrafford & Geis have an 8 by 8-ft. shaft down on a large vein. A cross-cut has been driven at the bottom of this and samples sent to the First National Bank assay office show a 20-ft. face averaging about $20 per ton. Mr. Thompson has found another vein farther up Skoogy gulch that pans well, but from which no samples for assay have been taken. A rich stringer extensively prospected last summer, is still being exploited by Lawson & Sommersett. This vein is on the divide between Fairbanks creek and Cleary creek. Rich specimens were brought in last summer. Dan McCarty is still working on his property on Wolf creek, the next tributary of Cleary on the right limit below Chatham. The vein shows good ore and developing has opened up a big body.

Mining at Fairbanks.

A lot of prospecting was done in the Bonnifield district last summer. The veins seem to be larger and lower grade than those near Fairbanks and contain a smaller percentage of free gold. On the big Jerome Ledge, owned by Crawford, McConnel & Chute, of Fairbanks, a small 3-stamp test-mill was placed last spring. Rock was taken along the 600-ft. face for the test and yielded $3 per ton free gold on the plates. Tailing brought to Fairbanks and tested at the Tanana assay office showed a total content of $5 per ton. It was found that a good extraction could be obtained with cyanide. The minerals appear in a finely divided state, explaining why rock was crushed through 40-mesh screens before any free gold was caught on the plates. The mine is a mountain of quartzose rock, a 600-ft. face being exposed by the creek. Seven miles below, Arthur Cruger has staked a 3 to 6-ft. vein yielding returns of 3.5% copper from the croppings. The vein is schist with small quartz stringers, apparently more copper being contained in the schist than in the quartz. The Berry hydraulic operations

on Eagle and Mastodon creeks in the Circle district seem to have made a good showing during the last summer's sluicing. Giants were used on these properties in a novel and singularly efficient manner. Water being plentiful and the grade of the creeks being slight, not only is the gravel piped up an incline into the boxes but the tailing is subsequently stacked by another nozzle. A foot or two of bedrock is taken up with the gravel. Captain Hawkes and party left Fairbanks the second week of February for the upper Chandlar river. With him is the freighting outfit which is taking his 3-stamp mill to Circle. From there on the mill will be taken by dog team to certain promising quartz prospects. The mill is a 3-stamp prospecting mill, the stamps weighing 250 lb. Another small mill, one of four stamps, is being taken into the Chandlar by S. I. Marsh. This plant includes a rock breaker, ore feeders, and two 2-stamp batteries of 750 lb. stamps. Some of the quartz veins in the Chandlar district are as much as 12 miles above timber line. Last year only 70 hours water was available for sluicing, the camp being far north and the season short. In that time, however, $11,000 was washed out of soil and crushed rock that had sloughed from the outcrop of a quartz vein. Wash gravel is practically unknown, most of the erosion being effected by shattering of rocks by frost.

Recent letters from the Koyukuk tell of rich finds being made on tributaries of Hammond river. One hundred and thirty pans netted $1500 for Joe Healey, while Shook and partners have panned and rocked out $5000 after being a month on bedrock. Frank Decker has exhibited a small baking powder can of nuggets at the company store that he claims to have picked up from his dump in one day. It is probable that a mild stampede will ensue this summer to the Koyukuk diggings. Although the telegrams from the Halditarod tell of four miles of pay on Flat creek, reliable prospectors who have visited the country contend that Flat creek is only three miles long from summit of ridge to mouth. The most conservative people still doubt that the Halditarod stampede was justified by anything except paper arguments and are loath to believe these late telegrams.

LONDON.

Ashanti Goldfields. — Tin in Burma. — Mexican Properties. — Midas Deep Scandal and Homersham's Report.

Attention of investors has been attracted once more to West Africa by the formation of a new company called the Ashanti Goldfields Territories. This has been formed by the Ashanti Goldfields Corporation for the purpose of acquiring mining rights over a tract of country of 100 sq. mi., in fact, the whole of the Corporation's property, with the exception of the seven or eight miles of ground already developed. The object of the new company will be to systematically explore this tract. The territory is known to contain many gold-bearing deposits and outcrops of rock similar to that found at the mines. The work will be done under the direction and advice of W. R. Feldtmann, and the manager will be J. N. Justice. That the latter has been successful as a developer and discoverer may be seen from the fact that one of the large orebodies belonging to the Ashanti Goldfields Corporation is known as Justice's Find. Another event in connection with the West African market has been the issue of 100,000 new shares in Prestea Block A. This company owns a large quartz deposit at Prestea, and, pending the completion of railway communication, operations are being centered on development and extension of plant. The report of the engineer, Walter Broadbridge, for the year 1909 has been published in advance of the director's report and balance sheet, in order that shareholders may have information at as early a date as possible, and thoroughly understand the reasons for a proposed issue of new capital. Since the end of July milling has been suspended and work concentrated on development and the provision of new plant. During the first seven months of the year 49,305 tons of ore was treated yielding 15,203 oz. in the battery, 2315 oz. in the cyanide plant, and 2009 oz. from concentrate; a total of 19,537 oz. valued at £82,996 or 33s. 7d. per ton. The ore reserve above the fifth level on December 30 was 500,911 ton, containing 2.96 dwt. per ton. Arrangements have been completed for the provision of new machinery. Fifty new stamps are to be provided, bringing the total to 110. Electric power is being adopted and new pumps are required. The total cost of the outlay on plant will be £90,000 and a similar amount will be required for development and construction work at the mine. The company has in hand a sum of £72,000 and they propose to create 100,000 new shares and offer them to shareholders at 27s. 6d. per share. The whole of this issue has been underwritten by Wernher, Beit & Co., the West African Mines, Ltd. (representing the Consolidated Gold Fields of South Africa), and the Ranti Consolidated and the United Exploration (both promoting companies belonging to the previous controllers of the Prestea Block A).

The mining has been attracting attention in London recently, especially in connection with Nigeria, and the Shan States in Burma, adjoining China and Siam. Southern China has been known as a tin producer for many years, but apparently little has been done in the Shan States. The Mawchi deposits were brought to the notice of English investors by W. B. Dick a year ago, and have been since partly developed. The company operating the property is called the Southern Shan States Syndicate. C. M. Euan Smith is the engineer in charge, and Norton Griffiths, Bruce Marriott & Co., are the consulting engineers. The capital is £150,000, of which £74,000 in shares went as purchase price, and 14,963 shares have been issued for cash and 10s. paid on each. The directors are now issuing 20,000 more shares and published a prospectus at the end of February. The report of Mr. Euan Smith accompanying the prospectus shows that the property is situated on the side of a steep hill. It contains a number of veins in the granite and is covered with tin-bearing gravel. The latter has been prospected by means of sampling pits. The depth of the pits average 9 ft. It is estimated that there is 475,944 cu. yd. of profitable gravel ready for treatment. The content varies within wide limits, the samples giving results from 2 lb. to 91 lb. black tin. Three-quarters of the gravel is estimated to average 6 lb., and the other quarter 2 lb. The cost of treatment with the present resources is 4½d. per cu. yd., but with a water-supply that can be brought from a spot 2½ miles away, the cost of sluicing could be reduced. The exploration of the underlying granite has been started at several points with some success. The sampling of the veins shows extensive deposits of varying content. Money is now being subscribed for systematic development. N. B. Knox has been sent to Burma to make an examination. There are some veins of galena on the property belonging to the syndicate; these also will be investigated by Mr. Knox.

The investing public has been treated to a Mexican antigua this week, by the publication of the prospectus of the Esmeralda Consolidated Mines, Ltd. The properties actually acquired are the old Guadalupe and Cocina silver-lead mines in the district of Iguana, Nuevo Leon. They are not far from an even more notable producer of days gone-by, the Voladora. Adjoining claims that are undeveloped have also been acquired by the company. These are called the Esmeralda property and give the company its name; but it is the two old mines and the old dump which are to be the centre of active operations. The estimated resources at the Guadalupe are stated to be a million tons, averaging 30 oz. silver and 18% lead, though no detailed account is given of the veins or of the method of sampling. The mine is said to contain also argentiferous blende. The dump is reported to contain 330,000 tons averaging 20 oz. silver and 10% lead. Some of the mining papers here speak well of the promotion, but to those who know Mexico, the affair is not quite so convincing. If the promoters were sure of their figures relating to the ore reserves, the capital of the company would never be fixed at the absurdly low figure of £150,000.

About a year ago there was some considerable scandal in South Africa in connection with the booming of the shares of Midas Deep. Extraordinarily high assays were published, and the shares bounded up. Subsequently the mill closed owing to the poverty of the ore. At the time little

definite information was available, and it is only now that an authoritative statement has been made by the directors. It is worth while giving some details, if only to show that the Rand is not entirely the humdrum centre of legitimate industry that is commonly supposed. The mine is situated at the extreme west of the Rand, beyond and to the south of the Randfontein group, and 20 miles from Johannesburg. It was originally floated in 1895 by the Consolidated Gold Fields and others, and milling was started in 1896, but only continued for 18 months, as the ore became gradually lower in grade. In 1904 additional property was acquired. E. H. A. Cohen, who had been in charge before the mine was closed in 1897, was appointed to supervise the re-opening in 1908. A year ago the directors announced sensational assays of ground recently developed, and as a matter of fact the directors had received even higher figures than those published. The chairman now states that some of the suppressed assays showed £7000 of gold per ton, which they had the good sense to discard. Mr. Cohen's engagement terminated last June, and Samuel Roberts has been in charge since. The mill started operations at the end of March and continued until the end of September, when the grade of ore was found to be too low to pay expenses. During this period 20,776 tons was milled and produced 1956 oz. gold by amalgamation, and 12,285 tons were cyanided yielding 1776 oz., a total of 3732 oz. valued at £15,-698. The situation was so serious that Edward C. Homersham, of Randfontein Estates, was asked to examine and report. He found that the 'Black Reef' on which the work had been done was narrow and of low grade. For instance, at one place the lode was 3 in. wide, and assayed 36 dwt., and at another point 1 dwt. over 30 in. One of the stopes was found to average 3.3 dwt. over 30 in., and occasionally gave samples running 90 dwt. for an inch or two. It becomes clear from this statement that Mr. Cohen was able to report high assays, in spite of the fact that the average was poor and the extent of the ore limited. Mr. Homersham proceeded to make a general geological examination of the ground, with the object of locating the Randfontein series, and diamond-drilling has been undertaken. In the meantime the scandal connected with the inflation and collapse had received the attention of the Transvaal Government and their commissioner had made an examination of the mine. His report has not been published, but his conclusions are the same as Mr. Homersham's. The directors urged the Government to make a searching investigation into the share transactions which took place while the sensational assays were being published, but the Government objected that the legal proceedings involved in such a course would be too lengthy and costly. This is a pity, for enlightenment on the subject as to who was reaping profits in this underhand manner would have been good for the mining industry.

BRITISH COLUMBIA.

Zinc Problem Again. — Early Agitation. — Zinc Commission. — Attempted Smelting.—Proposed Experiments.—Zinc Mines.

The recent authorization by the Canadian Parliament of an expenditure of $50,000 in experiments by the Dominion Department of Mines on processes for the reduction of zinc ores recalls previous efforts to solve these problems. Early in 1904 an organization, consisting chiefly of owners and managers of mines situated in Slocan district, known as the Associated Silver-Lead Mines of British Columbia, instructed its special committee to memorialize the Dominion Government to engage a high authority on zinc and its treatment to investigate and report on the zinc ores of the Kootenay district. This proposal was endorsed by the Associated Boards of Trade of Eastern British Columbia. In connection with this movement, A. C. Garde, the resident manager for the Payne Consolidated Mining Co., owning the Payne mine, near Sandon, Slocan district, prepared and published a strong statement outlining the benefits to be derived from fully investigating the resources of British Columbia as to their extent, value, and character, and giving much information relative to the occurrence of zinc in association with silver-lead ores in mines in Slocan district. An important consideration brought out was that, apart from their silver content, the zinc ores of British Columbia were worth mining for the zinc in them alone. It was believed that there exists in the Province an unlimited quantity of zinc ores suitable for both spelter and zinc-oxide production. Zinc smelters in both the United States and Europe had already awakened to the potentialities of the industry of the Province, and as a result zinc ores were being exported to foreign countries to be manufactured into spelter and zinc oxide. That meant that Canada first paid freight on the raw material taken out of the country and afterward paid freight and duty on the manufactured products imported. It was estimated that Canada in that way paid more than 2c. per pound on all spelter it used and proportionately on other zinc finished products.

As a result of the representations made from British Columbia, the Dominion Government in the summer of 1905 appointed W. R. Ingalls, of New York, "to make an investigation of the zinc resources of British Columbia and their commercial possibilities", and designated Philip

A Portion of British Columbia.

Argall, of Denver, Colorado, and A. C. Garde, of Sandon, British Columbia, as his assistants, with Henry E. Wood, of Denver, to investigate the adaptability of the ores to magnetic and electrostatic concentration. The report of this Commission contained between 300 and 400 pages. In the introductory chapter Mr. Ingalls dealt with the history of zinc mining and smelting in the West, statistics of production, character of the ores, markets for ores, valuation of zinc ores, cost of smelting, value of argentiferous blende, and wet processes of zinc extraction. Other chapters gave much detailed information relative to the zinc mines and undeveloped zinc resources of British Columbia, methods for concentration, assaying, and other subjects.

Despite this report no considerable progress toward the placing of the zinc mining industry on a permanent basis in British Columbia has yet been made. Much money was spent by one company operating mines in the Ainsworth and Slocan mining divisions, in erection and equipment of works designed to produce spelter, but commercially these were a failure. Other works were afterward built at Nelson and equipped for treatment of complex lead-zinc ores by an electro-thermic process, but here again results were unsatisfactory and operations were not continued. Meanwhile a duty was placed on zinc ores entering the United States, so those interested in the mines in Ainsworth and Slocan district held a meeting at Nelson, last December, and petitioned the Dominion Government to take the steps necessary to establish a smelting plant capable of treating

Canadian zinc ores and of producing manufactured products of zinc at least to the extent of supplying the Canadian market. Especially it was asked that the Dominion Department of Mines be authorized to take up the matter and conduct experimental work upon such a scale as will determine definitely the practicability of the economical treatment of zinc ores by electro-thermic or electro-chemical process. On March 21 the House of Commons provided for the expenditure of $50,000 for the purpose of investigating the processes in use in the production of zinc, and for experiments in manufacture of spelter and other zinc products from Canadian zinc ores. It is understood the experiments will be made at Nelson, probably at the works in existence there and at which much experimental work has already been done.

In conclusion, it may be mentioned that last year zinc ore and concentrate containing about 11,000,000 lb of spelter was shipped from mines in Ainsworth and Slocan divisions. The Lucky Jim mine shipped to the United States about 5000 tons of ore averaging about 52% Zn, while the Whitewater, Ruth, and Van Roi shipped concentrate running about 45% zinc.

JOHANNESBURG, TRANSVAAL.

A Manager's Opinions.—Administrative Questions of the Day.—Influence of Monthly Returns.—Costs per Ton Milled.

It is not often that the retiring president of the Association of Mine Managers delivers a valedictory address of the comprehensiveness marking that of P. Cazalet at the fifteenth annual meeting held on February 18. The ground was so fully covered (in a speech amounting to seven newspaper columns) and the affairs dealt with of such topical interest, that this letter will be devoted to a discussion of Mr. Cazalet's retrospective and prospective survey of technical events and tendencies. Apart from the native labor question—which is apt to be wearisome to readers in other lands, but in its present treatment was enlivened by a bold expression of regret concerning the re-patriation of the Chinese, the chief points raised were the following: (1) the mining regulations; (2) mine managers' examinations; (3) publication of statistics; (4) the 'bogey' of low costs per ton milled; (5) theft of gold; (6) training of white labor; and (7) contract and day's pay work underground.

The first three points have already been discussed at length in these columns, and on No. 1 and 2 opinions similar to those voiced by Mr. Cazalet have been expressed. There is undoubtedly a tendency to make the mining regulations too voluminous and too detailed, by attempting to introduce special provisions to meet all contingencies instead of relying upon general provisions. The necessity for changing the system of mine managers' examinations was mentioned in this correspondence twelve months ago, when W. W. Mein, the preceding president of the Association, expressed his dissatisfaction with the strange incongruities of examination results. Lately there have been many more men passing and the standard of papers has been found much better. Of course, the simplification process could be overdone.

In the matter of publication of statistics Mr. Cazalet takes a standpoint entirely opposed to mine. He pleads, in support of L. Reyersbach's proposal, for the non-publication of monthly returns and statistics, and attempts to justify this policy by suggesting that the erratic yields following a scheme of extreme concentration and of working the mine for the utmost gain, irrespective of 'regular' grade, would have excellent effects, if only annual results were made known. He says: "Carry out the policy of concentration and the grade in the erratic mines will almost inevitably vary from 1 to 2 dwt. in recovery in different months of the year. Where results are published monthly and regularity is looked for, the inevitable safeguard is the one so largely employed on the Rand—namely that of scattering the laborers in comparatively small working faces over long distances and it follows that some of that maximum profit, which is the ambition of the members of this association, is frittered away in the effort at regularity of output." Mr. Cazalet's honest enthusiasm leads him to an exaggerated view. In the first place, it is a daring assumption to state that the yield is likely to jump about to the extent of $1 to $2 per ton each month (say 15 to 30%) at any modern mine of big capacity. A mine requiring to put out, say, 2000 stope tons per day of two shifts will require 30 to 40 stope faces at least, however much they may be concentrated and forced at high pressure. These are most unlikely to vary more seriously than by an amount readily and legitimately adjusted by regulation of clean-ups and gold reserve, or by occasionally forcing or limiting the output from some of these 40 stope faces. Furthermore, Mr. Cazalet is in error when he states that efforts are wasted in order to attain "regularity of output." It is fair regularity of such profit as is consistent with the showing of payable ore reserves that is sought—not regularity of output. So that present supposed requirements tend to check managers from "flying about from one stope to another to obtain regular monthly returns." That is not the way to maintain regular costs at all events. As Mr. Cazalet says, it is not his concern that non publication of returns may create distrust with investors. But recognizing the danger of doing this, it is unquestionably the duty of the manager to see if he cannot still obtain the best economic results from his mine without causing uneasiness over fluctuating returns. It is another case of where there is a lot of talk and little achievement. Rand investors are already used to fluctuations in monthly profits, and if a drop for a month or two does not cause a panic (when they are supposed to understand that the manager has been scrambling round the mine for tit-bits of rich ore to prevent the fall), why should they feel nervous if they—namely, the investors in a few mines chosen for the scheme—are plainly told that the policy of equalization has been stopped and that the results for one month give no promise of equally good or bad ores in the next. Why cannot a manager and sympathetic board get to work on the scheme and show the good results to be obtained in a year, and the extent of the variations in profit to be expected? Let the monthly returns go on as usual, and let directors and managers rest assured that the ill consequences of publishing no figures at all would be infinitely worse than announcing fluctuating results following such an explanation and promising to total satisfactorily over a long period.

Of the 'bogey' of low costs per ton milled, more is likely to be heard later. The present system is liable to abuses, when the cost per ton milled is taken as the basis of comparison between the work of different mines or managers. By taking cost per fathom or any other unit of square measurement on the plane of the reef, there will be less inducement for the "ambitious manager to allow excessive stope widths to be carried on and to slight sorting." The square fathom is, however, a useless unit outside the mine, and the ton must still reign in most departments. Thus it is reasonable to suppose that the two standards would have to be used in parallel. There is one serious drawback (among many) that Mr. Cazalet failed to notice in his vigorous denunciation of the cost per ton 'bogey'. The new system would be open to as many and as serious abuses and would call for constant investigation and control as the present. A mine might be badly run and yet look well on the cost and immediate profit per fathom basis; for the less profitable bands of 'reef' might be left in foot-wall or hanging, and probably be entirely lost upon the caving of the ground. As to gold thefts, Mr. Cazalet deprecates wholesale accusations and vague generalizations, but evidently thinks the matter should be more adequately investigated. The importance of a more general all round mining training for white youths was forcibly and ably expressed. Mr. Cazalet pointed out the unfortunate thing that far too many of the skilled white labor recruits immediately apply themselves to machine-drilling and that only for the reason that machine contractors are the highest paid. The contract system was condemned mercilessly. Day's pay with a good living wage plus bonus was strongly advocated. He pointed out, however, that the change of practice could not be brought about by one mine or group of mines, but only by concerted action.

General Mining News.

ARIZONA.

COCHISE COUNTY.

The Cochise Gold Mining & Milling Co. has been organized to open a group of claims on Steel hill 20 miles northeast of Benson. The shaft now down 60 ft. will be sunk to the 100-ft. level and the vein cross-cut.

GILA COUNTY.

(Special Correspondence).—The Inspiration Copper Co. is about to erect a small experimental mill for making tests of its low-grade ore, preparatory to building a large concentrator. On and above the 400-ft. level of the Joe Bush shaft, 3000 ft. of drifts and raises have been completed. The cross-cut driven south from the Scorpion shaft is 360 ft. long and is continuing in ore. Before production begins, a new shaft, having at least four compartments, will be sunk about 1300 ft. south of the Joe Bush shaft and the ore mined by the mill-hole method.——The upper sub-levels of the Miami mine, above the 420-ft. extraction level, are now almost wholly blocked out, and much work is being done where tracks for motor cars are being put in. Preparations for building large ore-pockets on this level are also under way. Five churn-drill holes put down on the Captain claim have struck a body of ore apparently of considerable magnitude, which is believed to be an extension of the Inspiration orebody.——The churn-drill ordered for prospect work on the property of the Cactus Copper Co. is expected to arrive at the mine soon.——The estimated production of the Superior & Boston mine during March is 2250 tons of ore averaging 9% copper and containing nearly enough silver to meet smelting charges. It is expected that the output of copper for this month will be 500,000 lb. The method of stoping without timbering recently adopted is proving successful. J. D. Wanvig is superintendent.——Several directors and heavily interested stockholders of the Globe Mining Co. have visited Globe recently, and in company with J. F. Hechtman, president of the company, have inspected the property with a view to outlining future operations and directing the purchase of machinery for continuing the work. The resumption of sinking the vertical shaft from its present depth of 415 ft. is being contemplated, and a larger hoisting plant will be installed.——At its present depth of 620 ft. the Williams shaft of the National Mining Exploration property is in copper-stained quartzite.——The second churn-drill hole sunk on the property of the Cordova Copper Co. is 523 ft. deep and has passed through 100 ft. of low-grade sulphide ore.

Globe, March 26.

GRAHAM COUNTY.

The Cobre Grande group of claims 23 miles west of Fort Thomas in the Santa Teressa mountains has been sold for $100,000 to Albert F. S. Cooper, representing the firm of Wheeler & Shaw, of Boston. There are 14 claims in the group, and the payments are to be distributed over a period of two years. A number of open-cuts and adits have opened ore averaging 5% copper. The new owners will install machinery and commence sinking at once under the supervision of Mr. Cooper.

MOHAVE COUNTY.

Mineral Park, one of the oldest mining camps and second county seat of Mohave, is active again after years of practical desertion of all but its turquois mines. At the Keystone, one of the largest of the old-time producers of gold and silver, which is now under bond to a Los Angeles company, the new equipment consisting of a 100-hp. boiler, 50-hp. hoist, air-compressors, and electric generator has arrived and is being installed. The main shaft has been retimbered and a new head-frame completed. Work on water and oil tanks of 11,000 gal. capacity each is also well under way. The vein is from 6 to 40 ft. wide, and outcrops for over 5000 ft. Its ores are the usual lead, zinc, copper, and iron sulphides of the Cerbat range and assay well in gold and silver. S. R. Porter is superintendent.——The Venture Exploration Co., of Duluth, for which J. P. Hamilton is superintendent, is sinking a new shaft on the Oneida near Stockton hill. A larger hoist has been installed and the shaft will be sunk 400 ft. before cutting stations.——The sale of the Dandy mine, in the Weaver district, by William Hall to J. P. Hutchinson, of Chicago, has been completed. Mr. Hutchinson proposes to continue the present 230-ft. shaft to a depth of 500 ft., and to begin at once the erection of a 20-stamp mill and cyanide plant. There are about 10,000 tons of ore averaging $15 per ton in free milling gold blocked out in the mine.——The Redemption Copper Co. has resumed work on its new concentrating mill and it is expected to be in operation by May 1. R. J. Ferguson is superintendent.

YAVAPAI COUNTY.

The shaft at the Golden Idol claim of the Hillside Consolidated Mines Co., operating in the Cherrk Creek district, is now down 155 ft. and the mill is being run on the ore from the 100-ft. level. The company is to commence work on the Hillside and adjoining claims shortly. W. D. Achauer is superintendent. The cross-cut on the 800-ft. level of the United Verde Extension property near Jerome opened an 8-ft. orebody recently.——J. H. Morrison, superintendent for the United Gold Mines Co., at Congress, has been running the new mill about half the time, as the cyanide plant was not large enough to handle the pulp from a continuous run. An addition has been started to the plant and it is expected to have the mill running at its full capacity in the near future.——The Seth Bullock Mining Co. has purchased a group of five claims in the Cottonwood district from Srapp & Whithouse.

CALIFORNIA.

CALAVERAS COUNTY.

Operations have been resumed at the Washington mine near Sheep Ranch.——The drift at the Scossa mine in the Mountain Ranch district has opened a good shoot of ore.——At the Swank property development is being carried forward on a 5-ft. vein.——The shaft at the Martha property cut a shoot supposed to be the extension of that worked in the Ritter mine.——A $10,000 pocket was opened recently at the Finnegan mine, three miles from Angels Camp.——Work has been resumed at the old Petticoat mine at Railroad Flat under the management of Joseph King.

NEVADA COUNTY.

Work is to be resumed on the 20-stamp mill at the Fairview mine in the Washington district early this month. Underground work has been continued throughout the winter and considerable ore blocked out. C. M. Wilson is manager.——A raise has been started from the bedrock adit at the Blue Lead mine near Washington to open the channel. There are 640 acres in the company's holdings which extend for 9000 ft. along the channel.——The Ocean Star company has purchased 10 of the stamps in the Red Cross mill at Omega and will erect a mill at the Ocean Star property near Ormonde. The vein is about 6 ft. wide and the shoot 170 ft. long, assaying from $18 to $24 per ton. N. H. Truett is superintendent.——The Cassidy Consolidated Gold Mining Co. has been incorporated to open the Cassidy property that includes the ground between the Empire and Pennsylvania mines in Grass Valley district. An order for a 90-hp. hoist has been placed and the company will sink to the 1000-ft. level. The property has been worked to the 200-ft. level, but operations were suspended in the seventies on account of the heavy flow of water.——The North Star company has purchased the Tulle Belle group which adjoins its property. Very little work has been done on the group, though equipped with a small hoist.

PLACER COUNTY.

The adit at the Dewey mine at Foresthill is now in 300 ft. and will be driven 100 ft. farther to tap the shaft.——The Gold Blossom property is to be unwatered shortly.——Operations are to be resumed at the Crandall mine under the supervision of F. B. Norton.——Five stamps are dropping on good ore at the Orpheum mine and another five will soon be started.

SHASTA COUNTY.

(Special Correspondence).—It is announced that the

Afterthought Copper Co., which owns the Afterthought mines and smelter at Ingot about 28 miles east of Redding will resume operations this spring. The properties have been idle since 1907 but it is understood that sufficient capital has been raised by a recent assessment to enable the company to resume. The copper content of the ore is from 6 to 12 with considerable gold and silver and a high percentage of zinc. A. P. Flemming is president. The Gladstone mine operated by the Hazel Creek Gold Mining Co. is paying dividends of 1c per month a total disbursement of $6000. It is reported that the Natomas Consolidated of California will install dredges on the upper Sacramento river this summer.

Redding, March 28.

The new 10 stamp mill at the Milkmaid mine near French Gulch has been completed and is crushing 35 tons of ore per day. The main adit is in 900 ft and is expected to tap the old workings in a short time. The company is prospecting the ground with a diamond drill.——Braynard & Kimball, of Redding, have secured an option on the old Potosi mine near Muletown for Eastern parties and work is to be resumed on the property.——A contract for 250 ft of shaft work has been completed at the Reid mine in the Old Diggings district and an electric hoist will be installed that will elevate the ore to a place where it can be taken across the Sacramento river on an aerial tram.——A contract for 150 ft. of sinking has been let by the company which recently acquired the Evening Star mine.——The Mountain Copper Co. is installing a precipitating plant at the Hornet mine to treat the copper-bearing mine water.

SIERRA COUNTY.

A gasoline hoist is to be installed at the Sixteen to One property at Alleghany and a winze sunk on the vein.——The drift on the No. 6 level in the Sierra Buttes mine at Sierra City opened a shoot of high grade ore thought to be the lower portion of the rich ore worked on the No. 4 level. Jay A. Folsom is superintendent.——It is reported that the old Mountain mine above Sierra City is to be reopened this spring.——The drift at the Standard mine in the Downieville district opened another shoot of high-grade ore and $5000 worth has been sacked for shipment.

TRINITY COUNTY.

(Special Correspondence).—Articles of incorporation have been filed in the county clerk's office by the Trinity Dredging Co., which has recently purchased quite a lot of gravel near the mouth of Eastman gulch on Trinity river above Lewiston. The incorporation was for $300,000, place of business, Chico, California; directors, E. L. Smith, of New York, W. J. Baker, A. S. Jones, H. E. Chesebro, and H. P. Durley, of Chico.——The recent find of coarse gold on the Blue Gravel placer mine on a branch of Summit creek in the Hay Fork mining district still continues to appear well and from present indications points to a higher deposit than the present workings. The mine is being operated by T. J. Montgomery and E. Shock.——The Deadwater placer mine is being run by R. L. Duncan on a lease.——At Rocker Bar near Lowden's ranch on Trinity river the company has several men at work getting ready to install an improved type of dredge with heavy machinery and intend to have it ready for operation by midsummer.——The Northern Head light Quartz Mining Co. has a force of men at work getting ready to operate on a large scale. This property is being watched by mining men, as it is the first attempt to handle low grade ore on a large scale in the Trinity Center district, and if it proves successful several other enterprises of the same kind will be started.

Weaverville, March 28.

Trinity County, California.

TUOLUMNE COUNTY.

The new mill at the Maddox mine near Confidence will be completed about the middle of the month. John Frey is manager.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—W. Farragher has resumed work on his lease on the 240 ft. level of the Astor mine near Georgetown. A shipment of four tons of ore made last week milled 140 oz. silver per ton. Stoping is in progress on a 4-in. streak.——Machinery is to be installed soon at the property of the Bard Creek Mining Co., operating a group of claims near the head of Bard creek. Compressor, boiler, and machine-drills will be purchased. Gus Nelson is manager.——Work has been resumed on the Silver Mountain property situated on Silver mountain.——B. J. O'Connell has started shipments of zinc from the east drift of the Gambetta mine to Denver ore buyers.——At the Stanley mine in the Idaho Springs district, operated by J. E. Bowden under lease, it is proposed to cross-cut the Stanley-Donaldson group of veins in a northwest direction from the bottom of the shaft workings. This zone is 2000 ft. wide and the cross-cut would open the vein system 800 ft. under the Newhouse workings, which are the deepest in the district.——A. Morelli & Co., leasing on the Blue Bird property, have uncovered a 10-in. streak of smelting ore in the adit that assays $35 per ton in gold and silver.

Idaho Springs, March 26.

GILPIN COUNTY.

(Special Correspondence).—A shipment of ore was made last week from the Milton mine in Enterprise district that assayed 433.2 oz. silver per ton and 13.5% lead.——A 2-ft. body of ore has been found on the 200-ft. level of the Iroquois mine in the Russell district that contains $40 per ton gold and silver. T. Dunstone is manager.——The Coeur d'Alene mine on Academy mountain has been taken under bond and lease by Chicago interests. The shaft is to be retimbered from the 400 to the 600-ft. point, where sinking will be resumed.——Heavy shipments are being sent out from the Russell mine in Russell district to the Modern smelter.

Central City, March 26.

GUNNISON COUNTY.

The ore recently opened in the Madonna mine, near Whitepine, has been cross-cut for 60 ft. without reaching the foot-wall.——O. F. Thomas has opened a large body on the Last Chance property near Gothic and has increased the force at the mine. If enough ore of proper grade can be secured it is possible that the Gothic mill and smelter may resume operations.——Work is to be resumed at the Mountain King property as soon as the roads can be opened for freighting.——The Monmouth Leasing Co. has commenced work on its tunnel and is taking in supplies from Crested Butte.

LAKE COUNTY.

The Empire Zinc Co., operating the Colonel Sellers property in California gulch, at Leadville, is producing about 50 tons of ore per day which is shipped to the smelter at Canon City. The new shaft has been completed and self-dumping skips installed.——The Helena mine is to be un-

watered some time this month and work resumed on the lower levels where a good body of ore was exposed before operations were suspended.——Arrangements that were made last year for the installation of new machinery at the Tribune property will probably be completed this spring and work resumed in the mine through the Yak tunnel.——The Colorado-California Dredging Co. has completed prospecting the Hayden ranch south of Leadville, and it is probable that a dredge will be installed this summer.——The face of the Yak tunnel has now reached the upper end of the Maxy claim and is expected to cut the Diamond property within the next few months. A station has been cut on the Resurrection property, but no connection made with the shaft as a large amount of water is still flowing from the diamond-drill holes which tapped the old workings.——The lessees of the Yankee Doodle mine, on Carbonate hill, are shipping 30 tons of ore per day from the 420-ft. level.——At the Carbutt property 30 men are employed and 150 tons of ore is being taken out.

SAN MIGUEL COUNTY.

The Black Bear Mining Co., whose mines are situated in the northern portion of Ingram basin, is preparing for a large output during the coming season. The re-building of the tramway, which was destroyed by fire last year, is well under way and it is hoped to resume operations in the mill about the middle of this month. The ore has improved considerably in the lower levels and a high grade of lead-zinc concentrate will be produced in the mill.

TELLER COUNTY.

A 30-ton lot of screenings recently shipped from the El Paso mine at Cripple Creek by Owen Roberts, assayed 8 oz. gold per ton. The ore was mined on the 250-ft. level where a new shoot has been opened and is expected to average over $30 per ton when mixed with ore from the dumps which are being worked over.——Fogleman & Roach, operating the W. P. H. mine, on Ironclad hill, are shipping ore from the dumps to the Golden Cycle mill at Colorado City. On the lowest level of the property a cross-cut has been started to open the vein exposed in the Forest Queen mine adjoining.——Two cars of smelting ore was shipped from the Lucky Gus No. 2, which is being worked by Harry Moore under lease from the Stratton estate.——The March production of the Jerry Johnson is heavier than for some months past, exceeding 1500 tons, with an average value of $23.——F. N. Dorthy, Leo Cox, and J. W. Miller, have secured a two-year lease on the north end of the Burns claim of the Acacia Gold Mining Co., with royalties graded from 15 to 30% on all ore marketed. The lessees have been prospecting the ground through the Wrockloff shaft, and have found an orebody that assays from $10 to $20 per ton.——The winze from the ninth level of the Ruby mine on Bull hill has been completed and a cross-cut started for the vein. This makes the total depth at the mine 1525 ft. which is the lowest workings in that portion of the district.——An option has been secured by Eastern people on the Rittenhouse properties on Gold hill, and a prospecting permit granted for 60 days. The main shaft on the group is 750 ft. deep, and approximately $50,000 worth of bullion has been taken from the claim.

IDAHO.

ELMORE COUNTY.

The Bagdad-Chase Gold Mining Co., operating the Bagdad-Chase mine, near Atlanta, has shut down and laid off all the men indefinitely. Edgar Van Etten is manager.

OWYHEE COUNTY.

The Black Horse Silver City Mining Co. is running several drifts on a 5-ft. orebody and storing a fair grade of ore on the dump.——The drift on the lowest level of the White Brother's property, in the Flint district, opened a shoot of high-grade ore. There are now 120 sacks on the dump for shipment, and assays of picked samples have run as high as 1800 oz. silver per ton.

MICHIGAN.

HOUGHTON COUNTY.

Operations in the Mohawk Mining Co.'s new shaft, No. 6, sinking of which was begun in 1909 and in the first level of which the Kearsarge lode was found about a month back, are being carried on steadily. The depth of the shaft is now nearly 80 ft. below the place where the first level was cut. Sinking is being carried on at the rate of 70 to 75 ft. per month. At this rate, it will be possible to cut a new level about every five or six weeks. While the rock as being taken from the drift in the first level is not as rich in copper content as that revealed when the lode was first cut, the copper is in workable amount.

KEWEENAW COUNTY.

The Osceola company owns a valuable piece of mineralized territory in Keweenaw county. This land adjoins the one-time Bohemia mine, and exploratory work at the latter exposed a lode of value. Nothing has been done on the property since. The land was originally purchased for its timber, but the mineral rights went with the surface rights when the purchase was made. It is now proposed to investigate it further. The Osceola company is now paying dividends at the rate of $12 per year, and is earning more than that. The production during this fiscal year will run pretty close to 3,000,000 lb., and will undoubtedly be the heaviest in the history of the mine.

ONTONAGON COUNTY.

The good showing in the twentieth level of No. 2 shaft of the Trimountain mine continues. The Trimountain mill is now handling a portion of the Baltic production and will continue doing so till the new boiler-house at the Baltic mill is erected.

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—Shallow ore has been found on the Pinkard lease east of Joplin and the shaft is being sunk to 150 ft. The entire tract will be drained when the shaft reaches this depth. So far, the shaft has reached 70 ft., where the ore is first cut. According to drill-holes it extends to 100 ft. No drifts have yet been run.——The Innovator and the McKinley mills southeast of Webb City, idle since more than a year ago, are to resume operations. Each has a capacity of 150 tons. Operations are conducted in hard ground at 185 to 200 ft. The mills in this portion of the field have been idle for some time, but it is reported that a number are planning immediate resumption.——The new 500-ton Culpepper plant north of Carterville on the Cunningham land is almost ready for operation. High-grade blende is being taken from two shafts. It occurs from 155 to 195 ft. The company is installing what is called a 'bull' or extra rougher jig, which will greatly increase the capacity of the plant. This is the first bull-jig installed in this district.——Work at the Carl Junction camp is again becoming active after a rather dull period. Both 250-ton plants of the Mohler Smith Co. are again operating. In the open pit the steam-shovel is at work. The company is installing extra switch tracks. Considerable drilling is also being done.

Joplin, March 26.

MONTANA.

BROADWATER COUNTY.

Reports from the Radersburg district are that the Ohio-Keating Gold Mining Co. is about ready to resume mining and shipping, which has been suspended while the company was awaiting the installation of electric power. The electrical equipment has been received and is being installed. While mining was suspended development work was kept up and the company has a very large tonnage of high-grade ore blocked out and ready for mining. The United Missouri River Power Co. has extended its pole-line to the district and a number of the gold mining companies are using the power.

JEFFERSON COUNTY.

(Special Correspondence).—Two feet of bornite has been opened in the Bertha mine by the Boston & Corbin company in the Corbin district. The discovery was made in a drift on the Bertha vein on the 700-ft. level. The orebody is 9 ft. wide, all of a good grade, and two feet of it are the rich bornite which assays 40% copper and 25 oz. silver per ton.——The Montana-Corbin, the Boston & Alta, the London-Corbin, the Corbin Metal, and the Robert Emmet

Copper companies are all active in that district. The Robert Emmet has just made a connection with the old shaft by a drift on the 200 ft. level, about 181 ft. from the cross-cut driven from the new shaft. The connection makes good ventilation for the mine, and the drift is all the way in ore, the vein being 12 ft. wide, half of it being good ore with a streak 18 in. wide that assays 15% copper, 30% lead, and 120 oz. silver per ton.

Corbin, March 25.

SILVER BOW COUNTY.

(Special Correspondence).—While production in the Butte district is still under restriction all the mines are in exceptionally good condition. H. H. Thayer, president of the Anaconda Copper Mining Co., who has been in Butte several weeks, says the mines of the Amalgamated and allied companies have never been in shape for a bigger production than they are at present, so that if the copper market would justify it the Butte district could produce a record quantity of copper. The production at present continues about 15 to 20% below the normal.——The Parrot mine remains closed, the reason for it appearing in the statement of the Amalgamated company that the ore is of such a low grade that it cannot be mined and treated at a profit on the present copper market. The Little Mina, which produces 125 to 200 tons of ore per day, and also of a rather low grade, is the only property of the company working. However, the merger interests place a remarkably high exchange value on the Parrot in the offer of 90,000 shares of Anaconda for the Parrot property. On a par value basis that gives a value of $2,250,000 for Parrot as against a present par value of $2,298,500.

Butte, March 26.

NEVADA.

CLARK COUNTY.

The Occidental mill in the Eldorado district which started the early part of March has been running successfully, crushing 30 tons of ore per day which plates about $20 per ton.——The Eldorado-Crown 40-ton mill is to start about the middle of this month, and the management is considering doubling the capacity on account of the large number of applications to have custom ore treated.——At the Capital property the management has 20 tons of ore sacked for shipment that will assay from $150 to $200 per ton.——The Nevada-Eagle has stopped sinking temporarily at the 385-ft. level and will cross-cut the vein.——The Independence Mining Co. has broken ground for a new 20-stamp mill and let a contract for its construction. O. A. Ellis is manager.——A carload of 36 tons of ore from the Big Chief mine at Hart, California, has been treated by the Knight custom mill at Searchlight and another shipment is to be forwarded in a few days. The ore yielded $53 per ton on the plates.

ELKO COUNTY.

Snow is rapidly disappearing at Jarbidge and regular work is being carried on at the Bourne, Escallon, Winters, Belmont, Bunker Hill, and other properties.—John Escallon has bonded his claims to the Twin Falls Jarbidge Development Co.——Prenty Bros. have sold the Little Devil, and C. E. Smith the Climax group. The Rambler group brought $9000 and the Fanny $6000.——J. S. Safford describes the Bourne ore as occurring in a rhyolite dike cut by quartz stringers. His samples gave an average of 6.6 oz. silver and 1.06 gold.——Dan Greenwalt is driving on a 4-in. streak of high-grade ore at the Bunker Hill.——Discoveries are reported on Bruneau river, ten miles east of Jarbidge, near the head of East Bruneau and elsewhere.——Many people are coming into the district, though snow still closes the passes to the south, and prices are high. A hotel is being built and with the opening of communications to Elko a rush is expected. The ore in the veins so far opened is not high grade, but contains a fair amount of gold with a little silver. One vein has been traced for about a mile and practically the whole county is staked, though very little work has been done so far on account of the snow.

ESMERALDA COUNTY.

(Special Correspondence).—On the 1000-ft. level of the Clermont workings of the Consolidated an orebody of large size has been exposed and assays have been running as high as 6 oz. gold, with scarcely a trace of copper, the ore now being taken from the drift averaging above $30 per ton.——The dividend to be paid by the Florence company this month, of 10c per share, will bring the total of such payments to the sum of $735,000. The directors maintain their attitude of refusing to be committed to the payment of dividends at stipulated periods, but from recent announcements it is assumed that the company will be enabled in the future to continue the distribution of profits on the basis of at least 40c per share annually.——Jumbo Extension has attracted notice of late owing to the opening of a new vein at a depth of 800 ft. in the shaft of the Goldfield Annex lease on the Polverde claim. A shipment of ore of excellent quality was made recently from the LaFoe lease on the Gold Coin claim of the Jumbo Extension, situated near Diamondfield. This is the only production of this company since the Gold Wedge fraction, adjoining the Mohawk, was deeded to the Consolidated company as a result of disputes involving extralateral rights on that claim.——The Codd Mines Co. has secured a three-year extension on its lease on the St. Ives and will sink the 550 ft. shaft to a depth of at least 1000 ft.——The old Daisy lease has been declared forfeited and Millard & Jones, who were working a sublease on this ground, have secured a new lease from the Daisy company and will begin extensive work shortly.

Goldfield, March 25.

LINCOLN COUNTY.

The Reed Mining & Milling Co. is planning to resume work on its property near Delamar. The group adjoins the Magnolia claims from which a large amount of high-grade ore was taken in early days. Several lessees in the same district have ore on the dump waiting the completion of the railroad before shipping.——A test lot of ore from the Consolidated Pioche group was forwarded to Salt Lake to determine the best treatment for the ore. The company is to build a concentrating mill at Pioche to handle the ore, which averages 10% lead, 15 oz. silver, 20% zinc, and $2 gold, before shipping to the smelter.——A. E. Thomas has granted a bond on the Sultan group to Salt Lake parties, and the ore is being hauled eight miles to Goodsprings, from which point it is shipped to the smelter.——The Yellow Pine Mining Co. is now shipping 15 tons of ore per day.

NYE COUNTY.

(Special Correspondence).—The Montana Tonopah has opened a 6-ft. vein on the 615-ft. level, west of the shaft, which appears to be a continuation of the Martha orebody. The ore is a sulphide and the walls are very distinct. The semi-monthly melt of cyanide precipitate yielded 25 bars of bullion averaging 70 lb. each.——The Tonopah of Nevada is building several 400-ton ore-bins in the Red Plume shaft.——The West End company has arranged to obtain more air from the MacNamara, and two more machine-drills will be installed.——The Montgomery Mountain Mining Co.'s properties at Rhyolite will be sold for debt at Salt Lake on April 15, according to a published notice.——The Eclipse 10-stamp mill is now in operation, and the cyanide annex, having a capacity of 50 tons per day, will soon be completed. The company has a lease on the Tramp Consolidated and will devote principal attention to the treatment of ore from this source, though custom ore will be handled as soon as the sampler has been completed. It is proposed to treat $20 ore for $6 per ton, guaranteeing 90% of the assay value.——The Bullfrog Pioneer Leasing & Mining Co. has leased the Mayflower mill and will commence the treatment of low-grade ore at once. The lease will be renewed from month to month, until the Mayflower desires to resume the treatment of its own ores.——The Round Mountain Mining Co. is sinking a new shaft on the Combination claim, 1500 ft. east of the main shaft. It is down 20 ft. and will be sunk 200 ft. before lateral work is commenced.——The Nevada National is arranging for the erection of a milling plant.

Tonopah, March 25.

STOREY COUNTY.

The plans for resumption of work on the Brunswick lode have been completed and work will soon be started through the Sutro tunnel and the Zadig drift. The drift is in hard

rock except for 60 or 70 ft., so but little re-timbering will be needed. At the time operations were suspended the ventilation was poor, while now a strong current of cool air can be drawn from the Sutro tunnel. At the tunnel level a broad belt of quartz assaying from $1 to $14 per ton was crossed.——Frank O. Broili has been appointed superintendent for the Savage Gold & Silver Mining Co. to succeed W. W. Turney, who resigned recently.——The first of the new pumps for the 2100-ft. station of the Ward shaft has arrived at the mine and will be installed as soon as the station is completed.

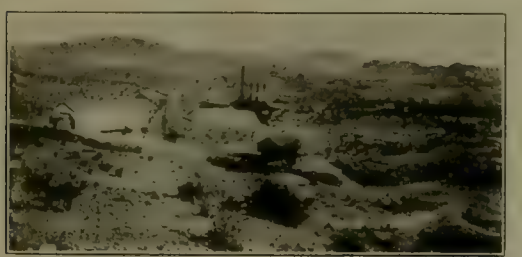
WHITE PINE COUNTY.

The properties of the Pittsburg Ely Copper Co. in the Ely district will be prospected during the summer by a core-drill. A contract has been let for the work and a drill shipped to the property.——John Macart and J. E. Talbott have purchased a group of 14 claims south of the Ely Consolidated property for $14,000.——The steam-shovels at the pit on Copper flat are increasing the output of ore and removing more overburden, as the ground has thawed enough to make shoveling comparatively easy. The output is now from 7500 to 10,000 tons per day.

TEXAS.

BREWSTER COUNTY.

(Special Correspondence).—The 20-ton furnace of the Chisos Mining Co. in the Terlingua quicksilver district is in regular operation. The mine has a monthly output of cinnabar ore which gives a return of about $15,000 worth of quicksilver. The workings are now below the 500-ft.



Terlingua Quicksilver District.

level and the water is said to be giving no trouble. The other mines of the district situated near Terlingua creek are flooded. It is reported that the Griffin prospect in the Shafter district has developed into a bonanza. The ore is said to be very rich and that it is easily mined. The fact that the Shafter mine, which has a record of producing more than $7,000,000 in silver and is still producing at the rate of about $350,000 per year, is situated in the same locality, lends interest to the development of the Griffin claim.

Terlingua, March 25.

EL PASO COUNTY.

A large body of silver ore has just been found in the Beulah mine, situated in the Quitman mountains, six miles from Lasca station on the Southern Pacific. This mine is being worked under lease by John Moffat and is owned by Thomas O'Keefe, of El Paso.

UTAH.

SALT LAKE COUNTY.

Four new steam-shovels and ten standard-gauge engines have been ordered by the Utah Copper Co. This will make a total of 19 steam-shovels operated by the company, and it will be only a short time when all the company's ore will be mined by this method.——The tramway of the Utah Consolidated Mining Co. has been completed and is now ready to handle ore between the mine in Carr Fork canyon and the International plant. While the smelter is not in a position to handle the ore at present, it will be stored in the bins, as the management wishes to have a large stock of ore on hand.

SUMMIT COUNTY.

The drifts on the 400 and 1100-ft. levels of the American Flag mine near Park City have opened shoots of high-grade ore. On the 400-ft. level the vein is 2 ft. wide and on the 1100 about 18 in.——The Silver King Coalition passed the April dividend and is planning to install new machinery, increase the development work, and re-timber the shaft. The Silver King company also owns a half interest in the Conklin and Arthur claims, and at the present time a suit for a division of the interests is pending, so the company wishes to be in a position to buy out the other owners if possible.

WASHINGTON.

FERRY COUNTY.

(Special Correspondence).—A large body of ore was recently opened on the Iron Chief group, which adjoins the Oversight mine on Cook mountain in the Belcher district. The group consists of seven full claims and has been prospected for several years, but the developments were unimportant, until an open-cut was driven about 100 ft., 30 ft. of the distance being across the apex of the vein which has been traced by open-cutting a distance of about 3000 ft. An open-cut and shaft on the Ironsides claim show that the vein pitches southwesterly into the hill 25 to 30°. The ore contains over 70% iron and small amounts of gold and silver. A vertical depth of 500 ft. may be obtained by an adit on the Keystone claims. The north extension of the Iron Chief vein has been uncovered on the Bonanza and Forrest claims.——The New Republic company has secured an extension of its lease and option to purchase the Republic mine of two years, the royalties agreed to be paid being 10% of the net output the first six months, 15 the second, and 20 the third six months, all to apply on the purchase price, the whole of which must be paid at or before the end of the second year.——The Republic Mines corporation has paid the Pearl Consolidated Mining Co. the second installment on the purchase price of the Lone Pine, Pearl, and Surprise claims and is getting out large quantities of ore, averaging in value about $45 per ton.——The Ben Hur Leasing Co., which is operating the Ben Hur mine under lease, has cleaned out the old stopes opened by the first company and carried those on the first level to the surface. The leasing company has opened four stopes and is preparing to open another on the first level, from which it has shipped about 4000 tons of ore that varies from $10 to $15 per ton. The value is in gold and silver, with a ratio of one to six. The company expects shortly to install a new boiler and air-compressor to operate ten drills, and later on a new hoist.

Republic, March 26.

CANADA.

BRITISH COLUMBIA.

(Special Correspondence).—Dominion Copper affairs do not seem to have quieted down even yet. P. F. Roosa, liquidator of the old company, is giving notice that he is about to deal with the affairs of the company under the winding-up act. The chairman of the protective committee of the dissenting stock and bondholders states that counsel has advised that suits for misappropriation of funds and mismanagement against the old officers should be brought in the United States Circuit Court at New York. At the meeting of the New Dominion Copper Co. to be held in June it is likely that there will be a contest for control of the board of directors. The British Columbia Copper Co. at present owns or controls 53% of the stock of the company, but does not control the directorate; Newman Erb and F. L. Sommers, of the British Columbia Copper Co. being only two of the seven on the board. Owing to dissension among the directorate it is difficult to say when shipments from the Rawhide will be started, as some of the directors are satisfied to do development only.——A small crew is at work on the Golden Eagle property, and about 100 tons of ore was shipped last week.——The Greenwood-Phoenix tunnel is now in over 400 ft., and it is thought that the first vein should be cut by the first of April.——At a recent meeting of the directors of the Granby company matters pertaining to dividend were passed over, it being thought advisable to hold this matter in abeyance until the new stock had been issued.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

J. E. Spurr is at Tonopah.

Gelasio Caetani is in Colorado.

F. W. Bewley is at Boise, Idaho.

H. R. Johnson was in San Francisco.

C. W. Purington is expected at New York.

M. K. Shaler will go to central Africa soon.

Robert Anderson was at Berkeley last week.

H. F. Osborn was at Los Angeles last week.

T. P. Brinigar has left Sonora for Kansas City.

Courtenay De Kalb was at Los Angeles this week.

S. H. Ball has returned to New York from London.

J. Nelson Nevius, of Pasadena, was in San Francisco.

J. P. Keene is at Pierce, Idaho, in charge of a dredge.

Alfred James was in New York on his way to Mexico.

J. A. Taft has returned to San Francisco from Coalinga.

J. H. G. Wolf has returned from Bakersfield, California.

Edgar Collins was at Grass Valley, California, this week.

G. H. Ashley has been appointed State Geologist of Tennessee.

Henry S. Washington expects to return from Brazil early in May.

Sumner S. Smith has returned to San Francisco from Sonora.

Errol MacBoyle has returned to San Francisco from Mexico.

J. Volney Lewis is examining mining properties in western North Carolina.

R. S. McGowan has returned to Hornbrook, California, from San Francisco.

Edwin E. Chase, of Denver, has gone to Sonora to examine copper properties.

James F. Kemp has been elected president of the New York Academy of Science.

T. A. Rickard has been appointed lecturer on mining geology at Harvard University.

Herbert Haas has moved his office to 528 Merchants Exchange building, San Francisco.

Waldemar Lindgren will attend the International Geological Congress at Stockholm this summer.

W. F. Ferrier has resigned as geologist to the United States S. R. & M. Co., and Scott Turner has been appointed to the place.

H. S. Reed, Jr., has resigned as manager of the La Gloria mine and is now at the Tres Hermanos, Batopilas, Chihuahua.

C. A. Beall has resigned as manager for the Casa Diablo G. M. Co. and will make headquarters hereafter at San Diego, California.

Delegates from the Geological Society of America to the eleventh International Geological Congress to be held at Stockholm, Sweden, in August of this year has been named as follows: Arnold Hague, Charles R. Van Hise, James F. Kemp, Frank D. Adams, and Edmund Otis Hovey.

Obituary.

Alexander Agassiz, who died on the steamer *Adriatic*, March 28, was one of the most successful American mining engineers, though known more generally as a zoologist. He was born at Neufchâtel, Switzerland, December 17, 1835, and graduated from Harvard University in 1855. In mining his best known work is that which he accomplished at the Calumet & Hecla in Michigan. A more extended notice of his life will be given later.

Metal Prices.

LOCAL METAL PRICES

San Francisco, March 31.

Antimony	12—12¾c	Quicksilver (flask)	49½—50½
Electrolytic Copper	16¼—16½c	Spelter	7 2¼c
Pig Lead	4.90—5.00c	Tin	36—37½c

METAL PRICES

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Mar. 24	13.19	4.39	5.53	52
" 25	13.19	4.39	5.53	52
" 26	13.19	4.39	5.53	52⅝
" 27	Sunday.	No market.		
" 28	13.13	4.39	5.56	52⅝
" 29	13.13	4.39	5.56	52¼
" 30	13.13	4.39	5.56	52⅜

FOREIGN METAL QUOTATIONS.

(Boston News Bureau.)

London—Tin opened and closed March 23, spot £148 7s. 6d.; futures, £150 7s. 6d. Market steady. Sales, 100 tons spot; 700 tons futures. Spot up £1 15s. 0d., futures up £1 12s. 6d. Lead, £13, up 1s. 3d. Spelter, £23, unchanged. Copper G. M. B. opened and closed, spot £58 15s. 0d., futures, £59 17s. 6d. Market easy. Sales, 300 tons spot; 200 tons futures. Spot off 2s. 6d.; futures off 2s. 6d. Best selected, £63, up 5s.

MARCH COPPER OUTPUT.

A member of the Copper Producers' Association is quoted by the *Boston News Bureau* as follows:

"The copper output for the month of February, as shown by the Association figures, was 10,000,000 lb. more than was expected. For the current month I predict an output of 110,000,000 lb., notwithstanding the fact that a less production is anticipated owing to the mine curtailment three months ago. The net result will probably be another increase in stock of about 5,000,000 lb. In diagnosing the situation, however, these small monthly increases should not be considered too seriously. Taken as a whole, the first quarter for 1910, when completed, will probably show a decrease in stocks, while the same condition will also undoubtedly prevail for the three months period ending June 30. Exports at the moment are small and the March total shipments abroad will not be large. On the other hand, domestic takings should improve somewhat. As nearly as I can estimate, there have been sold during the past two weeks about 125,000,000 lb., mostly for delivery to American manufacturers. One feature of the recent buying movement was the absence of large buying orders from Europe. Domestic consumers bought sufficient copper to last them through the current month, all through April, and partly through May so that when buying again commences it will call for some May copper together with deliveries for summer. At the moment there is no demand of note for the metal and prices have consequently dropped a peg, and lake may now be had for 13¾c. and electrolytic for 13½ to 13⅝."

The Anaconda Merger.

The companies absorbed by the new Anaconda company will receive its shares as listed below:

Companies absorbed.	Shares.
Boston & Montana	1,200,000
Butte & Boston	300,000
Washoe	380,000
Trenton	120,000
Big Blackfoot Lumber Co.	300,000
Parrot	90,000
Diamond Coal & Coke	100,000
Red Metal Mining Co.	500,000
Alice Gold & Silver Mining Co.	30,000
Original Anaconda	1,200,000
Grand total	4,220,000

Market Reports.

ANGLO-AMERICAN SHARES.

Cabled from London.

	Mar. 24. £ s. d.	Mar. 30. £ s. d.
Camp Bird	1 8 0	1 8 0
El Oro	1 8 0	1 8 3
Esperanza	2 16 3	2 16 3
Dolores	1 8 9	1 8 9
Oroville Dredging	0 10 0	0 9 9
Mexico Mines	8 18 9	8 17 6
Tomboy	0 18 1¼	0 18 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, March 31.		Closing prices, March 31.
Adventure	7	Isle Royale	17⅛
Allouez	43½	Lake	64
Arcadian	5	Miami	21⅛
Arizona Commercial	21	Nevada Con	21⅞
Atlantic	7½	North Butte	34½
Boston Con	18	Old Dominion	36⅛
Butte Coal	22½	Osceola	143
Calumet & Arizona	67	Parrot	16
Calumet & Hecla	606	Quincy	81
Centennial	18	Santa Fe	1¾
Copper Range	69	Shannon	12⅛
Corbin	8⅛	Tamarack	60
Daly West	9	Trinity	6
East Butte	9	Utah Con	28¾
Franklin	15	Victoria	3⅛
Granby	43	Wolverine	150
Greene-Cananea, ctf	9⅝	Wyandot	2¼

(By courtesy of J. C. Wilson, Mills Building.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, March 31.		Closing prices, March 31.
Amalgamated Copper	73¾	Miami Copper	21⅛
A. S. & R. Co.	80¾	Mines Co. of America	⅛
Boston Copper	17½	Montgomery-Shoshone	¾
B. C. Copper Co.	6¼	Nevada Con.	21
Butte Coalition	22⅝	Nevada Utah	1⅛
Chino	13⅛	Nipissing	10
Davis-Daly	2⅞	Ohio Copper	3⅞
Dolores	6⅛	Ray Central	3¼
El Rayo	2⅞	Ray Con	19⅝
Ely Central	1⅛	South Utah	2
First National	3	Superior & Pittsburg	13⅜
Giroux	8⅛	Tenn. Copper	56¾
Guanajuato Con	1⅛	Trinity	6¼
Inspiration	7⅞	Tuolumne Copper	3¾
Kerr Lake	8⅝	United Copper	7⅛
La Rose	4¼	Utah Copper	44⅞
Mason Valley	9⅛	Yukon Gold	4⅛

SOUTHERN NEVADA STOCKS.

San Francisco, March 31.

Atlanta	$ 16	Mayflower	$ 4
Belmont	2.60	Midway	36
Booth	19	Montana Tonopah	90
Columbia Mtn	7	Nevada Hills	50
Combination Fraction	48	Pittsburg Silver Peak	78
Daisy	10	Rawhide Coalition	84
Fairview Eagle	15	Rawhide Queen	20
Florence	2.17	Round Mountain	47
Goldfield Con	8.37	Silver Pick	10
Gold Kewenas	8	St. Ives	20
Great Bend	3	Tonopah Extension	85
Jim Butler	15	Tonopah of Nevada	7.25
Jumbo Extension	41	West End	39

(By courtesy of the San Francisco Stock & Exchange Board.)

OIL SHARES.

San Francisco, March 31.

Associated Oil	$49.50	Monte Cristo	$ 3.60
Bay City	2.00	Palmer	1.27
Blue Moon	26	Paraffine	1.45
Chicago Crude	11	Premier	1.42
Claremont	1.95	Record	6.50
Enos	1.37	S. F. & McK.	27.50
Four	29	Sauer Dough	2.25
Illinois Crude	50	Sesnon	8.00
Junction	40	Silver Tip	2.75
Mascot	2.50	W. K. Oil	2.90

(Courtesy California Stock & Oil Exchange.)

COMSTOCKS.

San Francisco, March 31.

Alpha	$ 12	Justice	$ 23
Andes	13	Kentuck	17
Belcher	90	Mexican	1.45
Bullion	25	Occident	80
Caledonia	62	Ophir	1.22
Challenge Con.	34	Overman	1.32
Chollar	26	Potosi	65
Confidence	1.15	Savage	41
Con. Imperial	5	Scorpion	7
Con. Virginia	1.10	Seg. Belcher	29
Crown Point	85	Sierra Nevada	44
Exchequer	25	Silver Hill	21
Gould & Curry	28	Union	72
Hale & Norcross	45	Utah	7
Julia	22	Yellow Jacket	90

Assessment of the Comstock mining companies on the listed stocks are now due and payable and the amounts per share, date of delinquency in the boards and offices and day of sale are as follows:

Companies.	Amt.	Del. in board.	Del. in office.	Sale day.
Yellow Jacket	10	Mar. 4	Mar. 7	Apr. 11
Belcher	10	Mar. 4	Mar. 9	Mar. 29
Chollar	10	Mar. 5	Mar. 8	Mar. 31
Hale & Norcross	10	Mar. 7	Mar. 9	Mar. 31
Union	10	Mar. 7	Mar. 10	Mar. 31
Alpha Con.	5	Mar. 12	Mar. 15	Apr. 7
Central Eureka	2½	Mar. 13	Mar. 18	Apr. 23
Gould & Curry	10	Mar. 14	Mar. 18	Apr. 6
Confidence	20	Mar. 21	Mar. 25	Apr. 15
Overman	10	Mar. 31	Apr. 6	Apr. 27
Sierra Nevada	10	Apr. 2	Apr. 6	Apr. 27
Potosi	10	Apr. 2	Apr. 5	Apr. 28
Utah	5	Apr. 8	Apr. 12	May 3
Con. Imperial	1	Apr. 15	Apr. 19	May 12
Ophir	25	Apr. 16	Apr. 22	May 16

United States Steel.

The income and surplus account of the United States Steel Corporation for 1909 and 1908, as shown by the annual report of the corporation, is as follows:

	1909.	1908.
Gross receipts, sales and earnings	$646,382,251.29	$482,307,840.34
Manufacturing cost and ordinary maintenance	$483,417,842.21	$367,735,102.27
Administrative and general expenses	15,460,613.78	12,932,696.13
Taxes	8,704,193.39	5,361,160.20
Discounts and interest	3,621,613.12	2,707,181.06
Balance	$135,177,988.79	$93,571,700.68
Sundry manufacturing and operating revenues and rentals	3,385,382.24	1,488,805.05
Income from investments, etc.	3,432,616.63	4,298,079.96
Total income	$141,995,987.66	$99,358,585.69
Interest charges subsidiary companies	7,887,178.18	7,401,205.18
Balance	$134,108,809.48	$91,957,380.51
Less net balance profit earned by subsidiary companies	2,617,395.54	109,669.94
Net earnings	$131,491,413.94	$91,847,710.57
Depreciation funds	23,718,313.98	16,965,181.46
Balance	$107,773,099.96	$74,882,529.11
Bond interest and sinking fund	29,247,850.00	29,247,850.00
Balance	$78,525,249.96	$45,634,679.11
Sundry credit adjustments	548,445.08	94,034.59
Total available for dividends, etc.	$79,073,695.04	$45,728,713.70
Preferred dividends paid	25,219,677.00	25,219,677.00
Common dividends paid	20,332,100.00	10,166,050.00
Balance, surplus	$33,521,918.04	$10,342,986.70
Appropriations for new construction, etc.	18,200,000.00	.....
Balance carried to surplus.	$15,321,918.04	$10,342,986.70
Increase in surplus of subsidiary companies	2,617,395.54	426,983.85
Previous surplus	133,415,214.17	122,645,243.62
Surplus, December 31	$151,354,527.75	$133,415,214.17

COMPANY REPORTS.

DALY JUDGE

The Daly Judge Mining Co. of Park City, Utah, had a prosperous year in 1909, the cash balance at the end amounting to $222,085. The ore statement shows 3137 dry tons of ore sold crude and 47,872 concentrated. The concentrate brought $222,609, the zinc middling, $109,918, iron middling, $27,467, and the crude $77,725. Miscellaneous receipts brought the total up to $447,631. The expenses for the year were $347,590. Costs are given as follows:

	Tons	Rate	Amount
Mining	51,309	$3.03	$155,649
Concentrating	47,872	0.95	45,596
Marketing	33,364	0.76	25,496
General Expense	51,309	0.25	12,635
Exploration	51,309	1.75	89,756
Total		$6.41	$329,132

Construction work cost $15,117, a new air compressor having been installed. Development amounted to 5165 ft. Total sales since the incorporation of the company have amounted to $2,486,155. Mining extends to the 1500-ft. level. The company is interested in the Snake Creek Mining & Tunnel Co., which proposes to underdrain the district.

MONTGOMERY SHOSHONE CON. M. CO.

This is a holding company which controls the Montgomery Shoshone Mines Co., Shoshone Polaris Mining Co., and Bullfrog Reduction & Water Co., concerned with mining and reduction of gold-silver ore at Bullfrog, Nevada. The principal mine is the Montgomery Shoshone, which is worked in part through a 'glory-hole', but has also been opened by shaft and levels to a depth of 700 ft. John G. Kirchen, the general manager, finds it impossible to make an accurate estimate of ore reserves owing to the irregular character of the orebody. In the stopes 9500 tons of broken ore are reported, valued at $6.50 per ton. Within the year ended December 31, 68,632 tons of an average value of $7.57 were mined and treated with an extraction of 87%. The cost of the milling is given at $2.27 per ton. The cost of mining may be figured by dividing the combined operating expenses of the two mines, $140,756, by the total tonnage, at $2.05. It is impossible with the data given to make proper allowances for development and ore reserves, but it is evident that, considering desert conditions and the irregularities of the deposit, the cost is low. That development was not neglected is indicated by the fact that 6982 ft. of drifts, cross-cuts, raises, and winzes is to be credited to the year's work. Important improvements have been made to the mill, which has been described in the MINING AND SCIENTIFIC PRESS, February 19, 1910.

UNITED STATES STEEL.

The eighth annual report of the United States Steel Corporation shows a substantial recovery from the depression of 1908, the figures following rather 1907 than the last preceding year. The gross sales and earnings increased $164,074,411 or 34%, and the net earnings $39,643,703 or 43%. The gross receipts were $646,382,251 and the net earnings $131,491,414. The total number of employees is given at 195,500 and the annual payroll $151,663,394. The total production of finished products for 1909 was equal to 75% of the normal maximum capacity of the properties. That the increased profits were related to lower prices quoted is indicated by the fact that the average domestic prices received in 1909 on finished products were 14.3% less than in 1908. On foreign sales the decrease amounted to 7.8%. Export shipments, however, increased 26.3% in the year and there were large unfilled orders on the books at the close. The bonded indebtedness of the corporation and its subsidiaries was increased $12,718,639 and totaled, December 31, $607,584,173. Since the formation of the corporation $495,212,235 has been taken out of earnings and put into the property in the form of improvements, enlargements, or extensions; an amount not much below the total of the common stock, $508,302,500.

PUBLICATIONS RECEIVED.

Any of the books noticed in these columns may be ordered through this office and can be procured from the MINING AND SCIENTIFIC PRESS.

HYDRAULIC MINING, with Supplements on Roads and Motor Traction for Mining. By C. C. Longridge. 8vo. Pp. 332, appendix, index, ill. *The Mining Journal*, London, 1910. Price $7.

A sharp demand has long existed for a work on hydraulic mining, giving modern practice in testing and in operating, with full details. The classic work of Augustus J. Bowie has not become obsolete, but neither does it completely answer the needs of the present-day miner, and it was always wanting in explanation of the minor matters of operation. Specific detail of that kind is needed as much as elucidation of general principles. Mr. Longridge has gone far toward supplying the need. The volume before us brings together an immense amount of information. The author does not appear to draw from a large practical experience, though he has evidently had sufficient contact with field work to give him a proper sense of the relative importance of the various features of the work. His reading has been wide and up to date. The discussion of the relations of geology and physiography to placer deposits is illuminating. He gives the MINING AND SCIENTIFIC PRESS credit for calling attention to the influence of 'creep en masse' of the gravel-fill in valleys in causing concentration of gold on bedrock. The conditions favoring gold accumulation are explained in a manner that will be helpful to prospectors. His classification of placers is interesting, but is open to some criticism as an attempt at discriminations which are too minute. The description of methods of testing is in accord with recent practice, but in this instance more detail would have been helpful. We commend the extended treatment of the engineering features, such as ditch and flume-construction, pipe-lines, and the like, accompanied with mathematical tables and examples of the calculations necessary. The chapter on dams is perfunctory, but this subject is necessarily one that cannot be condensed. Recourse must be had to extended treatises on dam-construction. All the appliances used in hydraulic mining are described, with ample illustrations, many of which are working drawings. The chapter on hydraulic elevators, giants, and nozzles, and the details of the duty of water in the various operations of hydraulic mining, is the best source of such information that we know. In the chapter on traction engines the Renard system is briefly explained. This offers some peculiar advantages, doing away with the heavily loaded draft-engine. The book is not well arranged, and is unattractive in appearance, but it is undoubtedly the most exhaustive treatise on hydraulic mining at present available.

THE MINING MANUAL FOR 1910. By Walter R. Skinner. Published by the author. London, 1910. Price $5.50.

Comment upon a standard reference book such as Skinner's Mining Manual is almost unnecessary. It has become an essential part of every office equipment where there is interest in the mines owned by British companies all around the world. It contains information upon 3600 mining properties, with the details needful to one interested in the financial status of these enterprises. It also contains, among much statistical matter and information of general interest to the mining public, the names and addresses of 1400 mining engineers and mine managers, and a dictionary of mining terms. The latter needs a thorough revision, since there are many inadequate and misleading definitions, such, for example as that of 'leaching', which is said to be "the process of separating metal from salts by treatment with a solvent."

RESULTS OF SPIRIT LEVELING IN ILLINOIS, 1896 TO 1908, INCLUSIVE. By S. S. Gannett and D. H. Baldwin. U. S. Geol. Surv., Bull. 421. Pp. 74. Washington, 1910.

REPORT OF THE DIRECTOR OF THE MINT, FOR THE FISCAL YEAR ENDED JUNE 30, 1909. Pp. 310, index. Washington, 1909.

The Prospector.

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

D. W. T., Butte, Montana: No. 1, diabase; No. 2, diorite.

R. L. L., Aire Libre, Mexico: The rock samples are phonolite.

R. J. H., Aqua Salada, Mexico: A mixture of epidote and garnet.

S. I. C., Dunsmuir, California: Massive serpentine sprinkled with pyrite.

C. C. W., Pahreah, Utah: The green mineral is torbernite and the yellow probably autunite.

E. S. R., New York: The specimen is an impure lime carbonate or travertine, and contains clay but very little magnesia.

M. J. O., Denio, Oregon: The specimen contains chalcopyrite, tetrahedrite, pyrite partly oxidized black, quartz, and barite.

A. H. B., Fullerton, California: No. 1, augite-andesite; No. 2, quartzite; No. 3, banded or schistose quartzite; No. 4, mica-schist.

CATALOGUES RECEIVED.

The Jeffrey Mfg. Co., Columbus, Ohio. Booklet No. 36, 'Spiral Conveyers'. Illustrated. 3½ by 6 inches. 20 pages.

Terry Core Drill Co., 50 Church street, New York, 1910 Catalogue. 'Core Drills'. Illustrated. 6 by 9 inches. 60 pages.

Smith, Emery & Co., San Francisco. 'Iron and Steel Inspection Catalogue'. Illustrated. 4 by 6½ inches. 24 pages.

The Jeffrey Mfg. Co., Columbus, Ohio. Booklet No. 35. 'Rubber Belt Conveyors'. Illustrated. 3½ by 6 inches. 24 pages.

Ernst Wiener Co., New York. Miniature Catalogue No. 155. 'Industrial Railways'. Illustrated. 3½ by 6 inches. 16 pages.

Ruggles-Coles Engineering Co., New York and Chicago. Catalogue G. 'Mechanical Dryers'. Illustrated. 5¾ by 8¾ inches. 46 pages.

National Brake & Electric Co., Milwaukee. Publication No. 387. 'Motor Driven Air Compressors'. Illustrated. 6 by 9 inches. 36 pages.

Morris Machine Works, Baldwinsville, New York. 1910 Catalogue of Centrifugal Pumping Machinery. Illustrated. 6 by 9 inches. 96 pages.

Western Electric Co., New York. Bulletin No. 1110. 'Telephones and Signaling Apparatus for Mines'. Illustrated. 8 by 11 inches. 12 pages.

United Iron Works, Oakland, California. Catalogue No. 37. 'Gold and Silver Milling and Hydraulic Machinery'. Illustrated. 8 by 10 inches. 114 pages.

American Steam Pump Co., Battle Creek, Michigan. Catalogue No. 18. 'Marsh and American Steam and Power Pumping Machinery'. Illustrated. 6 by 9 inches. 188 pages.

Braun-Knecht-Heimann Co., San Francisco, and The Braun Corporation, Los Angeles. An especially complete and attractive catalogue of assayers' and chemical laboratory apparatus and supplies. Illustrated. 6½ by 10 inches. 528 pages.

The Williams Patent Crusher & Pulverizer Co., Chicago. 'Coal Crusher Bulletin'. Illustrated. 7 by 9½ inches. 8 pages. 'Anthracite Mine Debris Bulletin'. Illustrated. 7 by 9½ inches. 8 pages. 'Facts Worth Reading'. Illustrated. 4 by 6 inches. 36 pages. 'Users of Williams Mills'. Illustrated. 4½ by 9 inches. 8 pages.

COMMERCIAL PARAGRAPHS.

Montgomery & Case have opened an office at Battle Mountain, Nevada, to do assaying and engineering.

The Trojan Powder Co. announces the removal of its California office from Oakland to the Phelan Bdg., San Francisco.

T. H. Proske, of Denver, recently shipped two 30-ft. D 24 Ajax drill sharpeners to Brazil for use on railroad construction work.

The Trent Engineering Co. has moved its Los Angeles office to the Union Trust building, at the corner of Fourth and Spring streets.

The Southwestern Machinery & Supply Co., Los Angeles, agents for the Fuller Lehigh mill, has moved its office to 504 Central Building.

The Kelly Filter Press Co., which has taken quarters in the new Felt building, at Salt Lake, reports the shipment of a second 50-ton press to the Treadwell mills at Treadwell, Alaska.

The Hammond Iron Works, Warren, Pa., advises that it is furnishing twelve Pachuca tanks, 15 by 47 ft., and numerous plain tanks and zinc boxes for the new plant of the Palmilla Milling Co., at Parral, Mexico.

The Inter-Ocean Steel Co., Chicago, announces that its plant at Chicago Heights will soon be ready to produce locomotive and car wheel tires, roll shells, die rings, and steel flanges. Julian Kennedy is chief engineer.

The S. M. Hildreth Co., New York, is putting a collapsible steel 'horse' or trestle on the market. It is built up of structural shapes and is said to be unusually rigid when extended. When folded the horse takes up very little room and is particularly convenient for transportation and handling.

The Atlantic Equipment Co., New York, announces that it has contracted with the Oliver Iron Mining Co., to furnish all steam-shovels used by the latter concern during the coming season. The class 80-18-3 shovel was selected after a severe test in the Mountain Iron and the Bart-Pool mines during 1908-1909.

On March 1 Alexander Backus disposed of his holdings in the Vulcan Steam Shovel Co., Toledo, Ohio, and retired from the presidency after an active service of twenty years. The new owners and officers of the company are H. P. Eells, president, and G. F. Steedman, vice-president. Carl Horix, who has been acting as general manager for some time past, will continue in this capacity.

A. J. McCone, of Reno, Nevada, is preparing to manufacture a double-drum friction, worm-gear hoist for sinking prospecting shafts from 100 to 300 ft. One drum is for the load and the other for a counter-balance. It can be operated by a 3 to 5-hp. gasoline engine or electric motor. The outfit includes a self-dumping bucket and a car-loading chute. He has an outfit set up for demonstration.

On May 1 the Dearborn Drug & Chemical Works will move its general offices and chemical laboratories at Chicago from the Postal Telegraph Bdg., to the new McCormick Bdg., on Michigan avenue and Van Buren street. The Dearborn company will have the entire frontage on Michigan avenue for its offices and laboratories, with a total floor space of more than 5000 square feet. The Dearborn company extends a cordial invitation to old and new friends to visit its new headquarters.

Abbot A. Hanks announces his removal to 630 Sacramento street, San Francisco. This well known assaying office was established in 1866 by Mr. Hanks' father. With the exception of the year following the catastrophe of 1906 the firm has been situated within a few blocks of its present location. The business has grown from a small assaying office to complete chemical and metallurgical laboratory. The new firm makes a specialty of representing shippers at the San Francisco smelters. The new building was designed especially for the use of Mr. Hanks, and provides all modern equipment.

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EDITORIAL.

AN ENGINEER in the Cabinet is suggested by *Engineering-Contracting*. Why not? Many engineers know enough law to qualify even under the present administration.

THE American Electrochemical Society will hold its spring meeting at Pittsburg, Pennsylvania, May 4, 5, 6, and 7. A full program and interesting excursions are promised.

JAPANESE are ubiquitous and useful. It is announced that 'Japanese spies' have been arrested at Manila. The importance of the matter dwindles when it is recalled that this story annually appears just about the time Congress is asked to vote two more battleships.

CANADA produced 54,061,106 pounds of copper in 1909, according to the statistics collected by the Dominion Government. This represents an increase of two per cent over the output for 1908. The bulk of this copper came from British Columbia, though Ontario yielded over 15,000,000 pounds.

MINERS' INSTITUTES were provided for by the special session of the General Assembly of Illinois just adjourned. Unfortunately the Attorney General finds the law to be unconstitutional since the matter lay outside the subjects mentioned in calling the Assembly together. The Governor has, accordingly, felt obliged to veto the law so that this important measure will need to be re-enacted at the regular session next winter.

INSURANCE against loss through failure to realize on advance royalties is provided in the case of the United States Steel Corporation by deducting from the surplus an amount to be held against such a loss. In 1906, $2,500,000 was so set aside. To this $300,000 was added in 1908, and $3,200,000 in 1909. In all, therefore, $6,000,000 is now held. It is known that in certain cases where the Corporation holds iron-ore land subject to a minimum yearly royalty, less than the minimum of ore has been extracted. This is, of course, equivalent to advance payment for mining, and money so spent properly constitutes an asset. Since, however, orebodies are subject to vagaries and even the best prospecting only allows of estimates of tonnage, it is always possible that less ore will be realized than the minimum estimated and so paid for. In the case of the Mesabi orebodies this is not a very probable contingency except possibly where there is a definite time limit on the lease. The fact that provision is made for such possible loss indicates how carefully the Corporation's affairs are managed.

PUBLIC confidence in the copper market has been shaken as a result of the unimproved demand for the metal. This has been reflected in the general decline of copper shares, in which subsidence practically every important producer in America has been affected. Even the stock of the Calumet & Hecla fell from 685 to 597, Utah Copper has shrunk to 43¾, Nevada Consolidated to 20⅞, while Amalgamated went from 90¾ to 74. The greatest shrinkage was that of Granby Consolidated, which had stood at 111¾, and was shortly quoted as low as 37. The special reasons for this are explained in our New York letter. These are only examples of a universal decline in value, which of course was exaggerated by the timidity of the speculating public. Such a depression is wholly unwarranted, and no one would pretend that the condition of the metal market and the outlook for the future were such as to mean a depreciation in the actual value of the stocks of $156,000,000, as the stock market quotations would indicate. The lack of discrimination by the public between the producers of low and high-priced copper is evidence of this.

Goldfield and Grass Valley Mines

Production by the Goldfield Consolidated Mines Company continues at the same extraordinary level as for many months past. During March the recovery amounted to $950,000, being at the rate of 93.5 per cent from ore averaging $38.20 per ton. We have taken occasion heretofore to remark upon this phenomenal result, illustrating the skill in technical operation and general management of those who have been in charge. The total operating cost, including administrative expenses, was $8.26, and the loss in tailing amounted to $2.51 per ton. There are few cases of equal extraction from high-grade ores. Mr. J. R. Finlay, the manager, reports additions to the ore reserves during the month of March of 60,000 tons, being almost double the tonnage milled. This is a most gratifying feature of the situation, which is increased by the fact that no diminution of the assay value of the ore has taken place. The great gold mine of Nevada will evidently long hold its own as the richest in the world. It is interesting to compare with this the results at the North Star mine, which is the greatest gold mine in California. The annual report just issued shows a total output for 1909 of 91,610 tons, averaging $13.59 per ton, which was treated at a total cost, including development, of $6.42. This has been achieved at a mine working to a depth of over 5000 feet on the incline, with a narrow vein, which necessarily adds to the cost of operating. The reserves now blocked are sufficient to supply the mill for several years. The success attained reflected credit upon Mr. A. D. Foote, the distinguished engineer in charge. While the North Star has had no such dazzling career as the Goldfield Consolidated, its long and steady production and its successful operation since 1884, have given it a standing that commands universal admiration. In this period of twenty-five years it has yielded a gross amount of $10,745,046, out of which dividends of $2,486,989 have been paid.

Alexander Agassiz

In the death of Alexander Agassiz the world has lost one of its greatest mining engineers. It is not usual to think of him as a mining engineer, for his distinction in the public eye was due more to his achievements in pure science. After all, it is the contributions to knowledge rather than the economic results which a man attains that win applause and lasting honor in the world. This is one of the things that keeps alive our faith in humanity as something more than a mechanism to produce iron and steel and copper or to raise wheat and to irrigate alfalfa. It is a tribute of the highest sort that the scientific and uneconomic achievements of Alexander Agassiz eclipsed his superb success in establishing and guiding the greatest single mining enterprise in the world. It was due to him that the Calumet & Hecla copper mine in Michigan was placed upon a paying basis; it was his genius that realized the hopelessness of attempting to found a copper industry on the Michigan peninsula based upon enriched spots in the great conglomerate and amygdaloid lodes, but foresaw the possibility of building it up by economical methods of operation on a large scale, utilizing the average low-grade ore. The Calumet & Hecla has distributed to its stockholders $110,550,000 in dividends, making the largest disbursement reached by any mining company in the world, and this from a copper ore that has yielded first and last about two per cent of metal. This splendid success made Mr. Agassiz a multi-millionaire, in the clean and noble way of winning fortune from the earth, adding at the same time to the world's wealth. There was never any manipulation of stock nor bleeding of the public. He could show his books and papers to the world and there would be none to reproach him. This wealth, moreover, did not come as sudden riches in answer to a rubbing of Aladdin's lamp. Mr. Agassiz was born poor; the only son of the intellectual giant Louis Agassiz, who had "no time to make money," being so busy in blazing new paths of knowledge through the unknown. He started in life with no inheritance save a sound training in the best scholarship of the age. He graduated from Harvard in 1855 in his twentieth year; in 1859 he began active duty in the West as a surveyor on the Coast Survey in California. It was in 1865 that he threw himself into the task of developing the Calumet & Hecla. The peninsula was a wild place in those days; inaccessible, and dreary; its vast stretches of swamp had not been reclaimed. There he lived and worked as a pioneer for four years, struggling to win where everyone predicted failure, inspiring a handful of friends with confidence while the world laughed at him as a scientific dreamer. But the dream came true, and his supporters were well rewarded.

His distinction as a zoologist and geologist has placed him upon a higher plane than his economic efforts, and in the magnitude of his scientific labors he perhaps excelled those of his father. The difference is that the world is now accustomed to the tenets of progressive evolutionists, so that his contributions carry with them no hint of the iconoclast, and hence are less spectacular. The fruits of his

work on the famous Albatross expeditions however built higher the structure of zoologic science. His most notable geologic work consisted in the disproval of the fascinating theory of coral island formation, which Darwin and Dana had worked out like a scientific romance. The world thus lost a pretty conception but Alexander Agassiz brought us back to truth. No great South Pacific continent had existed and subsided below the waves. With the homely application of the diamond drill he showed that the accumulations of coral were not due to gradual submergence. His labors for the advancement of knowledge, were conducted at enormous outlay from his private fortune. He will be remembered as a rare man, great as a scholar, scientist, and engineer.

What a Mining Bureau May Do

Our esteemed contemporary in New York, *The Engineering and Mining Journal*, is violently exercised over the probability of the establishment of a Federal Bureau of Mines. The functions of such a Bureau, and possibly its utility, are matters concerning which men differ, but surely reasoning is better than ridicule as a means of honest opposition. Failure to adduce argument suggests prejudice rather than knowledge. On another page of this issue Mr. S. B. Christy, whose long and eminent service at the College of Mining of the University of California gives weight to his words, discusses the arguments pro and con. For ourselves, we cannot believe that the distinguished metallurgist who edits our Eastern contemporary fails to see the need of further improvement in mining and metallurgy; nor can we believe that he is so pessimistic as to doubt the possibility of such improvement, or so ignorant as not to know that it must be based on research. It is surely a fair assumption that well directed research in chemistry, physics, and related sciences, will supply many of the missing data, and equally certain that a corps of qualified engineers and scientists with means and time to study these problems in the broadest way, may be expected to be helpful rather than harmful to the industry. That we have come so far on the road by present methods is no argument against taking advantage of conceivable additional aid. To insist that improvement is possible is not to deny that there already has been progress, any more than to propose additional means of research is to promise immediate solution of difficulties. Surely there can be no real misunderstanding on this point. As to the suggestion that a '$6000 per year director' would either prove ineffective or be gobbled by the Guggenheims, it might be well to remember that many men are already adding yearly to the store of mining and metallurgical knowledge in the colleges at less than this, and even editors of technical journals are known to be useful for years at such a salary without being abducted by any smelting company. Why should not the men in the Bureau of Mines serve a useful purpose, and even make important discoveries at the same stipend? If such an expert, after making and publishing such discovery, be offered a large salary by a corporation that desires his aid in making practical application of the new principle, we shall be first to congratulate both the man and the corporation, the one on having had the opportunity, temporarily free from the pressure for immediate commercial results, to ground himself in principles and to perfect his researches, and the other on securing a capable and efficient man. It has momentarily inconvenienced the Geological Survey, but the country at large has not suffered because Messrs. W. H. Weed, J. E. Spurr, J. M. Boutwell, C. K. Leith, J. D. Irving, and C. W. Purington, to mention only a few of the brilliant men who were trained in the Government service, are now engaged in private work. Does any one seriously believe that the Geological Survey has hampered rather than helped the mining engineering profession? The fear that a Bureau of Mines will impede the work of private engineers seems particularly ill founded. The Canadian Department of Mines has not done so. Indeed, it gave to the gentleman who has urged all these objections an excellent opportunity to study and report upon zinc mining and metallurgy north of the boundary; an opportunity which he and his associates improved in a most distinguished manner. Cheer up! While we do not for one moment accept the statement that "the chief purpose of a Bureau of Mines is to provide agreeable jobs for some amiable gentlemen," the bill as recommended to the Senate does provide that "there shall be in said Bureau such experts and other employees, that may from time to time be authorized by Congress." We see no reason why under this provision eminent engineers should not occasionally be employed to investigate special problems here as in Canada; and the Secretary of the Interior is authorized to fix the compensation at whatever may be necessary, with the single exception that it must be within the appropriations.

Establishment of a Federal Bureau of Mines is a simple measure of justice to miners and mining. It is paternalistic, but so is our Government, and has always been. The surest help is that which stimulates self-help and nothing does this like dissemination of accurate knowledge. This has been shown in the help given the farmers by the Department of Agriculture aiding development without interfering with any proper private activity. That Department began as a Bureau and developed on its merits. The Department of Commerce and Labor touches, directly, fewer persons and is concerned mainly with larger consolidations of interests. Its work also began under Bureau organization, but the Department even in its short life, has accomplished much good. The time may come when a Department of Mines will be in order; that is a matter for the future to determine. The time is now here, however, when a Bureau of Mines is needed, and neither trickery in the Senate nor ridicule on the part of those who misinterpret public opinion ought to be allowed to defeat it. The West is certainly for a Bureau of Mines, and this is true of the sentiment not only of the men in the ranks, but of those who manage large and successful mining and metallurgical enterprises. As to the wishes of those living in the shadow of Wall Street "between New Jersey and the Ocean" we cannot profess to have accurate information.

Geology Applied to Mining

By T. A. Rickard.

(Continued From Page 481.)

*Accepted ideas concerning the origin of ore deposits may be illustrated by describing briefly the manner in which a simple type of lode is supposed to have been formed. Let us take a gold-bearing quartz vein in granite: The vein occupies a fissure formed by a dislocation connected with the intrusion of igneous rock, which appears in the vicinity in the shape of dikes. The quartz contains iron sulphide, as pyrite, which near the surface is oxidized to hematite or appears in hydrous form as limonite, staining the white quartz red. The gold is found native and in coarse particles at the outcrop and for a variable depth, but below the zone of oxidation the gold is rarely visible and is associated intimately with the pyrite. Oxidation ceases a little below the level at which water freely enters the mine-opening. At a thousand feet the ground becomes dry and concurrently the vein becomes less rich in gold. At a depth of three thousand feet the quartz carries only traces of gold, but the gold-contents of the vein have not diminished steadily in depth; on the contrary, extreme variation has been noted both laterally and along the strike of the vein and vertically at different levels. In depth the rock enclosing the vein becomes harder, less fractured, and less moist. The pyrite tends to diminish in quantity. Even the vein-fissure is narrower, as if the rock were squeezing it on either side. The temperature increases in depth at the rate of 1°F. for every 50 ft.; obviously this increment indicates a depth at which the rock will be plastic or subject to deformation, incompatible with the existence of fissures or similar channels for water-circulation.

Given these facts, let us try to reconstruct the life-history of this gold vein, which is the fossilized remainder of a conduit through which mineralized solutions passed, not once only but at successive epochs, and for a period so long that as compared to it the time of one of the generations of man is as the life of a spring flower to the course of a star. As Emerson said: "Respect the *naturlangsamkeit* which hardens the ruby in a million years, and works in duration in which Alps and Andes come and go as rainbows." Indeed, the formation of a gold vein is an example of the cumulative effect of the infinitely little. We assume that the minerals—the quartz, the pyrite, and the gold—were precipitated from solution, but the solution, as compared to that of a chemist in his laboratory, was as weak in its dilution as it was potent in its volume. You will recall that Judd speaking of the hot spring at Bath points out that this, although an unimportant geological agent, brings daily to the surface 180,000 gallons of water at a constant temperature of 120°F., and as the spring is known to have been doing its duty at the time of the Roman invasion of Britain, it is estimated to have brought to surface in solution enough material to form a large volcanic cone. But the feeble spring that wells quietly to the surface at Bath is the product of thermal activities almost dead, while the gold vein is the sealed conduit of solutions that pulsated with the very life of the volcanic energy issuing from within the warm heart of the earth.

The vein is in granite, which is also traversed by dikes of andesite. This andesite elsewhere in the district penetrates some of the formations overlying the granite, but the andesite is itself overlaid by other more recent sedimentary strata; thus the age of the dikes is ascertained to be, let us say, early Tertiary. At that time this portion of the earth's crust was subjected to strains, due to the adjustment of a cold exterior upon a cooling and shrinking interior. The adjustment may have taken the form of a slow movement, which folded the yielding sedimentary rocks and cracked the less pliable granite. The granite was fissured down to the molten magma or to a horizon where the substance of this earth is subject to such a heat as to remain solid only because excessive pressure prevents liquefaction. As soon as the pressure is diminished, in place and temporarily, by the shifting of the crust and the formation of fissures, the magma becomes molten and rises in the cracks toward the surface. No gaping crevasse is assumed: the magma or lava follows and occupies the fissure as it is formed. The action may be compared to that of water filling the cracks in a sheet of ice; and as the water rising through a crack in the ice is referred to the body of water beneath that ice, so we connect the lava in a dike with the magmatic mass under the cold crust of the earth. Thus the dikes were formed.

The period of vulcanism was followed by a quiescent stage during which molten lava ceased to issue and was succeeded by watery emanations steadily more tenuous until they became essentially only hot water containing silica in solution with traces of iron and gold. This gradation expresses the process at work in the depths, whereby the molten mass undergoes differentiation by segregation of its constituent elements, the heaviest being first to crystallize, followed by others less basic, until finally all of the magma has consolidated, leaving a residuum of heated silicious water.

Meanwhile the granite was still subject to strain and to rupture: the dikes and other bodies of intrusive rock were cooling, and as they cooled they permitted cracks to be formed, sometimes along the lines of weakness they themselves now afforded. Up these cracks came the final products of magmatic segregation—the hot silicious waters containing the substances from which the gold vein was to be built.

Then supervened a long period of thermal activity, the heated solutions circulating through cracks and fissures after the manner in which hot water is impelled through the pipes in a house. Expansion under heat becomes an enormous force through the generation of steam, for one cubic inch of water makes one cubic foot of steam. Indeed steam is a prime factor in the formation of both dikes and veins. Andesite ordinarily fuses at 2520°F., but it is liquefied at 800° in the presence of superheated steam,

*The Le Neve Foster Memorial Lecture, delivered at the Royal School of Mines, London, on March 4, 1910.

the presence of which is indicated by the vesicular structure of lava, as well as by the emission of enormous volumes of water gas, which constitutes the clouds of so-called 'smoke' characteristic of volcanic outbursts.

The question now arises as to the source of the hot waters that formed the gold-quartz vein. As previously stated until recently it was held that all such solutions formed an integral part of the circulatory system originating at the surface from rainfall; that is, the underground waters were supposed to be of meteoric origin. But the weight of evidence is against such a theory. We know that in depth the rocks become less open to the passage of water, the gravitative stress that enables it to sink at the surface is overcome by increase of temperature and by a pressure that tends to close every opening. At a depth measured by about 30,000 feet the pressure and temperature have so increased as to produce deformation of the rock; hence no openings save of microscopic size are possible. Moreover, at about the same horizon the 'critical point' of water would be reached. At a temperature higher than 773° F. water cannot exist in liquid form, no matter how great the pressure; it becomes dissociated into its constituent gases. Allowing for an increment of 1° for every 50 ft. of descent this temperature would be reached at 34,700 ft. Thus there is a vertical limit to the descent of surface water.

Whence then comes the enormous volume of water ejected by volcanoes and thermal springs? At one time it was supposed that the sea found a way into cracks leading to volcanic vents and in a few instances this is believed to have happened to a minor degree, but this simple theory does not explain the emission of equally large volumes of steam in regions distant from any large body of superficial water. Briefly, it is held now that the volcanoes make the sea, rather than the contrary, that is, that the large bodies of water now covering the earth are the product of segregation from the cooling magma out of which the planet has been evolved. Thus we look to the depths—not to the surface—for the origin of the thermal waters that formed the gold vein. Regional disturbances had folded and fractured the granite, so as to create breaks reaching into the magma from which the andesite arose; and when a renewal of unrest, due to later re-adjustment, opened fresh fractures extending below the stony exterior of the earth, then the magmatic waters, the end product of segregation, rose under propulsion of steam until they reached the zone traversed by meteoric water, and forced their way through fissures and fractures even to the surface, where in places they issued forth as geysers or 'gushers'.

The dilute silicious solutions that thus finally reached the surface had traveled patiently along the underground waterways, dissolving and precipitating, enriching and impoverishing themselves, under the compulsion of chemical and physical conditions. Hot water under pressure, and especially as superheated steam, is a powerful solvent. At a depth below 10,000 feet and a temperature higher than 212° F., the dark silicates would be readily corroded and would yield both their silica and their metallic ingredients. The ability to carry matter in solution is increased by heat and pressure until saturation is attained, but at excessive temperatures the rapidity of solution is gained at the expense of stability. Thus at the greatest depth the interplay of solutions is rapid and the result unstable. Selective solution has full play. But as the waters ascend the pressure decreases and they become incapable of carrying so much material in solution. Then precipitation follows. Speaking generally, we may say that in the approach to surface the lessening of temperature and the decrease of pressure favor precipitation, as in depth, with augmenting heat and pressure, the reverse action, namely solution, is predominant.

Ore deposition may be regarded as a process of natural concentration; the vein is the depository of substances brought thither from many directions and solidified from solutions of extreme tenuity. As silica forms 60% of the substance of the earth's outer covering, it is not remarkable that it should be found in concentrated form as quartz in veins. But as the end product of magmatic segregation the silicious solutions followed naturally in the wake of eruptive activity and on the wane of vulcanism.

For the iron we may look to the dark silicates, which predominate in basic igneous rocks. The emission of sulphur compounds at volcanic vents points to the existence of that element as an original constituent of deeper rocks; thus the source of the iron sulphide, or pyrite, is indicated. Such sulphide of iron may be carried in alkaline solutions, in carbonated waters, or dissolved even in pure water. Carbon dioxide in liquid form is found plentifully in the microscopic cavities of rocks, and carbonate minerals are widely distributed. During periods of unrest, when the rocks are fractured, this carbon dioxide is liberated and when silicious waters penetrate limestone or dolomite the process of silicification is accompanied by the formation of carbonic acid. Thus a solvent is let loose. It is probable that water rich in bi-carbonates, and with an excess of carbon dioxide, was the chief solvent for the iron compounds from which the pyrite originated.

Next, the gold. Gold is widely disseminated in nature; in sea-water, in sedimentary rocks, in igneous rocks, it has been detected, but not until it has been concentrated to a point rendering it worth while to go to the pains of extracting it from its place amid less valuable minerals does the gold become of economic importance. The precious metal in a vein has undergone great and varied vicissitudes; it may have been laid down from magmatic waters that retained it at the end of a long process of segregation; it may have been leached from the iron and manganese silicates; it may have been derived from deeply buried oceanic sediments; it may have passed through each and all of these stages of existence, but in any case it is likely to have been dissolved, precipitated, redissolved, and re-precipitated, several times, before resting finally at the spot where it is struck by the pick of the miner.

Of solvents for gold there are many: Chlorine is prevalent in nature and used in metallurgy. Hydrochloric acid is one of the products of volcanic vents.

Iodine, which is a constituent of seaweed and exists in oceanic sediments, may have played a part. Alkaline sulphides may be mentioned. Iron persulphate is a more likely solvent, in view of the association with pyrite.

When ascending thermal waters containing gold in solution approach the earth's exterior they become susceptible to precipitation; if highly saturated the decrease of temperature and pressure is enough to compel unloading of the precious freight, but even for dilute solutions there lie in wait many reducing agents. Organic matter, in the form of carbonaceous remnants of vegetable organisms imbedded in the sedimentary rocks, is one of these. Even pyrite itself is a likely agent in the precipitation of gold. Ferric sulphate is a solvent, but ferrous sulphate is a precipitant. Once the gold is brought to the shallow horizon and is subject to the diverse chemical and physical conditions obtaining within the water-zone it is the sport of continual change, one effect of which is to produce the concentrations constituting rich ore.

The gold vein is a victim to nature's mutability. No sooner is it made, than it is attacked by forces of decomposition and decay. Life and death in nature go hand in hand; integration and distintegration pursue each other eternally. The uppermost portion of our quartz vein is exposed at surface to erosion and weathering. The minute crevices of the white quartz are penetrated by the rain, which, on freezing, serves as a wedge more powerful than steel to shatter the rock. The maximum density of water being at 39°F., there is an expansion between this temperature and the freezing point, sufficient to constitute a powerful agent of disruption. Moreover, the moisture acting upon the pyrite in the presence of air oxidizes the sulphide and forms ferric sulphate, which is set free to attack the gold. Thus the constituents of the vein near the surface are released for transport in the water-circulation, and merge into the meteoric waters, which, by gravitative stress, pass downward. The weathered cap of the vein remains as a honeycombed vertically tabular body of quartz, impoverished in gold, stained with iron oxide, and loosened by frost. The gold is carried a little deeper, but probably not far, for reducing agents are plentiful and speedy re-precipitation is likely. Thus an enrichment is produced, the gold from the upper part of the vein being superadded to the normal gold content as originally laid down. If, now, further erosion lowers the surface and removes the impoverished cap, the result will be to bring the enriched portion of the vein to the daylight or to the grass-roots, where the adventurous prospector haply may find it, greatly to his joy and possibly to his undoing.

My attempt briefly to indicate the processes by which a gold vein is formed would be misleading if I failed to emphasize the important part played by structural conditions. Deposition of ore is affected by the physical, and also chemical, conditions created by variations of rock-texture, by changes in the width and dip of the vein-fissures, by faults, by crossings with other veins, and by a multiplicity of local modifications such as the miner has a keen eye to appreciate. The scientific man helps to explain them and thereby sharpens the eye of the unscientific to observe them. By furnishing a clue to the vagaries of ore deposition, the geologist gives a key to the unraveling of the complexities of ore distribution. The key does not always fit the case but the difference between intelligent and unintelligent observation constitutes the great gift of geology to mining. "Without speculation there is no good and original observation," so said the author of 'The Origin of Species'. Theories come and go, but the multiplication of facts tends continually to furnish a safer basis for the ascertainment of ultimate truth. We have learned from Le Neve Foster, from Judd, from Huxley, that "we ought to exhaust known causes before seeking for the explanation of geological phenomena in causes of which we have no experience:" and we are impressed by a "conviction of the unbroken sequence of the order of natural phenomena, throughout the duration of the universe, which is the great, and, perhaps, the most important, effect of the increase of natural knowledge." So said Huxley. This conviction has guided the economic geologist; he has gone from the known to the unknown, from the present to the past, from the volcano in eruption to the solidified lava veining the rocks, from the hot spring bubbling at the surface to the fossilized vent that was once a thermal conduit, from the solution observed by him in his laboratory to the underground solutions whose activities formed the gold vein. Thus illumination has been given to the miner. No longer he gropes blindly in the darkness underground, for science has given him a light, feeble it may be as his candle in the gloom of cavernous workings, its rays do not reach far, they will not penetrate the rock, but at least they keep his feet from stumbling and his hands from misdirected labor. That is the gift of geology to mining.

COSTS AT THE ESPERANZA MINE

Written for the MINING AND SCIENTIFIC PRESS
By W. E. HINDRY

Considerable pains were taken to acquire reliable data with reference to labor and material per lineal metre of opening in various classes of development work done in the different kinds of ground found in the Esperanza mine, and also the progress and costs of shaft sinking at varying depths. These data have been tabulated and the results are given opposite. The first set of figures shows kind of opening, character of ground penetrated, total distance driven, average daily progress, condition of ventilation, whether hand or machine work, supplies consumed per lineal metre, and labor required per lineal metre, while the second statement shows the costs per lineal metre of two shafts sunk on the Sirio and Suceso properties of the Esperanza Mining Co. in 1899 and 1902, the unit cost of labor and supplies obtaining at that time being also appended in order that comparisons can be made with similar work under different conditions as regards these last items. An account of the methods of work at this mine has been given in the MINING AND SCIENTIFIC PRESS, December 18 and 25, of last year.

DEVELOPMENT DATA, ESPERANZA MINE, EL ORO, MEXICO, 1901.

Description.	Wide, ft.	High, ft.	Character of ground.	Total distance driven, metres.	Average daily advance, metres.	Ventilation.	Hand or machine work.	Supplies per lineal metre: Powder, kegs	Fuse, metres.	Caps, number	Candles, number	Labor, per metre: Miner, shifts	Labor, per metre: Helper, shifts	Remarks
Cross-cut ...	5	7	Fairly hard andesite	151.1	0.767	Fair	Hand	1.99	5.69	7.82	13.74	10.38	0.48	Not timbered
Cross-cut ...	5	7	Friable quartz	252.8	0.754	Good	Hand	3.08	7.96	10.07	12.74	10.62	1.86	Not timbered
Cross-cut ...	5	7	Fairly hard quartz	19.8	0.825	Poor	Machine	3.68	10.80	10.66	11.50	12.00	6.00	Not timbered
Cross-cut ...	5	7	Hard quartz	130.8	0.900	Fair	Machine	6.32	11.98	13.89	16.82	13.32	2.22	Not timbered
Drift	7	8	Soft swelling andesite	20.0	0.667	Poor	Hand	1.62	5.25	6.85	28.70			Timbered
Drift	5	7	Moderately hard black shale	193.5	0.675	Poor	Hand	4.59	8.47	10.43	10.01	10.98	2.04	Timbered
Drift	5	7	Friable quartz	43.5	0.787	Good	Hand	0.63	3.12	5.20	11.62			Not timbered
Drift	5	7	Fairly hard quartz	737.3	0.797	Fair	Machine	4.16	9.17	10.78	16.73	12.12	0.84	Not timbered
Drift	5	7	Hard tight andesite	241.8	0.676	Fair	Hand	4.98	11.99	15.48	16.43			Not timbered
Drift	5	7	Hard quartz	180.2	0.795	Fair	Machine	6.11	13.63	14.02	18.51	12.66	2.94	Not timbered
Raise	6	11	Friable quartz	87.0	0.317	Poor	Hand	4.14	14.47	16.35	21.84	15.78	3.06	Timbered
Raise	6	11	Fairly hard quartz	145.1	0.400	Good	Hand	2.60	8.71	12.36	37.35	21.96	2.70	Timbered
Raise	5½	10	Fairly hard andesite	6.7	0.478	Poor	Hand	5.00	8.00	7.00	14.80			Timbered
Raise	6	11	Hard quartz	191.8	0.318	Fair	Machine	8.43	28.77	27.22	33.65	17.28	2.58	Timbered
Winze	5	10	Friable quartz	29.2	0.406	Good	Hand	2.90	8.31	11.17	43.52	25.94	1.56	Timbered
Winze	6	11	Moderately hard black shale	17.6	0.226	Good	Hand	4.91	17.21	16.47	31.64	23.52	2.52	Timbered
Winze	6	11	Hard andesite	12.1	0.288	Poor	Hand	1.78	12.56	11.00	51.65	35.16	3.48	Timbered
Winze	6	11	Hard quartz	128.2	0.233	Fair	Hand	6.65	24.72	26.58	51.22	17.16	3.98	Timbered
Shaft	7	23	Hard black shale	91.9	0.786	Good	Machine	11.11	17.79	14.55	29.19	..		Timbered
Shaft	7	21	Hard andesite	117.7	0.581	Good	Machine	29.60	1.73	29.17	48.17	..		Timbered

COST OF SHAFT SINKING, EL ORO, MEXICO (MEXICAN CURRENCY).

Vertical shaft, 3 compartments. Hoisting compartments, 5 by 5 ft. in the clear; pump and ladder way, 5 by 7 ft. Timbers, 10 by 10 in.; 2-in. tight lagging, sets 5 ft. Centre to centre, 4 posts per set, 1 by 6 in. guides. Sunk 30.8 m. by windlass and handwork, afterward by steam-hoist and machine-drills. 1899.

Vertical 2-compartment shaft, compartments 5 by 5 ft. in the clear; timbers 10 by 10 in.; 2-in. tight lagging, sets 5 ft. Centre to centre, 4 posts per set, 4 by 6-in guides, hand drilling, steam hoist, water-flow 150 gal. per minute. 1902.

1899.	Character of ground.	Depth sunk, metres.	Total depth, metres.	Cost per lineal metre, labor: Superintendence	Shaft-men: Foreign	Shaft-men: Native	Top men	Blacksmiths	Firemen	Hoist-men	Miscellaneous	Total	Cost per lineal metre, supplies: Fuel: Timber	Fuel: Wood	Fuel: Coal	Powder	Fuse	Caps	Candles	Oils, grease	Miscellaneous	Total	Grand total
Jan. 7	Decomposed andesite	9.20	9.20	8.15	....	20.41	...	...	...	...	3.24	31.80	26.77	.....	...	....	....	...	...	...		26.77	58.57
Jan. 14	Soft andesite boulders	6.20	15.20	12.50	....	45.50	...	...	...	...	3.24	61.24	26.77	.....	...	.....	....	...	...	...		26.77	88.01*
Feb. 10	Hard andesite boulders	9.90	25.10	30.30	10.10	80.70	...	...	...	...	3.24	124.34	26.77	.....	...	10.46	0.58	0.58	..	.		38.89	163.23
Mar. 3	Solid andesite, fairly hard	5.70	30.80	39.47	18.42	92.24	...	2.63	...	...	3.24	156.00	26.77	.....	...	16.50	0.91	0.91	..	.		45.09	201.09
Apr. 29	Hard andesite	11.20	42.00	26.78	49.72	65.15	...	7.91	3.68	11.09	15.74	180.37	26.77	34.54	4.91	23.14	0.31	3.42	2.57			95.66	276.03
June 17	Very hard andesite	27.00	69.00	19.44	29.35	50.18	3.11	6.60	2.69	8.86	13.45	133.68	26.77	29.03	3.34	31.88	...	3.77	1.98			96.77	230.45
Oct. 21	Hard tight andesite	79.50	148.50	16.98	27.68	46.15	5.73	5.46	2.72	7.50	3.24	115.46	26.77	34.63	0.86	26.99	0.07	2.55	2.25		0.64	94.76	210.22
Jan. 13.	Black shale—good ground	58.50	207.00	11.58	19.80	38.97	4.60	4.90	1.95	4.91	6.98	93.96	26.77	19.79	0.63	9.01	0.01	0.99	0.88	0.59	0.28	59.95	153.91
	Totals and averages	207.00	207.00	17.11	23.74	47.43	3.91	4.84	2.15	6.03	6.31	111.52	26.77	25.55	1.21	19.28	0.10	1.99	1.51	0.17	0.33	77.91	189.43
1902.																							
June 22	Hard andesite	38.20	91.20	29.91	....	88.67	8.80	7.09	6.41	7.70	15.98	164.56	22.96	43.54	0.94	9.42	...	2.14	3.90	1.98	0.37	85.25	249.81

*Struck water at 12 metres depth. Average flow 50 gal. per minute. Shaft stopped 30 days for installation of machinery.
†Shaft stopped 18 days to cut pump station.

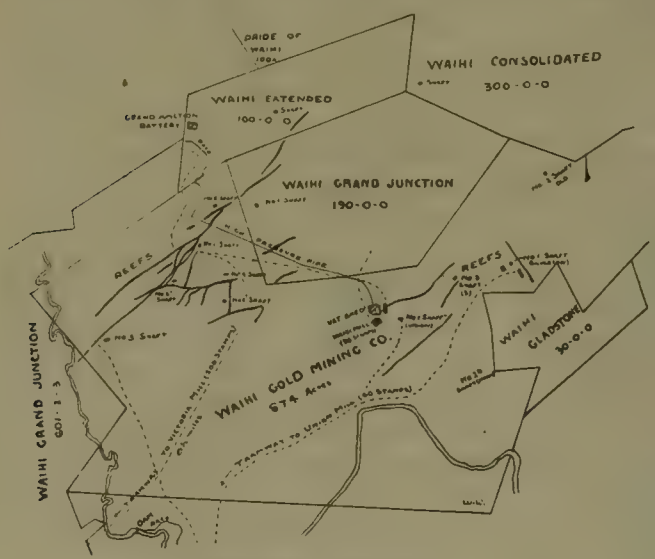
The following prices were paid during the sinking in 1899; later, both labor and supplies were higher. In all the work the holes in shafts were fired by battery, very little fuse being used.

Superintendent	₱10.00	per 24 hours	Timber	₱28.00	per M
Shaft-men:			Wood	6.50	per cord
Foreign	6.66	per shift (8 hours)	Coal	15.00	per ton
Native (average)	1.09	" " " "	Powder (60%)	0.83	per kg
Top-men	0.87	" " " "	Fuse	0.038	per metre
Blasksmiths	3.00	" " " "	Caps	0.012	each
Firemen	1.00	" " " "	Candles	0.04	each
Hoist-men	2.00	" " " "			

Gold and Silver Mining in New Zealand

By W. Wilson

The mining of gold dates from a very early epoch in the history of New Zealand. It was in 1852 that the first gold was found in the Auckland province, and since then many fortunes have been made in the Dominion. In 1907 over £2,000,000 worth of gold was exported, of which more than half comes from Auckland. The rest is derived from two other gold-producing areas—Westland and Otago. In the north the metal is from quartz-mining solely, while in the two southern fields alluvial mining and dredging are also utilized. By far the best property is the famous Waihi mine, in the Ohinemuri hills of Auckland, which yields steadily about £70,000 worth per month. Adjoining Waihi is the Karangahake district, with many wealthy claims, of which the Talisman, producing £184,445 in 1907, and the New Zealand Crown Mines, producing £57,242, are the most important. The Komata Reefs company yielded £47,128, and the Thames district, in the same neighborhood, contains a number of mines that have produced phenomenally rich yields. The Waiotaki gave £149,833 in 1907, and besides this there are the May Queen, Kuranui-Caledonian, and others. In the south gold-winning is proceeding vigorously in Westland, where advances are being made just at present. The Progress mine, and the Keep-it-Dark, at Reefton, are the chief quartz-mines, the former yielding £87,805 worth in 1907. The Mont d'Or claim, at Ross, is an extensive sluicing property, while gold is obtained from the rivers of this district and of Otago by means of 165 dredges. The Clutha river, in the southern province, is a huge natural sluice-box and the scene of great dredging industry. A total value of £620,900, mostly obtained from dredges and small sluicing claims, came from Otago and £381,874 from Westland in the same period.



Waihi Mines, New Zealand.

With regard to future extensions of the industry, there is every evidence of abundance of metal untouched. This is particularly the case in Auckland, as will be seen when an inspection of the existing sites is made. At Waihi there is much undeveloped land of great promise adjoining the Waihi Gold company's mine. This enterprise is famous throughout the world for its productiveness, as a venture which steadily pays dividends of 85 and 90% deserves to be. Its success has been due to the discovery of the cyanide process for treating low-grade ores, a method originating from this country. A map of the region is shown. Every indication points to the rich reefs extending into the adjoining properties, notably the Waihi Grand Junction. The investment of more capital in the near future will almost certainly prove this to be the case. At the Thames new extensions are about to be made beneath the present levels. Up till now the workings have been comparatively shallow, as it was believed that gold could not exist at a depth of 1000 feet.

However, good ore is now obtained at Bendigo, in Victoria, at depths of 3000 and 4000 ft., and at Reefton, in Westland, the Wealth of Nations Co. obtains good ore at a depth of 1775 ft., and is at present sinking to a further depth of 125 ft. The formation of the Thames reefs indicates their presence at greater depths, and though want of capital is checking enterprise at present, there should be a great future before the Thames Deep Levels. In Westland growing enterprise is accomplishing good results. The whole province is a proclaimed goldfield, and much gold exists that yet awaits working. In September 1909, a hydro-electric plant of 2000 hp. has started work at Ross. In Otago gold is produced over a wide area, and is worked almost entirely by dredging and sluicing. The total production is high, but the prospects of extensions are not so bright as in the northern fields.

Silver is found accompanying gold in many places, such as Waihi. In 1907 over a million and a half ounces was mined. Copper occurs in thirty-one known localities altogether but is richest in Nelson and Auckland. Small quantities have been worked at various times, such as 351 tons in 1858 and 245 tons in 1859; but for want of systematic prospecting, not sufficient ore has been developed to warrant extensive outlay. A heavy lode of copper pyrite, with native metal, is at the present time being worked near Nelson City, and a syndicate has just begun smelting operations in Auckland.

Aside from these metals others are present. Iron ore may become one of the most valuable resources in New Zealand. This consists of two varieties, the Taranaki iron sand and the Parapara deposits, in the Nelson district. The former is a black, titaniferous, magnetic ore, present in quantity on the sea-shore. Owing to its finely divided condition, smelting by existing processes has not been commercially possible, although briquetting was

*Abstract from 'Natural Resources of New Zealand', *Cassier's Magazine.*

tried for some years. A successful process is being sought. Quantities have been exported to Germany for reduction by the electrolytic process, for which the sea-front and is in the immediate vicinity of coal, limestone and water power, so that it would seem to be particularly valuable. The ore is pure

Round Hill Gold Mining Co., Southland. View of Claim Looking Northeast.

Panoramic View of Workings of Round Hill Gold Mining Co., Ourawera River, Southland.

this ore is exactly suited. The Parapara deposit is of comparatively recent discovery in the Nelson province, and forms a stratum 100 ft. thick, exposed over several acres. It is less than half a mile from hematite mixed with quartz pebbles, and contains 40% iron. Nine other fairly large deposits of iron are known and none are at present worked to any extent.

Tonopah Extension Mill

Written for the MINING AND SCIENTIFIC PRESS
By JOHN G. KIRCHEN

The new mill of the Tonopah Extension Mining Co., at Tonopah, Nevada, has but recently been started. A brief description of the machinery and arrangement of the plant is given below.

The ore from the mine is dumped direct into a No. 4 Kennedy crusher, placed on top of an ore-bin. This bin is 15 by 15 ft. inside. The crusher is driven by a 30-hp. Westinghouse motor, 900 r. p. m., 9-in. pulley. The ore is crushed to about 1½ in. The ore-bin discharges through an 18 by 24-in. rack and pinion gate to the belt of a 16-in. troughed incline belt-conveyor, and is thus carried to the top of the battery-bins. The conveyor is driven by a 7½-hp. motor 1120 r. p. m. The distributor on the battery-bins is driven by a 5-hp. motor 1120 r. p. m. The incline distance of the conveyor is 235 ft., the total rise being 40 ft. The above crusher and conveyor were furnished by Chalmers & Williams.

The battery-bins are of wood, and are an integral part of the mill-building. They are 13 ft. wide, 15 deep, 50 long, and have a flat bottom. The inside of the bins, at the ore-bin gates, is protected from the usual wear by means of 16-lb. rails, spiked vertically on the battery-side of the ore-bin. The bins are double-floored with building-paper between, protecting the mill from dust.

The battery ore-bins feed through six 18 by 24-in. rack and pinion ore-bin gates into suspended Challenge feeders, and thence into mortars. The mortars are of the modified Homestake type with extra wide base for setting on concrete foundations. The casting is 12 in. thick under the dies, and weighs, with liners, about 9500 lb. Each stamp weighs 1050 lb., and makes 98 drops per minute. There are 30 stamps, in batteries of 10 each, with 5 stamps per mortar. Every group of 10 stamps is driven by a 30-hp. Westinghouse motor, running 690 r. p. m., placed under the ore-bins and driving the drive-shaft by means of an 11-in. endless double leather belt. The battery drive-shaft is 3 in. diam. The cam-shaft is 5⅞ in. diam., with drive-pulley of wood, 72 in. diam. by 17 face. The belt is 16-in. 5-ply rubber, with a swinging triangular-frame battery-belt tightner. The stems are 3⅜ in. diam. by 15 ft. long. The cams are keyed to the shaft by Blanton patent fasteners. The complete stamp-battery was furnished by the Union Iron Works of San Francisco. The mortar block is of concrete, reinforced with 6-in. flat iron hoisting cable, the oil and grease on the cable having first been removed by heating.

The pulp from each battery of 10 stamps flows to two Deister concentrators, where the coarse concentrate is removed. The six Deister concentrators are driven by a 5-hp. Westinghouse motor, 1120 r. p. m. The tailing flows direct to two Dorr classifiers. The classifiers are sheet-steel tanks 4 ft. 6 in. wide by 16 ft. long, with a bottom slope of 2 in. per foot. Inside are a series of rakes set transversely, which move back and forth, pushing the coarse pulp to the top, and lifting clear of it on the return motion by means of a cam and rocker arm. The slime and surplus water overflow at the lower edge of the tank. The classifiers are operated by a 5-hp. Westinghouse motor 1120 revolutions per minute.

The coarse pulp from the Dorr classifiers is fed direct to two 5 by 18-ft. trunnion-type tube-mills, with scoop feed. These mills were built by the Traylor Engineering Co., and are lined with El Oro liners, cast in blocks about 21 by 16 in., with ribs about 1½ in. thick projecting 3 in. and leaving a space between the ribs of about 3 in. These blocks are bolted to the shell. The two tube-mills are driven by a 100-hp. Westinghouse motor, 690 r. p. m. The motor belt is of double leather, 14 in. wide, connected with the main shaft from which clutch-pulleys operate the tube-mills separately. The tube-mill belts are of 6-ply rubber, 14 in. wide.

The tube-mills discharge direct to hydraulic classifying cones where, with the assistance of the solution and slime-overflow from the Dorr classifiers, the coarse particles are removed and the thin slime-pulp is delivered to three 8 by 54-in. Frenier sand-pumps. A feature here worthy of special mention is the tube-mill floor, which is made of concrete and is sloped to a central pit where all leakage finds its way, and where, together with the coarse particles from the hydraulic classifiers, it is elevated by means of a bucket-elevator, and returned to the Dorr classifiers for re-treatment. The Frenier sand-pumps elevate the slime to six 8-ft. Callow cones. The overflow from these cones goes direct to the mill solution-tank, while the thickened pulp is distributed over 12 Deister slime concentrators. These 12 machines are operated by a 10-hp. Westinghouse motor running 1120 r. p. m. The slime tailing is run to a central sump and is pumped to slime collecting tanks. The pump used is a 7 by 9-in. Aldrich triplex slime-pump. A 15-hp. Westinghouse motor running 1120 r. p. m. is used to operate the three Frenier sand-pumps and the Aldrich triplex pump.

There are four slime-collecting tanks 24 ft. diam., 16 ft. high, having a false conical bottom 25° slope toward the centre. These tanks are fitted with overflow launders and decanters. Arrangements are such that the clear solution can be discharged either to the mill-tank or the gold-tank, depending on the gold and silver the solution contains.

The thickened pulp from the slime-collecting tanks is pumped into either of the three agitating tanks by means of a 6-in. Krogh centrifugal slime-pump, operated by a 10-hp. Westinghouse motor, 1120 r. p. m. Here the solution is brought to its proper cyanide strength. These agitating tanks are 24 ft. diam. and 16 high, and represent the latest development in agitation and aeration of cyanide solution and pulp. It is known as the L. C. Trent Shoshone agitator and aerator, and works on principles that are both unique and effective. It is operated by drawing off the liquid and thin slime from the top of the tank containing the agitator and with a centrifugal pump forcing same through a central pipe to near the bottom of the tank. This central pipe has four arms or pipes radiating from it. These arms are fitted with short jet-pipes or nozzles inclined downward toward the bottom of the tank and through

which all the solution and pulp drawn from the top must pass. The pressure of the solution and slime discharging through these restricted nozzles causes the arms to revolve at a speed sufficient to thoroughly stir and agitate. Air is admitted to the suction through a small valve and is introduced into the pump and forced into the solution, resulting in a complete admixture of air, solution, and slime. The solution readily becomes charged with microscopic air bubbles and the top of the tank presents a seething effervescent surface.

The feature that permits of the economic operation of this machine is the patent grit-proof step-bearing. The action of this device is such that as the tank is being filled with slime and solution, air is automatically imprisoned in an inverted chamber that surrounds the step-box, and the liquid and solid in the tank are excluded from the bearings which are maintained free from solution and slime, so that friction is no greater than were it not submerged. Numerous experiments have been made by stopping the agitator and allowing the slime to settle several hours. In each case the arms revolve within a few minutes after starting the agitator. The wear on the pump is light, owing to the fact that only fine slime and solution are drawn through it, while the coarser particles are held in suspension in the tank by the constant rising currents. Each agitator is operated by a 10-hp. Westinghouse motor, 1120 r. p. m. driving a 5-in. Price centrifugal slime-pump. The actual power consumed has not yet been determined, but it is safe to say it will be much less than the capacity of the motor. It is claimed for this agitator, that a much higher extraction is obtained, with less time for agitation and a low power-consumption. These are manufactured by the Trent Engineering Co., of Los Angeles. The pulp from the agitators is pumped to a large storage-tank with the same pump as is used to charge the agitating tanks. This storage tank is 30 ft. diam. by 20 high. The pulp is agitated and kept in suspension by an agitator similar to those above described. The important difference is that in this case the agitator is of the under-feed type, the agitating arms revolving on ball-bearings. The solution is drawn from the bottom of the storage-tank to the Blaisdell filters by gravity.

The filter-tank is constructed of steel having five hopper-bottoms. There are 100 leaves 5 by 10 ft., made of canvas-covered grooved wooden strips, similar to the Butters filter-leaf, with the exception of the cocoa matting. The bottom of the tank is so constructed that each set of 20 leaves discharges the washed pulp throught a separate hopper connected with an outlet-pipe which carries the slime to the main sluice-launder. In this department there are two more tanks placed above the filters, one being used for weak-solution, and the other for wash-water. These tanks are both 26 ft. diam. by 8 high. The vacuum for the filters is furnished by a Knowles 10 by 10-in. vertical pump. There is also an 8-in. Krogh centrifugal slime-pump, which is used to return the excess of slime from the filter-tank back to the storage-tank.

The solutions from the filters run direct to the gold-tank, which is 30 ft. diam. by 8 high, and thence to a long wooden box 4 ft. square, filled with excelsior, which serves to remove any fine slime from the solution. The overflow from this clarifying box goes direct to the zinc-boxes, of which there are eight, each having six compartments. These boxes are constructed of steel, each compartment being 3 ft. long, 31 in. wide, and 32 in. deep, with a hopper-bottom under each compartment, over which a screen with ¼-in. mesh is placed to retain the zinc. Short-zinc will be transferred toward the head-compartment at each clean-up.

The barren solutions run to two sump-tanks 26 ft. diam. by 8 high, and is then pumped to the main mill-solution tank by a 5 by 6-in. Aldrich triplex-pump, operated by a 10-hp. Westinghouse motor, 1120 r. p. m. This motor also drives a smaller size of pump, which is used as an auxiliary. From the mill-tank, the solution is pumped by a 6 by 9-in. Aldrich triplex pump, operated by a 7½-hp. Westinghouse motor, 1120 r. p. m. to a 24 by 15-ft. mill-tank, which is situated above the batteries.

The silver and gold precipitate is sluiced from the hopper-bottom of the zinc-boxes to two tanks, 4 ft. deep by 10 diam., provided with false-bottoms of cloth over slats, which act as filters. Connection is made under the filter to the 5 by 6-in. Aldrich auxiliary pump, which serves to filter the precipitate and return the solution to the zinc-boxes.

The gold and silver precipitate is shoveled out and delivered to a steam dryer. This is a jacketed steam-box constructed of ⅜-in. steel-plate, the inside dimensions being 6 ft. wide, by 15 long, and 14 in. deep. Four inches of this depth is used as the steam-jacket. After drying, the precipitate is mixed with borax and melted in an oil-fired No. 275 Monadnock steel Harvey furnace.

The mill is run three shifts of 8 hr. each; one man is employed on each shift on the batteries and also attends the electric-driven air-compressor which supplies air to the mine; one man looks after the tube-mills, Callow cones, and Deister slimers; one solution-man to look after the agitators and solution-tanks. The filters are also attended by one man on each shift. On the day shift a roustabout, a man to attend the zinc-boxes and clean-up, is employed; these, with the mill superintendent, make a total force of 15 men.

The mill-building is a frame structure covered with corrugated galvanized iron, everything being under one roof. The site is such that the transportation of materials by gravity is not allowable in all cases, but the pumping has been reduced to a minimum, as the description shows. Electric power is supplied to the motors throughout the plant at 400 volts, by the Nevada-California Power Co. All the tanks used in the mill are of redwood, manufactured by the Pacific Tank Co. The mill is designed for a capacity of 120 tons per 24 hr. The material treated is a complex silver-gold ore carrying approximately 90 oz. silver to 1 of gold. In designing the mill I was assisted by Fred M. Field. J. P. Montague is the present mill superintendent.

Magnesium chloride and sulphate in water have a deleterious effect upon cement.

Plotting Co-ordinate Surveys

Written for the Mining and Scientific Press
By J. J. Bristol

(*Continued From Page 490.*)

The application of the protractor is best understood by considering a practical example of a stope-survey. In connection with this example the determination of dip and areas will be discussed. Suppose the notes of two successive surveys of the stope 17 on 1 are as follows:

Stope 17 on 1 West. Under 1701 A. Backsight 1701.

Survey A.

Pt.	H. A.	V. A.	S. D.	V. D.
1a	204°40′	123°00′	105.9	57.8
2a	207°40′	122°40′	100.7	54.4
3a	213°20′	121°10′	88.8	46.0
4a	218°20′	119°30′	89.4	44.0
5a	223°20′	117°40′	84.4	39.4
6a	225°40′	116°40′	80.2	36.0
7a	229°40′	115°00′	79.0	33.4
8a	231°40′	114°10′	74.9	30.7
9a	237°40′	111°10′	75.6	27.3
10a	240°30′	109°10′	73.4	24.1
11a	244 10′	107°10′	69.6	20.6
12a	247°00′	105°10′	69.5	18.2
13a	250°10′	103°30′	66.4	15.5
14a	254°20′	100°20′	64.0	11.5
15a	257°10′	98°10′	63.6	9.0

Survey B.

Pt.	H. A.	V. A.	S. D.	V. D.
1b	268°00′	90°50′	54.6	0.8
2b	264°10′	93°50′	57.6	3.8
3b	263°50′	94°10′	62.3	4.5
4b	257°10′	98°10′	63.6	9.0
5b	254°20′	100°20′	64.0	11.5
6b	250°10′	103°30′	66.4	15.5
7b	246°50′	105°30′	74.9	20.0
8b	239°10′	110°00′	74.5	25.7
9b	235°40′	111°50′	76.6	28.5
10b	231°40′	114°10′	74.9	30.7
11b	224°50′	116°10′	87.4	39.0
12b	221°50′	117°50′	94.1	44.0
13b	219°40′	119°00′	101.4	49.1
14b	218°30′	119°10′	104.8	51.2
15b	214°20′	120°30′	107.4	54.8
16b	208°40′	122°10′	110.8	59.0
17b	204°40′	123°00′	105.9	57.8

Stope 17 on 1 East. Under 1701 A. Backsight 1701.

Survey A.

Pt.	H. A.	V. A.	S. D.	V. D.
1a	80°50′	93°50′	29.0	2.0
2a	84°50′	97°10′	28.7	3.7
3a	99°10′	105°50′	31.1	8.5
4a	101°20′	105°30′	35.5	9.5
5a	111°50′	110°20′	37.4	13.0
6a	113°30′	110°50′	41.7	14.8
7a	120 30′	113°00′	49.1	19.2
8a	124°00′	114°10′	52.5	21.5
9a	128 10′	115°40′	53.1	23.0
10a	132°40′	117°20′	58.4	26.9
11a	138°40′	119°50′	59.1	29.4
12a	140°10′	120°00′	63.3	31.7
13a	145°00′	121°50′	68.6	36.2
14a	153°00′	123°50′	75.8	42.2
15a	156°40′	124°50′	83.1	47.5
16a	159°30′	125 20′	87.3	50.5

Survey B.

Pt.	H. A.	V. A.	S. D.	V. D.
1b	80°50′	93°50′	29.0	2.0
2b	93°10′	101°20′	30.6	6.0
3b	101 50′	104°50′	40.9	10.5
4b	106°50′	107°30′	46.0	13.9
5b	110 30′	109 09′	51.5	16.9
6b	115°00′	111 10′	52.6	19.0
7b	120 10′	113°20′	60.5	24.0
8b	127°40′	116°30′	61.6	27.5
9b	132°10′	118 10′	65.2	30.8
10b	136°40′	119°50′	72.4	36.0
11b	138°30′	120°10′	77.6	39.0
12b	144°30′	122 20′	80.4	43.0
13b	146°30′	122°50′	84.8	46.0
14b	151°50′	124°00′	85.8	48.0
15b	157°40′	125°20	85.1	49.5

To plot 17 on 1 West, Survey A, draw a line through 1701 A and 1701 (as in this instance the two stations are very near together it is best to extend the line as previously discussed in the plotting of drifts), place the protractor on the plan with the needle *I* pressed down through 1701 A, and then revolve until 204°40′ black, if line extending through backsight is used, or 204°40′ red, if the line extending from backsight through and beyond 1701 A is used; then move the scale *C* until 123° is indicated on *B*; then scale *D* until its graduated edge indicates 105.9 on the scale *C*; the needle *II* is then pressed down and a point marked on the surface of the paper. The vertical distance to be used later in the determination of the angle of dip, is read off on scale *D* and recorded opposite the station number to which it belongs. All the other points are plotted similarly, and the vertical distances recorded. The vertical distances above recorded have been read off from the protractor, and with a few exceptions will be found to agree with the calculated distances to 0.1 ft.; the exceptions to 0.2 ft. The points thus plotted for each survey are joined by right lines, inked in, thus showing the horizontal projection of the contour of the face of the stope for each survey (see Fig. 9). The freedom of the plan from pencil marks and lines is here noticeable; no erasures being necessary. As the data are not at hand and as the area stoped has no connection with the upper and lower drifts, they are not indicated on the plan of the stope shown in Fig. 9.

Before discussing the determination of dip it would, perhaps, be as well at this point to explain the use of the two sets of figures, red and black, on circle *A*. If, when plotting a stope, the line drawn through the backsight would place the protractor in a less convenient position to use, by extending the line in the opposite direction and without altering the horizontal angles as read, the red set of figures would be used and the plotting proceeded with as before. This has been done in the plotting of the stope above. Also, when making the underground survey, sometimes owing to the nature of the stope it is more convenient to read vernier II than vernier I; in this case the angle is recorded as read from vernier II and when plotting, if the line through the backsight is being used as the reference line, the red set of figures is used; if the line extending in the opposite direction, the black figures. And again it is sometimes necessary to transit the telescope to be enabled to read the vertical circle; in this case, if using the line through backsight vernier II would require the black, and vernier I the red, and if using the line extending in the opposite direction, vernier I black and vernier II red. The vertical angles would

have to be changed, depending on how the vertical circle was numbered and on the position of the vernier.

Assuming that the strike and the dip for the stope above plotted are uniform, no considerable error, considering the irregularities of the trend of the stope face, will be evidenced if it is assumed that the line of strike passes through a point in 17 on 1 East, Survey B, the elevation of which is the same as the elevation of a point in 17 on 1 West, Survey B. For this assumption the point 8b in 17 on 1 West, at a vertical distance 25.7 below horizontal axis of instrument and a point in 17 on 1 East halfway between points 7b and 8b the mean of whose vertical distances below the horizontal axis of the instrument is 25.7, and hence the elevation of the assumed point, will suffice. A line drawn through these two points is the line of strike which, while not the true line of strike, as will develop later, is near enough for practical purposes. At any convenient point draw a line at right angles to the line of strike; on this line project the points plotted; then lay off at right angles to this line from each projected point the vertical distance belonging to that point; join the points thus determined. The contour thus formed is the line of dip (see Fig. 9).

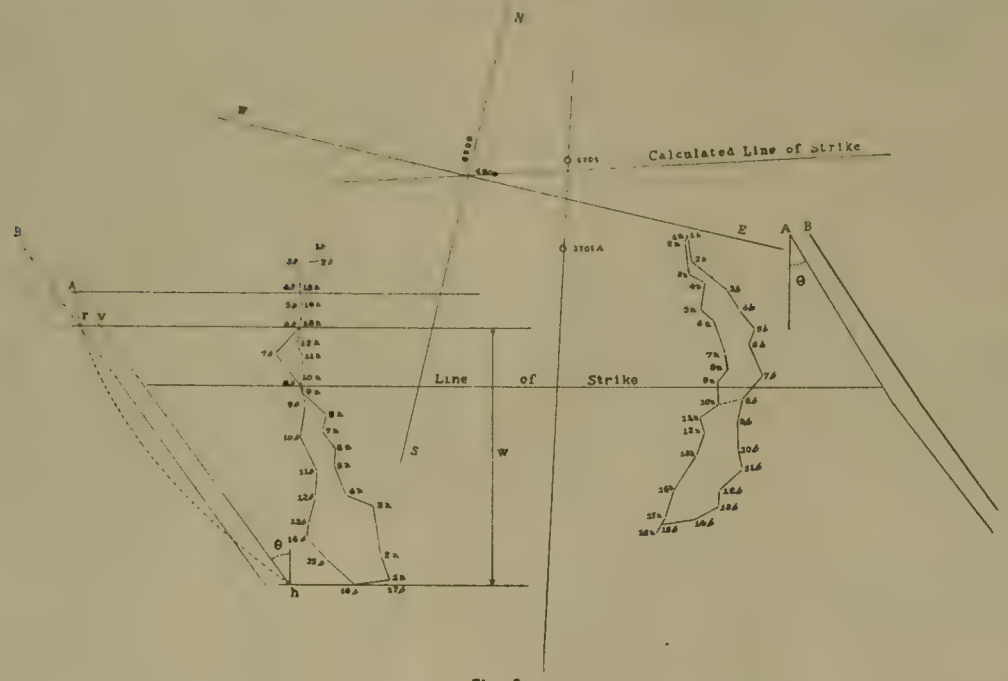


Fig. 9.

It is preferable to transfer the projected points to a separate paper, and lay off the distances thereon. Thus the dip-lines for each survey will not be confused with the stope-contours.

In the dip-contour of 17 on 1 East, Survey A, the points from 1a to 10a are practically on the same line of dip; at 10a the dip changes, and from 10a to 16a the points are on the same dip-line. In the dip-contour of 17, on 1 East, Survey B, the points from 1b to 8b are on the same line of dip; at 8b the dip changes and the points from 8b to 15b are on the same dip-line. The angles of dip are then taken off with a protractor and in the order mentioned above are 30° 30', 30° 00', 34° 30', 45° 00'. Draw a line from 10a to 8b, dividing the area into two parts. To determine the slope area of the upper one multiply the horizontal area by the secant of 42° 00' (the mean of the two dip-angles for that part of the stope) of the lower one, multiply by the secant of 35° 45' (the mean of the two dip-angles for that part of the stope). The sum is the slope area stoped. In the stope 17, on 1 West, Survey A, the points are practically on the same line of dip, which is determined to be 35° 45'. For Survey B the dip is found to be the same. The area is found as before. As the stoping surface in 17, on 1 East, is a warped surface, the more accurate method would be to find points in contour 17, on 1 East, Survey B, at the same elevation as those in contour 17, on 1 East, Survey A, assuming that the change of dip between any two consecutive points is uniform, and then draw lines through points of the same elevation. These lines will be the lines of strike at those points; then taking the mean of any two strike-lines as the line of strike for the area between those two lines and the mean dip as determined by projecting the points, and laying off vertical distances as before, the slope-area is determined for that part of the stope. The areas of the remainder of the stope are determined in the same way, and the sum of the whole is the area stoped. For small areas, and where the stope is slightly warped, the difference of area is inappreciable. If the stoping surface is considerably warped the difference of area is considerable, and an application of the preceding method, or one of the following, is necessary for a precise determination of the slope-area.

In the case where the line of strike is constant, and the dip variable, and hence the contour of the line of dip is a curved line, to find the slope-area plot the

stope as before, and upon determining the line of strike plot the dip-line, and either divide the horizontal area into several parts, taking the dip off the dip-line for each part, find the slope-area for each part, the sum of the several areas being the area of the whole; or find the horizontal area and the horizontal length of this area, measured at right angles to the line of strike, between the line of strike through the uppermost point of the horizontal area and the line of strike through the lowest point of the area; divide the area by the length, giving the average width of the horizontal area, multiply this by the length of the dip-line between the two dip-lines, giving the area stoped. For example in 17, on 1 West, draw the line of strike through 6b and 16b, measure the distance *W* between them, divide the horizontal area by this length, giving the average width, multiply this by the length of dip-line *vh*, giving the slope-area (see Fig. 9).

The line of strike and the angle of dip may be determined as follows: the co-ordinates of 1701 and 1701 A being

	X.	Y.	Z.
1701	6922.16	4891.28	1164.84
1701A	6925.89	4911.44	1178.67

then by calculation the co-ordinates of the points 2a, 3a, 12b, and 15b, in stope 17, on 1 West, are

	X.	Y.	Z.
2a	6900.88	4992.43	1235.32
3a	6896.41	4981.37	1226.92
12b	6882.62	4982.51	1224.92
15b	6888.40	4996.09	1235.72

Changing the origin of co-ordinates, to facilitate computations, to $x = 6880$, $y = 4980$, and $z = 1220$, the co-ordinates of the above points become:

	X.	Y.	Z.
2a	20.88	12.43	15.32
3a	16.41	1.37	6.92
12b	2.62	2.51	4.92
15b	8.40	16.09	15.72

Find the equation of the plane containing any three of the above points; then the intersection of this plane and any horizontal plane will be the line of strike, and the angle between the two planes the angle of dip. The general equation of the plane is $Ax + By + Cz = D$. First taking the points 3a, 12b, and 15b, substituting the values of x, y, and z in $Ax + By + Cz = D$, solving for B, C, and D, in terms of A, substituting the values thus found in $Ax + By + Cz = D$, the equation of the plane is found to be $x + 3.4802y - 4.9118z = -12.808$. Substituting $z = 0$, the equation of the line of stroke is $x + 3.4802 = -12.808$. Solving for y, $y = -x \div 3.4802 - 12.808 \div 3.4802$. Whence tangent $\Phi = 1 \div 3.4802$ $\Phi = -16°00'$. Hence the strike is N.74°00'E. The angle of dip is given by Cosine $\Theta = AA' + BB' + CC' \div (A + B + C)^{\frac{1}{2}}$ $(A^1 + B^1 + C^1)^{\frac{1}{2}}$; A, B, C, and A^1, B^1, C^1, being the coefficients of x, y, and z in the equation of the plane $x + 3.4802y - 4.9118z = -12.808$ and $z = 0$ respectively. Making the proper substitutions and solving, the angle of dip is found to be $\Theta = -36°24'$.

Again taking the points 2a, 3a, and 12b the equation of the plane is found to be $x + 3.37254y - 4.97265z = -13.27081$. Whence $\Phi = -16°31'$. Hence the strike is N.73°29'E. The mean strike is N.73°44'30" E. The angle of dip $\Theta = -35°17'$. The mean dip is 35°50', which is nearly in agreement with the angle of dip previously found.

The discrepancy in the two determinations of the angle of dip is due to the points sighted at being slightly above or below the true line of dip, thus causing a slight error in the vertical distances, which when introduced into the equation of the plane produces a slight difference in the coefficients of x, y, and z; this difference causing considerable difference in the determinations of Cos. Θ by the above formula. While a difference of half a foot in elevation is not very noticeable in the plotting of the dip-line, it is quite so when used in the above formula, as is evidenced by the discrepancy in the two angles of dip.

That the points sighted at must, to ensure accuracy, be chosen precisely half way between the hanging and foot-wall, or on the line of trend of the stoping face, is evident. If the points are carefully chosen then the probability is that they are all equally in error, and therefore the mean of two determinations should be taken as the true dip.

The direction of the line of strike is somewhat different from the one assumed, but not enough to cause an appreciable difference in the determination of the dip by plotting the vertical distances parallel to the assumed line of strike. This difference is explained by the fact that the east side of the stope dips less than the west side so that the point between 7b and 8b east side would at the same dip as the west side be higher up the stope; thus the assumed line of strike would have more nearly approached the calculated line of strike.

Another method of determining the dip, if the foot or hanging wall of the stope is of uniform dip, is by taking sights to three points on either hanging or foot-wall, two in one line on one side of the dip-line and one on the other side, reading the horizontal angles, the vertical angles, and the slope-distances.

The form of the notes and the formulae are as follows:

Inst..	Un.. B. Hor. angle.	B. S.. A. Ver. angle.	F. S., x_1, x_2, x_3. Sta. dist.	Ver. dist.	Hor. dist.
x_1	$\Phi_1°$	$\Theta_1°$	S_1	a	d
x_2	$\Phi_2°$	$\Theta_2°$	S_2	b	e
x_3	$\Phi_3°$	$\Theta_3°$	S_3	c	f

$\Phi_3 - \Phi_1 = 90°00'$. Bearing A to B $= \Theta°$. If $\Phi°$ is the angle made by the line of strike with the line x_1, x_2, then Tan. $\Phi = f(b - a) \div [e(c - a) - d(e - b)]$. Hence knowing Θ and Φ the bearing x_1, x_2 can be found and then the bearing of the line of strike. Tan. angle of dip $= (b - a) \div (e - d)$ Sin Θ.

As a practical example: bearing A to B S. 30°20'W.

	Hor. angle.	Ver. angle.	Sta. dist.				
x_1	175°40'	140°00'	17.0	a	13.0227	d	10.9273
x_2	175°40'	135°00'	31.5	b	22.2738	e	22.2738
x_3	85°40'	122°00'	36.0	c	19.0771	f	30.5297

Whence, bearing x to x is S.26°00'W. $\Phi = 59°01'$. Hence, bearing of line of strike is N.85°01'E.; and the angle of dip is 43°35'.

The slope-area may be found without either finding the angle of dip or the line of strike, as follows: divide the area into triangles as 1a, 2a, 16b; 2a, 16b,

15b, 2a, 15b, 14b, 2a, 3a, 14b, and so on (see Fig. 9, 17 on 1 West), then use the formula

Area $= \sqrt{s(s-a)(s-b)(s-c)}$, $s = \frac{1}{2}(a+b+c)$

$a = \sqrt{(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2}$

$b = \sqrt{(x_2-x_3)^2 + (y_2-y_3)^2 + (z_2-z_3)^2}$

$c = \sqrt{(x_3-x_1)^2 + (y_3-y_1)^2 + (z_3-z_1)^2}$

$x_1, y_1, z_1, x_2, y_2, z_2, x_3, y_3, z_3$

being the co-ordinates of the vertices of the triangles. The fault of this method is that it requires numerous calculations of co-ordinates, although the labor could be shortened by taking the co-ordinates of the points, as plotted with the 'plotting protractor', off the plan, and using the vertical distances given by the 'plotting protractor'

Stopes on a conical surface are plotted as before, the dip and slope-area determined, considering the stoping surface as plane, the error in so doing being inappreciable except when the radius of the base of the cone is small; in which case the surface may be developed according to the principles of descriptive geometry.

It will be noticed that the dip, as plotted, changes abruptly at 10a, 8b. Actually this is not the case, as there is no slip or fold at 10a, 8b. Probably the points between 1a and 10a, and 10a and 16a, have been chosen slightly below their true positions and hence the dip-lines are curved. The slight difference in the slope-area is inappreciable.

Sometimes, although the pay-streak or leader or vein being stoped, preserves its continuity, it may be carried near the hanging or the foot-wall at the time of one survey and at the next survey may be on the opposite wall. This would modify the strike, and hence the angle of dip and the slope-area stoped. In a case of this kind the points sighted at instead of being chosen half-way between the hanging and the foot-wall should be on the pay-streak or leader or vein, irrespective of its position in relation to the two walls. This is again modified in case the stope is on contract, depending on whether the contractor has strayed off the leader, or owing to a change in the walls has been ordered to change the position of the stoping face. If the contractor has erred, then the sights should be taken on the pay-streak or leader; if not, on points half-way between the hanging and foot-walls. In either case, the horizontal plane is the same, the slope-area only varying.

In the stope 17, on 1 East, the assumed line of strike has been used in the determination of the angle of dip. Perhaps a better plan would be to take a point 6a, and find the point at the same elevation between 4b and 5b, drawing a line through 6a and the point found, giving the line of strike, and then finding the dip; find the slope-area for that part of stope 1a, 10a, 8b; and also the point 13a; finding a point between 10b and 11b at same elevation as 13a, the line of strike and the angle of dip and slope-area as before of that part of stope 10a, 8b, 15b; the sum of the two areas thus found giving the area stoped.

In an earlier paragraph the method is discussed as though the line *rh* were a curved line, which is not the case. If the line were curved as *rh* (see dotted line, Fig. 9) the length of *rh* would be found with an opisometer, and the average width of the horizontal area, multiplied by the length found, giving the slope area

In the stope 17 on 1 for another successive survey the mean of the dip-line then found and the dip-line of the preceding survey would be the dip line to be used in finding the angle of dip and thence the area stoped. If the line of strike were altered in direction in the successive surveys then the vertical distances of the preceding survey should be laid off parallel to the new line of strike (from the projected points of the contour of the face of the stope at the preceding survey) on a line at right angles to the line of strike.

ORE DEPOSITS AT BULLFROG

A report on the geology and the ore deposits of the Bullfrog mining district, in Nye county, Nevada, by F. L. Ransome, W. H. Emmons, and G. H. Garrey has just been published by the United States Geological Survey as Bulletin 407. The district is a tract of arid hills and mountains lying northwest of the Amargosa desert and including about 21 sq. mi. The principal town is Rhyolite, which is 60 miles south-southeast of Goldfield and about 85 south-southeast of Tonopah. The other towns are Beatty and Bullfrog.

Long before valuable ores were discovered at Tonopah and Goldfield the springs in Oasis valley, just north of the site of Beatty, attracted a few wanderers, who established rude ranches along Amargosa river. In 1904 the Bullfrog claim was located. The name is said to have been suggested by the green color of the ore; certainly no one has found in that scorchingly arid region anything resembling a bullfrog. In a few months the towns of Amargosa City, Bonanza, Bullfrog, Beatty, and Rhyolite rose from the desert sands and mining was actively begun, but until 1907 only the richest ore was shipped from the region, for lack of satisfactory means of transportation. In 1907 three lines of railroad reached the district, and during that year the value of its mineral output was $207,538, principally in gold and silver.

The deposits of the Bullfrog district, unlike those at Goldfield, are not likely to yield quick and large profits with a moderate outlay of capital, though small masses of superficial ore may for some time reward a few fortunate lessees. The ores generally are of low grade and the question whether the deeper sulphide ores can be profitably mined is still unanswered.

The North American Lead Co. has a large reduction plant running on copper, nickel, and cobalt ore and is producing electrolytic copper and nickel and cobalt oxide. Great quantities of this ore are now known to exist in Missouri, and no doubt in the future this district will be a producer of these metals.

Alkaline tannates are efficient in boiler water treatment. They act by separating the alkaline earths in a light precipitate that remains in suspension and does not form scale. In their use there is not the danger of corrosion that may occur when tannic acid is used alone.

Southeast Missouri Mining

Written for the MINING AND SCIENTIFIC PRESS
By S. S. CLARKE

The lead, copper, nickel, and cobalt ores of southeastern Missouri are disseminated through the magnesian limestones of the Bonne Terre formation of the middle Cambrian period. The mineral zone follows the plane of the limestone bed overlying sandstone and granite. The ore is found principally in the bedding planes of the dark colored limestones, and disseminated in fine grains through the more porous limestone. Crystallized minerals are found in cavities and mud channels. A few instances have been noted where the ore has penetrated the sandstone several feet. In two headings of the Madison mine as the ore approached the granite rim of the basin (in which the mine is situated), the galena was replaced by iron pyrite. This gave way in turn to chalcopyrite and siegenite. At the mine of the North American Lead Co., galena has been almost entirely replaced by copper, nickel, and cobalt sulphides, which occur as chalcopyrite, siegenite (nickel linnaeite), and absolite. Lead occurs mainly as non-argentiferous galena. Some cerussite is found in the clay overlying the limestone. The depths of the shafts vary from 70 to 250 ft. Nearly all diamond-drill holes and shafts bottom on the sandstone. The ore is mined by underhand stopes, the height of the back varying from column high to 40 ft. Timbering is not required as the back is good and pillars are left from 20 to 25 ft. apart, depending on conditions of the ground. The ore is roughly sorted underground, about one ton of waste being sorted out for ten tons of ore. The average efficiency of the underground work is 21 tons broken per drill and 18 tons loaded per shoveler. At present the average wages are $1.80 per 8-hr. shift for machine men and shovelers. One-man drills are usually run on contract at 6c. per foot.

The general practice of milling followed is dry-crushing, using gyratory or Blake type of crushers, breaking to 1½ in., screening through revolving screens with ½-in. perforations, oversize to 14 by 36-in. steel-shell rolls. The product of the rolls and the undersize from the first screen are elevated to a 10-mm. (one section being 3-mm.) revolving screen; oversize goes to 14 by 30-in. Joplin type rolls and returns to feed; 10-mm. stock from screen goes to a vortex type of classifier, 3-mm. feed and overflow from classifier flows to trough hydraulic classifiers. The discharge from first classifier goes to a Hancock jig, the lead concentrate being discharged in the first hutch; a mixture of lead and copper; nickel and cobalt are discharged in the second hutch; and copper, nickel, and cobalt in the third. The product of the second hutch is re-ground and sent to the tables. If the lead predominates in the ore as sometimes it does, it is then necessary to re-grind the third hutch product; if the lead is low the second hutch product is usually clean enough to be classed as 'sulphide'. The 3-mm. stock is discharged from the hydraulic classifier into a two-compartment, 3-cell, Harz type of jig; the hutch products are similar to that of the Hancock. The middling from both sets of jigs is re-ground in Huntington mills or narrow-face high-speed rolls and then elevated to a series of spitzkasten; the overflow from the hydraulic classifier also passes to the spitzkasten; from here the feed passes to Overstrom and Wilfley tables. The table middling is re-ground in a Huntington mill and returned to the table feed.

At Mine Lamotte before any special attention was paid to the deposits of copper, nickel, and cobalt, the lead concentrate carried about 1.4% of these metals. The matte resulting from the smelting of the lead concentrate was calcined and fed into the furnace with another charge. The resulting matte was called second matte. This was again calcined and smelted in a small stack. Enough pig lead was recovered to pay for the handling of the matte. The resulting third matte ran from 8 to 10% Cu and 18 to 24% Ni and Co; this was barreled and shipped East. About six years ago the company began to mine ore richer in copper-nickel-cobalt ore. The mill then produced two kinds of concentrate: lead concentrate assaying about 68% Pb and 1.5 Cu, Ni, and Co, and a second called 'sulphide' which assayed 15% Pb, 2.5 Cu, and 3 NiCo. The ratio of cobalt to nickel is 1 to 1 in the ore. The 'sulphide' was roasted in a McDougall furnace and smelted in a small copula with roasted first matte from the lead-furnace. This second matte assayed about 25% Pb, 5 Cu, 8 Ni, and 5 Co. This matte was again roasted and smelted, some lead being extracted and the metallic content raised to 12% Cu and 30 NiCo. The matte was then dead roasted in hand calcines and ground to about 20 mesh, after which the matte was dissolved in earthenware digesting tubs with hydrochloric acid. The solution was then run into a tier of tanks, the iron precipitated by the addition of milk of lime, and the solution was filtered on a vacuum filter. The iron precipitate was returned to the blast-furnace. The solution was next pumped to another tier of tanks where the copper was precipitated by means of hydrogen sulphide gas. The gas was generated in three lead-lined gas generators of 150 cu. ft. capacity each. The iron sulphide was made by melting iron pyrite, iron borings, lathe turnings, etc., in a crucible furnace. Sulphuric acid was added to the generators with an acid pump. The spent acid from the generator was tapped into boiling tanks and the copperas crystallized out.

The copper sulphide was filtered and converted to an oxide in a hand calcining-furnace. The oxide was then dissolved in sulphuric acid and boiled to the proper degree Beaumé, and tapped into crystallizing tanks; the blue vitriol forming on a lead spider submerged in the tanks. The cobalt was next precipitated, using calcium hypo-chlorite as the precipitant. The precipitate was filtered, washed, then muffled and washed again. The finished oxide was then pulverized. The cobalt oxides averaged 68% cobalt. The nickel was next precipitated by adding milk of lime; the nickel hydrate was then washed and roasted to the black oxide of nickel, and either shipped in this form or reduced to shot nickel. This plant was shut down without fully demonstrating the practicability of the process.

Method of Specific Gravity Determination

Written for the Mining and Scientific Press
By A. C. Daft

The following method for the determination of the specific gravity of solids is so simple as almost to require apologies for its presentation. However, having mentioned it to several to whom its application is of value and having found it to be generally unknown, I, to whom the idea is original, venture to publish it, together with records of a few tests showing its accuracy.

The apparatus required consists of an ordinary pulp balance, weighing to the second or third decimal part of a gram, and a burette, or, preferably, a section of an old burette, 10 to 15 c.c. long, sealed at the lower end.

The method is as follows: weigh one or more pieces of the material to be tested, being sure that each is small enough to enter the burette; partly fill the burette with water and take its reading when as nearly in a vertical position as possible; place the weighed material in the burette, shake to free the adhering object from air-bubbles, and read again. The difference in the burette readings is the volume of the material, and the weight, in grams, divided by this volume, is the specific gravity. The temperature and purity of the water used do not affect the accuracy of the result.

For the determination of the specific gravity of middling, and other crushed products of concentration, a convenient modification of the method is to weigh about 10 gm. of the material and slowly add a part to the water in the burette until its reading has been increased by exactly one cubic centimetre, then weigh the portion remaining, and the difference in weight is the specific gravity.

In testing the accuracy of the method a few pieces of the following minerals and rocks were used: albite, apatite, chalcocite, fluorite, and obsidian. These were weighed, to the third place of decimals, in air and in water, dried, and the volume determined by burette readings. For obtaining the weights in water a small porcelain crucible was suspended by a loop and two wires of platinum in a beaker of distilled water which, in turn, was supported on a bridge over the left-hand balance-pan. Having balanced it with the crucible in water, the minerals were added and weighed in a continuous series, and the individual weights obtained by subtraction. For the purpose of better comparing the accuracy of the method the same pieces were determined by the Eimer & Amend 'universal hydrometer'. A tabulation of the determinations and results follows:

DETERMINATIONS—EXPERIMENTAL DATA.

Material.	Weight in air, gm.	Weight in water, gm.	Volume by loss in water, c.c.	Volume by burette, c.c.
Albite	2.619	1.603	1.016	0.99
Apatite	2.819	1.932	0.887	0.90
Chalcocite ..	2.234	1.840	0.394	0.40
Fluorite	1.769	1.214	0.555	0.56
Obsidian ...	1.614	0.931	0.683	0.69

RESULTS.

Material.	Specific gravity: By weight	By burette	By hydrometer	According to Dana	Phillips
Albite	2.63	2.58	2.58	2.624	
Apatite	3.13	3.18	3.04	3.091	3.217
Chalcocite	5.59	5.67	5.52	5.5	5.6
Fluorite	3.16	3.19	3.20	3.01	3.25
Obsidian	2.34	2.36	2.34	2.3	2.7

STEEL FORMS FOR SHAFT LINING

Steel forms for shaft lining have been used in sinking the Brier Hill shaft in northern Michigan and are described in a paper by William Kelly before the Lake Superior Mining Institute. The shaft is vertical, 14 ft. diam., and has horizontal steel sets, 10 ft. 8 in. apart, to support the cage and skip guides, the ladder, and the pipes. The forms are $\frac{1}{8}$-in. steel plate with bracing of angles to retain the circular shape. They are 5 ft. 4 in. high, and each circle is made in four segments. At two of the joints between segments are blocks to give space for collapsing the circle. Two rings of forms are used. After the excavation has been carried deep enough to allow three or four steel sets to be placed, supports are inserted in hitches in the rock wall and a platform built on them. A ring of forms is set on the platform, displacing boxes placed at intervals around the bottom, and the form filled with concrete. When the concrete has set the form is collapsed, hoisted, and hung from the lowest steel set of the completed shaft above. A steel set is then placed in pockets left in the top of the new concrete, the ring of forms lowered on it, the next ring placed and filled. The forms are raised when the concrete has set, another steel set placed, and the work thus continued. The closing ring of concrete between the new and older work above is placed through the holes left in the bottom of the concrete work by displacement boxes. A 10-ft. 8-in. ring can be concreted in an 8-hr. shift, and 12 hr. is sufficient for the concrete to set, so that it is possible to pour this height and place the steel in considerably less than two days. The excavation was facilitated by sinking a 6 by 8-ft. shaft first, and working upward from all the intersected levels of the old mine. The best record for enlarging and concreting was 69.3 ft. per month, made in two successive months. At that time eleven 10-hr. shifts were working per week. Each shift for excavating and concreting consisted of six men.

Aside from gold and silver, the chief minerals known to occur and mined in New Zealand are mercury (cinnabar), platinum, nickel, lead, tin, zinc, antimony, arsenic, manganese, chromium, osmium, iridium, tellurium, titanium, tungsten, and petroleum. The last-named is being worked by small companies in Taranaki and at Kotuku, in Westland, while tungsten is found as scheelite in considerable quantity in Otago. The available ore in the two veins being worked is estimated at 60,000 tons. It is being shipped to Europe, where it is used for the manufacture of high-grade steels. The export for 1907 totaled 137 tons, valued at £15,486.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Vacuum Filters at Pachuca

The Editor:

Sir—We beg to call your attention to the special correspondence from Mexico in your issue of March 12, and to correct several statements made therein. In mentioning the equipment ordered by the Palmilla Milling Co. at Parral for the 250-ton unit of the new plant your correspondent omitted the 180-leaf Butters filter plant. At the Dos Estrellas mine the Butters filter plant which is nearing completion, consists of 300 leaves and is calculated to handle 600 to 800 tons of dry slime daily and not 100 tons as stated. E. H. GARTHWAITE.

San Francisco, March 26.

High Priests and Promotion

The Editor:

Sir—Lately a lot of stress has been laid upon 'Professional Ethics', 'Qualified Mining Engineer', 'The M. E. Degree', and similar topics in several mining journals. There are also read addresses by the 'high priests' of the profession advising investors. I am not qualified as a writer, neither have I time nor inclination to enter an active discussion in this matter, yet I wish to protest against the injustice done to those who honestly and quietly work at the front developing new ground, blazing new trails, and emphatically to protest against the undue advertisement others receive through these articles. Our friends seem to favor a close corporation chosen by themselves to determine who is and is not qualified to report on or develop a mine. It seems to me time to call down these press bureau engineers who have been advertised to the top notch, and used to gull the public. The Newhouse mine at Cactus may be cited as an instance in point. It was reported on by an engineer sent out by the New York Stock Exchange. The stock went to $30, one dividend was paid; the rest is familiar history. Greenwater and Montgomery-Shoshone, vouched for by those who had berths at 71 Broadway, may also be cited. Nipissing and many others may be recalled to advantage. James Phillips, Jr., openly accuses some of these engineers of not only bad faith and misrepresentation, but actual neglect and dishonesty. They have not defended themselves. Perhaps they consider it beneath their dignity to defend their honor as mining engineers. Some of these gentlemen are advertised like Hammerstein's 'Song Birds'—so much per night. The churn-drill properties some are now vouching for may warrant a question or two. The game has been played so well that the copper stocks are selling at par, and some above. In the strict sense, Tom Walsh, Tom Kearns, W. A. Clark, Marcus Daly, W. S. Stratton, the Comstock pioneers, it would cover the history of mining to mention them all, including the South Africans, were neither capitalists nor mining engineers, yet they made good. I, for one, am sick and tired of, and have the utmost contempt for the engineer who allows himself to be advertised and exploited. A short time ago a prominent E. M. saw the powers that be, fixed the president for the merger—so the press agents told us—and as a result Amalgamated was put to $95 and Utah Copper to $66. Today they are $20 or more below these figures. The confiding public is paying interest on the stuff in the bag, and the Morganheims are in Europe buying works of art, while a new crop grows. I do not care to get in print, but this may be a subject of interest to many of your subscribers who do not dwell in the shadow of Wall street, Broad street, or lower Broadway. I believe $100 has been filched from the confiding public through these immaculate high priests, where one dollar has been lost by petty mining schemes and irresponsible promotions.

JOHN G. WORTH.

Reno, Nevada, March 28.

Bureau of Mines

The Editor:

Sir—It will probably interest your readers to know that the long-continued effort on the part of those concerned in the development of the mining industry of the United States to secure the establishment of a Bureau of Mines by the Government, is likely to prove successful in the near future. A very satisfactory bill has been passed by the House of Representatives and has been favorably reported by the Senate committee on mines. In the discussion which has arisen concerning the expediency of such a measure, certain objections have been stated which I should like to meet.

One of the arguments advanced in opposition to the establishment of the proposed Bureau is that it might duplicate the work of the Geological Survey, thus producing friction that might seriously affect the usefulness of one or both organizations. It is hard to see how such a duplication of work could possibly occur if the Bureau should be established under the provisions of the Huff bill now pending; for if this bill be adopted, the Geological Survey and the Bureau of Mines will be co-ordinate branches of the Government service under the direction of the Secretary of the Interior. Any man competent to fill this position may reasonably be counted upon to prevent any duplication of work, and to stimulate them to co-operate without friction, in their efforts to serve the public. If it were proposed to have the two organizations under separate cabinet officers, such an argument might have weight; but when two co-ordinate branches of one department are under the direction of its head, such a contingency seems to be likely only when that official is grossly incompetent and inefficient. In that case, any plan of organization would break down even if both duties were in charge of a single bureau. In order to show that the apprehended danger is not real, it is only necessary to call attention to the fact that the above arguments might be urged much more strongly against the present organization of the army and navy, which happen to be in charge of different cabinet officers. These organizations have been able to co-operate in the defense of our country very

efficiently, even though they are under the direction of separate secretaries. The work of the Geological Survey and that of the proposed Bureau of Mines, though bearing on the same general subject, are as different in their details as is the work of the army and of the navy of the United States. The Huff bill, while recognizing their separation, places them both under the direction of the same cabinet officer.

Another objection which I have seen urged is that "a scientific organization like the Geological Survey must of necessity have a highly trained staff, the same cannot be said of a Bureau of Mines." It is agreed that the first clause of the quotation is correct, but I do not know any reason why the members of the staff of a Bureau of Mines should not be equally highly trained specialists. I understand it is proposed that they should be. Men who have had the training of mining engineers ought to be at least as thoroughly trained and efficient for their work as are the assistants on the staff of the Geological Survey; and it is to be hoped that no others would be employed in the Bureau of Mines.

Another objection advanced is that it would be impossible to obtain the services of competent engineers for the salaries to be paid by the Bureau of Mines. This is really another form of the same argument. I should be much surprised if there were not many competent engineers in America who are as unselfishly devoted to the development of the mining resources of their country, and who take the same self-sacrificing interest in this great work, as has been taken by the members of the staff of the Geological Survey in theirs. I cannot bring myself to believe that the mining engineers of the United States are as a body, less efficient and more mercenary than the members of the staff of the Geological Survey. I feel sure that there are among them many men of the highest ability who would welcome such an opportunity to do genuine scientific work of a high order, which may lead to the wise conservation of the mineral resources of the country, to the saving of the lives of many miners, hundreds of whom are killed every year by avoidable accidents in the development of these resources—they would welcome an opportunity to do such work even at the sacrifice of large professional emoluments.

It has further been assumed that the new Bureau would be bound to come under political influence. The same argument was advanced when the establishment of the United States Geological Survey was proposed; but it has an honorable record, and has proved that it is possible for a Government organization to render efficient service independent of political influence. I see no reason why one bureau should be more subject to such influences than the other. The objectors should read the address of George S. Rice, at present employed by the Technological branch of the Geological Survey, printed in Bulletin No. 20 of the Mining & Metallurgical Society of America. He answers many objections which have been urged against the establishment of a Bureau of Mines.

I wish further to call attention to the fact that a number of interesting subjects of investigation aside from the main purpose of the United States Geological Survey, have grown up under its wing until it was found necessary for convenient administration, to transfer them to some other agency. For examples, I might mention the ethnological investigations, which were for many years the hobby of the late J. W. Powell, long Director of the Geological Survey. Experience has shown that they could be best administered under other auspices and they were consequently transferred. The Reclamation Service was also for a long time part of the work of the Survey; and I have it from the present Director and from many of its members that the administration of this Service was found to be so different from that of the proper work of the Survey that it became necessary to transfer its administration to a separate organization. The point was that the engineering work of the Reclamation Service, dealing with large masses of materials and large groups of workingmen, required men whose training was quite different from that suited to the purely scientific work of the Survey. The same thing is true of the present Technological branch of the Geological Survey which has grown up under its charge. The investigations already undertaken have to deal with the economical use of fuels, coal, coke, oil, gas, and other mineral materials; with the safety of miners underground; with explosives, blasting, and firedamp; all of which require men of engineering training and practical experience in mining. It is hard to find such men among those whose training has been that of the geologist only.

If a new Bureau be created as provided by the Huff bill, the Geological Survey and the Bureau of Mines will be of equal rank and each under competent supervision; they will both be under the direction of the Secretary of the Interior, and there ought to be no trouble in getting them to co-operate for the good of the country; and being separate, each will be more efficient. They could co-operate when it was necessary and work independently when it was not. Many of the bills first introduced in Congress were crude, and some would have seriously hampered the work of the Geological Survey. These were properly opposed by its friends of whom I am most emphatically one. The present bill is without these offensive provisions. I am sure that no mistake would be made in creating such a Bureau, but there are two things concerning which care should be exercised: (1) the work of the Bureau should be for the benefit of the whole public, not for private or personal interests. It should undertake only such investigations as are too large for an individual or a corporation to carry out, and should not concern itself with problems properly belonging to the initiative of the individual engineer. (2) It is of prime importance that if this Bureau be created it should have at its head a thoroughly trained mining engineer, whose character and attainments shall command the confidence of the entire country.

I suggest that to aid in the passage of the bill, all your readers who are in favor of this bill should put themselves on record with the Congressmen of their States, and show that the mining public is behind the measure.

SAMUEL B. CHRISTY.

Berkeley, California, March 24.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Tamping drill-holes in coal mines with drill dust, slack coal, or other inflammable material is forbidden in European coal-producing countries, it having been found that gas and coal-dust explosions are more likely to occur when such materials are used. The laws of Great Britain compel the use of clay or like substance for tamping. The material is delivered to the miner near the working place.

Edison's recently tested storage-battery car ran fifteen miles an hour loaded. The battery consists of 200 cells placed under the seats. The car can be run for 150 miles on one charge, which it takes four hours to complete. On an experimental track the car was run at a cost of 8 mills per mile, while that of the trolley car is about 5c. It is not expected that the cost will go over 2c. per mile for the storage-battery car, even under most unfavorable conditions. It costs about $6000, as against $10,000 for a trolley car.

Mining ranks second only to agriculture among the foundation industries of the country. It now contributes over $2,000,000,000 annually to the national wealth, as compared with $7,500,000,000 from agriculture; but it contributes 65% of the freight traffic of the country, as compared to 8½% from agriculture. Its manufactured products in 1907 amounted to a total of $4,318,598,661, and the wages paid to the men engaged in such manufacture amounted to $863,558,487, as against $735,101,760 paid to those engaged in agriculture.

Diamond-drill holes in loose ground may often be saved by cementing. For this purpose neat cement should be used mixed at the hole in small quantities just thin enough to pour into the hole. Put in enough to fill the hole about one foot and then tamp carefully with a blind bit turning the latter slowly until it begins to stick. The rods should then be promptly withdrawn and another lot of cement poured in. When the bad ground is passed the cement should be allowed to set twenty-four hours after which it can be drilled through as though it were hard rock.

Lime is added in cyanidation both to correct acidity and to induce settling of slime. The latter is accomplished by altering the surface tension of the solution. Best results are attained when the lime is slacked hour by hour as needed and mixed as the pulp goes from the plates or concentrates to the vats. If lime be fed into the battery the screens become clogged, the concentrating tables are coated and a much larger quantity is used. A good method is to shovel the lime into a box or half barrel, let it slack, transfer it to a water box where a small air jet keeps it in agitation and from which an overflow of water carries the milk of lime into the launders.

A comet's tail, according to W. H. Pickering, in the *Century*, is composed of gas, existing in a highly rarified condition. Little particles of electricity called corpuscles, or ions, are being constantly given off at enormous speed by the sun. Each meteorite in the comet's head is surrounded by its own rarified atmosphere. When one of these little ions strikes one of the molecules of gas in the comet's atmosphere, it carries it off with it to form the tail. The electrical charge makes the gas luminous, and it is by this light, and not by reflected sunlight, that the tail is made visible. A comet's tail, therefore, seems to be merely a very extended aurora.

Selenium is a non-metallic element, with characteristics similar to phosphorus, sulphur, and tellurium. It occurs in meteoric iron and in rare metals. Though universally distributed, selenium occurs only in small quantities. The chief interest in it is in the fact that light has a powerful influence on its capacity for conductivity of electricity. This fact was not discovered until as late as 1873, when Willoughby Smith communicated the fact to the Society of Telegraphic Engineers of London. Earl Ross substantiated Smith's statements by a series of spectroscopic experiments. These conclusively established the fact that light, and light alone, is the active agent in this peculiar change of conductivity.

Coal deposits on public lands are burning in a number of the Western States. There have been a number of coal beds on fire in northwestern Colorado coalfields, and a large part of the Yampa coalfields in Routt county, and also in the coalfields of Rio Blanca, Mesa, Garfield, and Pitkin counties. Coal beds are now burning on a large scale near Newcatle and at a number of other points in Colorado. On Grand Hogback mine fires are burning valuable beds of coal, and at Newcastle the coalfields contain an aggregate thickness of 108 ft. of coal, of which a single bed of coal now on fire ranges from 40 to 50 ft., this fire having started in a mine belonging to a private company and now extending to lands belonging to the Government.

Claimants for mineral ground when proceeding to patent should select some deputy mineral surveyor to make the survey and make arrangements for the work. The claimant then applies to the surveyor-general for the district in which the claim is situated, asking that an official order be issued directing the deputy to survey the claim. This application is accompanied by a certified copy of the location notice of the mine, and a certificate of deposit for $30 issued by a sub-treasurer of the United States depository authorized to accept such deposits. The applicant in making the deposit should give the name of the owner. The deposit is for the purpose of paying for work in the surveyor-general's office. Upon receipt of the application, the surveyor-general issues an order and forwards it to the deputy, who makes the survey in accordance with the instructions furnished by the department, and makes returns to the surveyor-general. In due time there is forwarded to the claimant a copy of the field notes of the surveyor, and two copies of the official plat. The claimant then prepares his application papers.

Special Correspondence

MEXICO

San Juan, Tavicho —Naica District, Chihuahua —San Bernardo, Zacatecas —Real del Monte. — Elmore Process in Mexico.— El Oro District.

The Supreme Court of Mexico has just added a chapter to the litigation over the rich San Juan mine in the Tavicho district of Oaxaca by affirming the decision of the Second Federal District Court which recently returned the property to the possession of the San Juan Mining Co., an American concern. The company lost possession of the mine to Juan Baigts, the former Mexican owner, through the action of an Oaxaca court in January, 1908, and on November 19 last, the case was reopened by an appeal to the Federal District Court, it being alleged that the company was never properly served, that many other errors were made, and that the judgment was secured by default. While there is nothing in the decision of the Supreme Court that prevents Baigts from again instituting proceedings for the possession of the mine, it shows that the highest court of the Republic will not allow individuals or corporations to be deprived of property without a full hearing, and is accordingly gratifying to foreigners and foreign companies interested in the mining industry in Mexico.

It is announced from the headquarters of the Compañía Minera de Naica at San Pedro, Coahuila, that an option on the company's San Pedro and other mines in the Naica district of Chihuahua has been given American interests. The price is stated to be ₱6,000,000, with a deposit of ₱50,000, which will be forfeited if the purchase is not made. The Naica is the concern that has plans for a smelter to cost ₱1,000,000 at Concho, a station on the main line of the National Railways. The company was organized with a capital of ₱30,000, divided into 100 shares of a par value of ₱300 each, and the option price represents an increase to ₱60,000. This Mexican concern has had an extraordinary record, and is one of the big dividend payers of the Republic. The building of the Terrazas-Madera link of the Mexico Northwestern railroad is resulting in some activity in the old Guaynopa district, which will be benefited by the new line. The Tres Amigos Gold Mining Co. has resumed work and is doing extensive development. Luis Terrazas, Jr., Charles Seawell, and J. W. Clayton, all of Chihuahua, recently secured a concession for a smelter in the Guaynopa district, and may dispose of it to foreign interests. Opportunities for hydro-electric installation exist in that section of Chihuahua. The Candelaria Mining Co., operating the Candelaria, Congreso, and other mines at San Pedro, in northern Chihuahua, is installing a concentrating plant. Shipments of ore to the El Paso smelter now range from 100 to 150 tons per day. The company has one of the largest mine pumping plants on the continent. The Rio Plata Mining Co. has just paid its second quarterly dividend. The rate was 2%, an increase of 0.5% over the first dividend.

The San Bernabé mine in the Zacatecas district of Zacatecas, the oldest mine in that section of Mexico, has been taken under a working option by a company subsidiary to the British-Mexican Development Co., of London. The mine will be unwatered, new development work commenced, and an experimental reduction-plant erected. The San Bernabé was opened in 1584, and it has a recorded production of many millions. The San Carlos Gold Mines, Ltd., of London, which was recently reorganized and new capital provided for operations, will resume milling at its properties in the Mezquital del Oro district of Zacatecas. The old 50-stamp mill and cyanide plant are being overhauled, and it is expected to handle from 4000 to 4500 tons per month.

The Real del Monte y Pachuca Co. reports an output of 12 tons of silver bullion in the month of February. The bullion production of the Pachuca district is increasing steadily, and is now close to 30 tons per month. The district is at present suffering from a scarcity of power, and little relief can be expected until the transmission line of the Mexican Light & Power Co. for the delivery of Necaxa power is completed, in June or July. New equipment recently installed at the San Francisco custom reduction works will be soon in commission. It consists of 20 stamps, 8 concentrators, 2 tube mills, 3 Pachuca tanks and a Moore filter. Preparations are being made for further additions. Rich ore has been found in the lowest workings of the Sorpresa mine of the San Rafael y Anexas Co. The company continues to pay big dividends regularly. In the Argentina mine at El Chico, Hidalgo, ore assaying as high as 1½ kg silver and 300 gm gold has been opened. H. T. Oliver is in charge of the property for the Argentina Mining Co. A. E. Lafrancoso, a mining engineer representing English capital, has bought the Union mine west of Real del Monte. It adjoins the old Cruz de Todos Santos property.

The mines and small reduction plant of the Beryl Gold Mining Co., of San Diego, in the San Andrés district of Lower California, are under option to English interests, and the mines are being examined. The ore in sight is estimated at 75,000 tons. Patrick Burns, the wealthy British Columbian packer, is investing in copper properties in Lower California. The mines purchased are said to include those of the Julius Caesar Copper Mining Co., which suspended operation some time ago. The Peninsula Onyx Co., operating in Lower California, sold $137,000 worth of onyx in the United States last year. It is stated that this year's sales will exceed that amount.

The Magistral Ameca Copper Co., of the Ameca district of Jalisco, will be the first in Mexico to use the Elmore flotation process in the treatment of copper ores. The first Elmore plant in Mexico was recently installed in the Parral district of Chihuahua by the American Zinc Extraction Co., for the treatment of zinc ores. Jigs and tables are expected to save 60% of the mineral in the Magistral ores, and working tests have shown a total extraction of 92% by the Elmore process. Delays in the arrival of machinery will make it impossible to have the 100-ton plant ready for operation before May 1. The Chapala Hydro-Electric & Irrigation Co. will extend its Etzatlán transmission line into the Ameca district of Jalisco, and supply mining concerns there.

Official figures show that the four big concerns of the El Oro district of the State of Mexico, the Dos Estrellas, El Oro Mining & Railway Co., Esperanza & Mexico Mines of El Oro, milled 922,766 tons of ore in 1909 and spent ₱749,934 in permanent improvements. The total production of the four concerns is given at ₱20,242,351, and the profits at ₱9,062,583. The profits were divided as follows: Dos Estrellas, ₱4,227,235; El Oro Mining & Railway, ₱1,828,760; Esperanza, ₱1,515,828; Mexico Mines, ₱1,490,760.

KALGOORLIE, WESTERN AUSTRALIA

Development and Production in January. — Perseverance Mill.

The gold yield of this State in January was valued at $2,632,320, being a decrease of $101,900 with the same period of 1909; but the temporary stoppage of the Perseverance, and the low returns from the Associated and Associated Northern account for this drop. The lode in the Great Boulder at 2500 ft. has been driven on for 700 ft. averaging $15 per ton. The Main shaft is down 2660 ft., and Edwards' 2600 ft. Sinking is proceeding, and the mine at the above depth is very satisfactory. The Kalgurli has been looking a little better of late, and at 1650 ft. the crosscut in the south drift shows 5 ft. of ore worth $14, and a farther 6 ft. worth $4. The Associated publishes its ore reserves as 465,525 tons, worth $7.50 per ton, and the Golden Horseshoe, 1,078,638 tons at $11 per ton. The former has a lot of low-grade ore of late, and returns are low. The mill may be increased by two No. 8 Krupp mills, and a couple of Edwards' duplex roasters, two of the latter being at work roasting over 80 tons daily each. The Horseshoe is increasing its mill to equal 200 head of heavy stamps, and also installing a low-pressure turbo-generator of some 750-kw. capacity. The Perseverance management is hurrying with its new milling department to replace that portion burnt. The eight No. 8 Krupp mills are now

arriving. The foundations for these and the ore-bins are well under way, and the place presents a busy scene. The mill has only treated 19,000 tons monthly so far, but an increase may be expected. Ball-mills require some careful attention on these ores, to get the maximum efficiency. The January returns from the large producers were as below:

Name.	Tonnage.	Value.	Profit.	Dividend.
Associated	11,616	$ 78,000	$ 4,200	.....
Associated North'n Blk.	3,132	21,000	2,000	$87,000
Chaffers	4,143	27,000	1,000	.....
Golden Horseshoe	24,892	139,000c	13,000	375,000
Golden Ridge	2,219	28,000	14,000	.....
Gt. Boulder Proprietary	17,862	250,000	136,000	.....
Great Fingall	10,339	75,000	10,000	.....
Hainault	5,894	40,000	7,500	.....
Ivanhoe	19,642	205,000	100,000	250,000
Kalgurli	10,810	138,000	76,000	185,000
Lake View Consols	11,347	77,000	12,000	.....
Oroyo-Brownhill	22,371a	31,000	14,000	.....
Oroya-Black Range	4,457	44,000	9,000	.....
Oroya-Links	11,392b	76,000	11,000	.....
Sons of Gwalia	13,522	115,000	50,000	.....
South Kalgurli	9,040	62,000	14,000	.....

a. Only retreatment of old dumps by the vacuum process.
b. The initial return from the new amalgamation.
c. A drop of $110,000.

TORONTO, CANADA

Cobalt Dividends.— Power. — Stock Market. — Ore-Stealing. — Mining Labors and Federal Jurisdiction.

Cobalt has certainly made a good showing for the first quarter of the year in the matter of dividends. So far eight companies have declared $2,277,961. This is additional to the profits of close corporations like the O'Brien and Drummond, and the payments in royalties to the Provincial Government. The largest payments are Nipissing, $900,000; Crown Reserve, $530,644; La Rose, $300,000; and Kerr Lake, $300,000. The highest rate paid is by Crown Reserve, being 12% dividend with an 18% bonus. The Haileybury Silver Co. figures in the list with a payment of $25,000, being 50% on its small capitalization, but the money comes not from ore production but from the sale of one of their properties. The Coniagas has passed its dividend, owing to the cost of putting the smelter at Thorold, Ontario, on a sound economical basis. Recently about seven tons of silver was shipped to England.

Rapid progress is being made in the installation of electric power at Cobalt. The sub-stations in connection with the Mines Power Co. are receiving the full load of 44,000 volts over the transmission lines from the Matabitchowan river, and plants and mills aggregating 1775 hp. are now connected with the system. These include the Nova Scotia mill, Silver Cliff, O'Brien, Northern Customs concentrator, McKinley-Darragh, and Bailey.

The stock market continues in the main quiet, with operations limited, owing to lack of public interest, but improved mining conditions are having some effect upon the lower priced issues, which are gradually advancing. The most noticeable feature has been the heavy demand for Cobalt Lake followed by a steady rise in price consequent upon the decision of the directors to reduce the capitalization from $5,000,000 to $3,500,000 by buying in and canceling stock. The long-pending action of the Florence Mining Co. against the Cobalt Lake Co., claiming the property on the ground of previous discovery, has been finally settled by the decision of the Imperial Privy Council, to which an appeal was taken, confirming the judgment of the Ontario courts dismissing the action. The main issue was whether the Ontario Legislature had power by special legislation to confirm a title and stay litigation proceedings. This much disputed question is now definitely settled in the affirmative, and the decision will affect more important interests than those involved in this particular case, as the same question has since arisen in connection with the Provincial Government's hydro-electric scheme, several lawsuits having been stayed by the fiat of the legislation.

This week several cases of ore-stealing arising out of the discovery some months since of a wholesale system of thievery by which the Cobalt mines have been robbed of large amounts, were brought to trial in Toronto. The results so far have not been such as to encourage the hope that the existing machinery of legislation is sufficient to check the practice. Three prisoners were put on trial charged with selling ore without the authority of the mine-owner. The defence set up was that the prisoners did not sell the ore, but the silver, the transaction not being completed until the metal was refined, and that the act did not touch the sale of 'silver'. In two cases the juries disagreed, the third, a verdict of 'guilty' was returned against George Barber. The prisoner's counsel asked for the submission of a stated case to the High Court for the decision of the point raised. This was granted and the remainder of the cases traversed to the next court.

The unsatisfactory and confusing condition of the mining laws of Canada relating to those districts that remain under Federal control, as distinct from the jurisdiction of the Provinces, has long demanded attention. The matter was brought to the notice of the Dominion Government this week, when a strong deputation from the Canadian Mining Institute waited on Sir Wilfrid Laurier, the Premier, and Hon. William Templeman, Minister of Mines at Ottawa. Among the changes sought was the placing of the issuing of mining titles, and the administration of mining laws in the hands of the Department of Mines, and the consolidation of the mining laws. The Premier intimated that these recommendations would be carried into effect. The work of consolidating the mining laws has been entrusted to a sub-committee of the House of Commons Committee on Mines, who in drafting the measure will consult with representative mining men. The bill will be submitted to Parliament next session.

WASHINGTON

Pinchot-Ballinger Inquiry.—Alaskan Coal and Oil Lands.—Conservation Legislation.—Bureau of Mines.

Among recent witnesses before the joint committee investigating the Pinchot-Ballinger controversy were Stephen D. Birch, managing director of the Morgan-Guggenheim Syndicate of Alaska, and John N. Steele, its attorney. Mr. Birch said he first saw Clarence Cunningham in connection with his Alaskan claims at Seattle early in April 1907. In August of the same year, the Guggenheims notified Mr. Cunningham that they had been advised by counsel not to purchase the claims in their incompleted state, and requested that the patents be hurried. He replied that the issuance of patents was a matter that rested with the convenience of the Government. Mr. Brandeis read a telegram from Daniel Guggenheim to Clarence Cunningham dated December 7, 1907, "finally accepting the proposition made in the memorandum agreement of July 20" by Cunningham, Moore, and Campbell on behalf of themselves and their associates. A letter from Mr. Cunningham acknowledging receipt of the telegram also was put in evidence. Mr. Brandeis was about to question Mr. Birch concerning the report of the expert sent by the Guggenheims to examine the Cunningham coal claims when Mr. Steele protested against making the report public, it being a private matter. He was willing to let the committee have the report in confidence, and this was agreed to. Mr. Birch testified that the Guggenheims had projected a railroad from Katalla to the coal lands. Later they changed their plans to build from Cordova to the copper fields. When Mr. Cunningham heard of this change early in 1908, he told Mr. Birch that the agreement had been violated, that it was no longer binding, and would not be lived up to. The witness said he did not consider the change of plans a violation of the agreement, for, as a matter of fact, the Cunningham claimants had done nothing on their side of the contract.

The nine so-called conservation bills, which contemplate a complete overhauling of the land laws of the country, are still resting on the calendar of the Senate. They are reached from day to day, but are always put over on the ground that Mr. Nelson of Minnesota, in charge of the bills, is busy with the Pinchot-Ballinger inquiry Many Sena-

tors are beginning to question whether anything will be done with these measures during this term of Congress. Meanwhile individual members continue to introduce additional bills. Herbert Parsons, Representative from New York, has added to the general interest by introducing a joint resolution calling upon the Secretary of the Interior to inform Congress whether he has any reports on the public land laws of foreign countries relating to the disposal of such lands and the deposits therein, by lease rather than by grant, and to disposal of the surface as distinguished from the deposits, and the development and practical workings of such laws. James W. Good, Representative from Cedar Rapids, Iowa, has introduced a bill providing for leasing the coal and oil lands of Alaska to the persons agreeing to pay the largest amount of royalty. Sylvester C. Smith, Representative from Bakersfield, California, has a bill proposing to classify all the public lands. The measure provides that such lands, when classified, shall be disposed of in accordance with existing laws. A proviso states that where lands are classified as containing mineral substances the surface may also be given separate classification according to its chief value and proper use. He also would have the general mining laws of the United States applicable to all lands containing valuable mineral deposits, irrespective of the classification under this act, upon proof of the existence of such valuable minerals therein. That many of the functions of conservation popularly ascribed to the Federal Government belong to the States is the belief of many members of Congress. Wesley L. Jones, Senator from Washington, evidently shares such a belief, for he has introduced a bill providing that all sites for use in connection with the development of water-power shall not be subject to entry or disposition under any of the public land laws of the United States, but at the request of the States shall be turned over to them; provided the laws of such State fully prevent power monopoly. The States, under these circumstances, must never alienate the fee simple title to the land so conveyed.

The bill to create a Bureau of Mines in the Department of the Interior got a rude jolt in the Senate several days ago. The bill was on the calendar under Rule No. 8, which permits it to be called every time it is reached, providing it goes over without prejudice. When the bill was announced, Eugene Hale, Senator from Maine, made a motion that it go to Rule No. 9, which was agreed to. The calendar under this rule is rarely, if ever, reached, and in order to get a bill on it up for hearing, it is necessary to make a motion at the proper time and have that motion passed by a majority vote. Charles Dick, Senator from Ohio, and chairman of the committee on mines and mining, who has charge of the bill, was out of the chamber when the measure was called up.

BUTTE, MONTANA

Production for April. — Below Normal. — Tuolumne Producing.

The Butte district produced 23,963,860 lb. of copper in March from 360,995 tons of ore, which is still about 5,000,000 lb. below the normal production. The Tuolumne, included in the miscellaneous, is estimated to have produced 1,000,000 lb. The production by the different companies in tons of ore and pounds of copper in March were as follows:

Companies.	Tons of Ore.	Pounds of Copper.
Boston & Montana	96,100	6,823,100
Anaconda	106,950	6,630,900
Butte & Boston	10,850	672,700
Washoe	7,750	472,750
Parrot	3,875	240,250
Trenton	9,300	576,600
North Butte	35,650	2,317,250
Butte Coalition	48,050	3,123,250
Original	18,600	1,190,400
East Butte	8,370	569,160
Miscellaneous	15,500	1,317,500
Totals	360,995	23,963,860

BAKERSFIELD, CALIFORNIA

San Joaquin Valley Oil Fields — Great Activity Everywhere — Enormous Gushers and Much New Territory

California is now in the midst of its greatest and healthiest oil boom. After a quiet period of nearly ten years the industry has re-awakened and oil is now by far California's leading mineral product. Veterans of the boom of ten years ago who, when oil dropped to 15c per bbl., abandoned it for the metal mine or the farm, are again to be seen in crowds on the streets of Bakersfield and Coalinga. With them are returning the parasites, those unscrupulous promoters who floated thousands of worthless companies, and only recently have done much to blacken the name of Nevada. The Coalinga district leads by a safe margin, and owing to the immense acreage of demonstrated territory, seems destined to continue to do so. The latest development of note is the completion of the Coalinga Mohawk well at about 4000 ft. This is upon the crest of a large broad anticline, that crosses the East Side field, and is nearly a mile out from any other producing well. The production has been above 2000 bbl. per day of 31° oil. This is much lighter than any oil produced in the district except that from those remarkable wells in the old Oil City pool on Sec. 20. Two new pipe lines to tide-water have just been completed, and in 1910 Coalinga should show a greatly increased production. The Kern River still continues to produce oil at a rate of nearly 40,000 bbl. per day. There is nothing spectacular about the bringing in of a well there as they come in small. However, the wells are shallow and the drilling easy so the oil produced represents a good return on the investment. A well being drilled by the Santa Fe, about two miles south of the last producing wells, has reached a depth of more than 2400 ft. As yet they have had no great encouragement. The Midway-Sunset-McKittrick district has in the last few months, been the scene of the most phenomenal developments in the history of California's oil industry. Closely following each other extraordinarily large wells were brought in by the following companies: Santa Fe, St. Lawrence, Ethel D., K. H. O., Standard, Mays, and Lakeview. The latter is at Sunset, and is the greatest well ever brought in California, and has been gushing at a 30,000-bbl. rate since March 15. The oil flows in a black column nearly 300 ft., and much is undoubtedly lost by volatilization. The Mays well is located in the extreme northern portion of the proved Midway field, and is about 15 miles from the Lakeview. It gushes occasionally at a 50,000-bbl. rate, but has not as yet flowed continuously for any great length of time. The Standard gusher has been producing since the first of the year and is still delivering 6000 to 7000 bbl. per day to the pipe-lines. Naturally, these developments have caused unusual activity in the region and the Midway boom has no parallel. To add to the interest a wildcat well, in the Buena Vista hills, drilled by the Honolulu Oil Co., came in late in January. Though not yet completed, it makes over 100 bbl. per day of 28° oil. There is considerable unpatented land in the vicinity and the title to nearly all vacant sections is claimed by several locators. Hundreds of horses and mules are employed, day and night, hauling timber and supplies to the outlying hills, and the bustle and activity of Taft and Maricopa compare favorably with the Nevada mining camps in their boom days. The McKittrick field is still producing at its regular rate. The field is very narrow and does not contain more than 800 acres of demonstrated territory. Some of this territory has a great thickness of oil sand and has been very productive. The old Shamrock No. 3, which began flowing in 1901 at a 1500-bbl. rate, still flows more than 300 bbl. per day, and is one of the most remarkable California wells ever brought in. Late in 1909 the Nacirema Oil Co. brought in a well on the lower row of hills to the northeast of McKittrick. This well produces about 30 bbl. of tar-like oil, and is of little value for itself, but it has caused some activity in that vicinity which may uncover something of importance.

From a few miles north of McKittrick, to several miles southeast of Sunset, a distance of more than 40 miles, there is hardly a section of land upon which there is not a new derrick standing.

NEW YORK

Collapse of the Granby. — British Columbia Copper. — Phelps-Dodge Report.—Bank Finds Itself Richer.—North Butte. — Porcupine.

Not since the first move was made to work up interest in coppers has public enthusiasm received such a set-back as has come from the collapse in Granby. The relations of the Granby to Great Northern Railway, and the fact that J. J. Hill has always been supposed to be one of the largest stockholders have always given the property high standing. Many investors, who, as a rule, shunned mining securities, made an exception of Granby. No market rigging accompanied the discovery of the decline in ore reserves; all hands were taken by surprise. In view of the superlatives which have been lavished on Granby and the awakening following Otto Sussman's report, estimates of 'developed' ore, with figures as to tonnage and the profit to be derived therefrom are likely to be heavily discounted for some time. Such estimates and figures have been used liberally in connection with 'porphyry coppers'. One of the leading authorities of the copper world, a geologist whose name must be withheld, recently characterized the situation as "criminal, in obtaining money under false pretense." It is characteristic that encouragement is found by some in the plight of Granby. They argue that there may be others in like condition, and, therefore, the low-grade steam-shovel coppers may not be dangerous as regards over-production as contended. Nevertheless the coppers have lost favor and the merger, so recently an absorbing topic of interest is largely disregarded. The second large producer of the Boundary camp, the British Columbia Copper Co., has abandoned none of its plans for an increased production by reason of the Granby episode. Work has been started already on enlargement of two of the three furnaces, and negotiations are under way to induce the Canadian Pacific road to build a seven mile spur to connect the Lone Star mine with the Wellington group; failing this, an aerial tramway will be constructed.

The 1909 report of the Phelps, Dodge & Co., Inc., shows a production for the year of 130,204,764 lb., as against 113,870,914 for 1908. While the dividends paid by the company during the year, 10.8%, leave no question as to profit earning, it is a little disappointing that the average selling price of the copper and the cost price per pound are not stated. About 1000 acres of ground, the property of the Burro Mountain Copper Mines, with some 2,000,000 tons of ore proved, was acquired during the year, and is to be held in reserve.

Shares of the Phoenix National Bank recently scored an advance without apparent cause. After some diligent inquiry the fact was reluctantly disclosed that some years ago the bank acquired in settlement of a claim, a block of Copper Queen stock, with other collateral. It was inventoried at a nominal figure of $1, and, by some strange oversight, was exchanged into Phelps, Dodge & Co., Inc., without being placed among the assets of the bank at any increased figure. Only recently the bank realized that an asset of $500,000 was not being counted in its balance sheet. The discovery results in an addition of about $50 to the book value of the bank shares and as the copper stock will probably be sold, there will be a melon. A member of the Boston Stock Exchange is soliciting proxies in behalf of the minority stockholders of the North Butte. It is interesting to note in this connection that there is sent with the request for proxy, a quotation from a letter of Thomas F. Cole, dated December 27, 1909, as follows: "A great deal of misleading information has recently been given out by the newspapers to the effect that we do not own the apex of the Jessie vein. We do own it, and the neighboring company, which is claiming the ore in this vein has simply a five-eighths interest in a small triangular piece of land through which the vein passes. We own it on both sides of this small strip." The Boston letter quotes Mr. Cole's statement as "representing the true condition of the mine today." It is quite evident that the 'neighboring company' referred to is the Tuolumne, and the statement so quoted in the letter is particularly interesting as being the first made officially, and given out publicly as to the position of the North Butte in regard to the apex question. It is equally evident that the fact has been overlooked that the Tuolumne has since the date mentioned been shipping each day from 100 to 300 tons of the richest ore in Butte from the ore-bodies in question, and will have a production in March of 1,000,000 lb. copper, at by far the lowest cost of any of the mines in Butte. Since this is done without protest from the North Butte, it follows that the North Butte has abandoned its position wholly. The questions involved are accepted in Butte without argument as being the real reason for the Anaconda merger not including the North Butte. The controlling interests in the South Side M. Co., which ground the South Quincy was to take over, have postponed action on the proposed sale to the new company and are contemplating doing some drilling. The ground lies to the south of the Hancock, and is believed to carry the extension of the Hancock and Pewabic lodes. Elbert H. Gary and William E. Corey are interested in a company headed by Ambrose Monell, of the International Nickel company, which has purchased the Wilson 'dome' claim in the Porcupine goldfield, and is preparing for vigorous work during the summer.

LONDON

Mysore and Nundydroog Report a good Year.

The progress at the gold mines belonging to the John Taylor & Sons' group in Mysore, India, is always watched with keen interest by those who wish for a speculative investment that depends for its risk solely on the fortunes of the ore deposit itself and not on the manipulation of the market by those behind the scenes. The longevity of these mines is remarkable, and at the present time, after a 30-year life, the Mysore and the Nundydroog are both in better position than ever before. Naturally there is not as much ore as at the beginning, but it must be remembered that at no time during the life of the mines could this great extraction have been predicted. In fact at the beginning of operations in 1882, the shareholders were more than half inclined to give up the venture in despair, and if it had not been for John Taylor's persistence the whole district would have been abandoned. The Mysore will always be quoted as an example of the advantages of perseverance in mining. Since the commencement of production in 1884 the total output of gold has been £11,680,522, and the dividends distributed have amounted to £5,935,094. At the present time the ore reserve amounts to over a million tons, an increase of 30,000 tons during the year, and the vein is maintaining its width and value at the deepest workings, one of which is down 3900 ft. on the dip, another 4200 or about 2700 vertically. Consequently, in spite of the age of the mine and the depth of the workings, the outlook is uncommonly good. During the year 1909 the 210 stamps were in full operation and crushed 234,500 tons of ore, yielding by amalgamation 202,359 oz. of bullion. The cyanide plant treated 190,388 tons of tailing and produced 25,890 oz. bullion. The total value of the gold was £894,834. After paying royalty and adding other small receipts, the total income for the year was £854,959. The expenses at the mine and in London were £390,855, leaving a profit of £464,103. Out of this £350,750 has been distributed as dividend, being at the rate of 115% on the nominal capital. In addition £20,000 was placed as the nucleus of a reserve fund, £25,230 was allocated for income tax, £50,000 was allowed for expenditure on capital account and depreciation, and £19,950 was spent on exploration at the Dharwar goldfield. The new shaft known as Edgar's is down 2600 ft. vertically and the equipment is nearly complete. Connection has been made between this shaft and the workings in the main part of the mine at the 3226-ft. level, and the ventilation of the mine has been greatly improved. The output of gold for 1909 was the highest on record, but the rate of dividend was rather less than during the years 1898-1907. This is accounted for not by an increase in cost, as might be supposed by a casual observer, but by the fact that until two years ago extensions of plant and additional shaft-sinking were paid for out of new capital specially issued for the purpose.

General Mining News

ARIZONA.

COCHISE COUNTY.

(Special Correspondence.)—Since the flooding of the lower levels of the Tombstone Consolidated on June 1, 1909, the water has been lowered to 125 ft. beneath the 800-ft. level. This has been accomplished by the installation of two Prescott station pumps on the 800-ft. level. The new compressor supplied only sufficient air to operate two sinking pumps, and for this reason the water has not been lowered as quickly as at first expected. Very little mining is being done at present. About 15 miners are being employed following contacts between the quartzite and limestone on the 700-ft. level, and a few men are engaged in sinking a single compartment shaft on the Northwest claim.

Tombstone, April 2.

The work of widening the main drifts from the Holbrook and Czar shafts of the Copper Queen Consolidated Co., at Bisbee, and raising the chutes to make room for the new motors will be completed about the middle of the month. The raising of the Holbrook shaft from the Spray drift has been started and it will be in working order May 1. The Czar cut-off has been finished and crosscuts from this have opened from 15 to 30 ft. of commercial ore.——At the Superior & Pittsburg the Briggs shaft is down 1200 ft. and a station is being cut at that level and a pump set in position. Sinking is continued in the shaft and a drift has been started to connect with the Junction and Hoatson shafts. The drift on the 1500-ft. level of the Junction opened a body of sulphide ore.——The Shattuck-Arizona is hoisting 300 mine cars of ore per day from the 500 and 600-ft. levels. Much of this is high-grade material assaying over 20% copper. The stopes are now being timbered by stulls only instead of using square sets.——The adit at the Virtue property at Paradise is now in 700 ft., the face being in a hard gray limestone. A stove and suction pipe is to be installed to improve the ventilation and later the company may install a compressor and machine-drills. It is expected that the contact between the limestone and porphyry will be cut within the next 400 ft.——The Whitetail Mining & Milling Co. has been organized to take over the Doran & Gallagher property and expects to increase the force at the mine in a short time.——The 80-stamp mill of the Commonwealth Mining Co., at Courtland, was recently destroyed by fire. The mill had been remodeled a short time ago, and fitted with tube-mills and filter plant.

GILA COUNTY.

(Special Correspondence).—A new corporation, the Great Eastern Development Co., capitalized at $500,000, divided into 50,000 shares at $10 par, has purchased the property of the Arizona-Colorado Copper Belt and Gold Mining & Milling Co. for approximately $900,000. According to the terms of the option held by E. M. White, formerly manager of the Warrior Copper Co., who is the organizer of the Great Eastern company, $35,000 cash is to be paid in one month, and a cash balance of $225,000 and $650,000 worth of stock in a mining company to be formed later will be due at the end of three years. The Arizona-Colorado property consists of about 400 acres of mineral land, three miles north of Globe. The present workings on the land consist of numerous pits and adits and a 900-ft. shaft with eighth and ninth levels established. E. M. White is manager of the new company.——The Cactus Copper Co. has just placed a Starr churn-drill on its property. W. H. Hamilton is superintendent.——The McGaw shaft of the Superior & Boston Copper company is being equipped with the water and steam columns for the pump just installed at the sixth level. The east and west drifts on the Black Oxide vein on the 400-ft. level of the Gardner shaft of the Superior & Boston mine are opening what is apparently a large body of ore averaging about 8% copper, and having a high iron content making good fluxing material.——The sinking of a third churn-drill hole has just been commenced on the Eureka group of claims belonging to the Cordova Copper Co.——The sinking of the Williams shaft on the properties of the National Mining Exploration Company has been temporarily discontinued at a depth of 650 ft., while a station is being cut at a distance of 660 ft. from the surface preparatory to crosscutting. The material in the bottom of the shaft is red shale containing considerable hematite. A 200-hp. boiler will soon be added to the surface equipment.——The vertical shaft on the Live Oak property has been sunk from the 329-ft. mark to a depth of 350 ft. since work was resumed there about a week ago.——The Warrior mine is producing over 100 tons per day of chrysocolla ore averaging about 9.5% copper.

Globe, April 1.

YAVAPAI COUNTY.

The Commercial Mining Co. is installing a new hoist at its property in the Copper Basin district. A. J. Pickerell is superintendent.——The new 10-stamp mill at the Crosby-Nelman mine, 16 miles northwest of Hillside, has been started and is now running satisfactorily. There are 30 men employed in the mine, which is down 260 ft. J. H. Boyd is manager.——The adit of the Big Pine Mining Co., operating in the Hassayampa district, opened 3 ft. of ore when in 175 ft. A drift has been started on the ore which was cut at a vertical depth of 120 ft.——A 2½-ft. vein of $60 ore has been opened in the Devonshire mine.——Sinking has been resumed at the 500-ft. level of the Leghorn mine in the Cherry Creek district. A new Lane mill has been installed in the company's plant and a better saving is being effected.

CALIFORNIA.

CALAVERAS COUNTY.

The Newman mine, at West Point, is soon to resume operations.——A new mill is to be erected at the Little Daisy mine in the Mountain Ranch district this summer.——Operations are to be resumed at the 400 mine this month.——The Summit mine, on Esperanza creek, has been bonded to San Francisco parties.——The Ball Mountain Mining Co. has unwatered its shaft, now down 473 ft., and will probably break through the lava cap into the bedrock in a short time.——A pocket estimated to contain approximately $100,000, has been opened in the Crystal mine at Angels Camp. James V. Coleman is the owner.——Good ore has been opened by the drift at the Smythe-Ryland mine.——The work of removing 40 stamps from the 100-stamp Stickle mill to the Gold Cliff mine has been commenced by the Utica company.——It is reported that work is to be resumed at the Lightner mine at an early date.

KERN COUNTY.

There is another lot of ore on the dump of the Pearl Wedge property for shipment to the mill. This will be the fourth lot sent out recently and is expected to contain about $3000 worth of bullion. The shaft is now down 150 ft.——Eleven tons from the Merced mine in the Stringer district milled $2500. The ore was mined at the 100-ft. level.

NEVADA COUNTY.

The drift at the Red Ledge property, at Washington, is opening some good ore and it is probable that the owners will erect a 5-stamp mill this spring.——The Cassidy Consolidated Gold Mining Co. is arranging to install new machinery at its recently acquired claims in the Grass Valley district.——The El Oro Mining Co., which has been operating the Marcotte claim in the Washington district for some time, is planning the consolidation of a number of claims in that vicinity, including the Marcotte, Starr, Ethel, and Baltic groups. There is a mill on the Marcotte and one on the Ethel groups, and it is proposed to open the properties by a long adit near Canyon creek.

PLACER COUNTY.

A portion of the equipment for the new dredge at Cash Rock is at the Auburn depot and will soon be hauled to a dredge which is rapidly being completed.——The Lee Brothers have crushed the ore stored on the dump and shipped the bullion to the mint. It is their intention to install concentrating tables in the plant as the ore contains considerable rich sulphide.——The company operating the Rawhide property is laying the second pipe-line to the mill.——The Spring Garden company is to let a contract to drive a 3000-

ft. bedrock adit.——Pay gravel has been uncovered in the Big Gun property at Michigan Bluff.——J. B. Hobson has granted a lease on the channel under the townsite to W. N. Bissett and an adit has been started to open the gravel. The channel has been worked close to the western edge of the town and has paid well.——Work has been started on the Humbug property, on the American river, after an idleness of eight years. Harry W. Morris is manager.

SIERRA COUNTY.

The Haskell Peak Mining Co. is running an 800-ft. bedrock adit at its property on the border of Sierra and Plumas counties. A prospect shaft has been sunk 190 ft. to bedrock opening 8 ft. of gravel.——The shoot recently cut at the Sierra Buttes mine, near Downieville, contains high-grade ore. A 200-ft. drift has been started that will open the ore the length of the shoot.——A recent test on the concentrate from the Standard mine gave a result of $11 per pound.

TRINITY COUNTY.

Hydraulic operations have been started at the Nash Deep Gravel mine, on Coffee creek, and a successful run is anticipated.——It is reported that the Bonanza King mine, above Trinity Center, is to change hands shortly and work will be resumed on a larger scale this spring.

Cemented Gravels Covered by Boulder Clay, Minersville.

TUOLUMNE COUNTY.

(Special Correspondence).—An Oakland company has taken a bond on the Blue Lead mine, near Arrastraville, and will begin work about May 1.——A small crew of men has begun cleaning the ditch which supplies water to the Sunnyside mine, and it is expected that actual mining operations will be in progress in a few weeks.——It is reported that a company represented by F. Chapellet has become interested in the Starr King mine and that work is to be started at an early date.——The new mill at the Maddox mine, near Confidence, has been completed and will be in operation in a few days. A cyanide plant has also been constructed.——The mill at the Draper mine, which consists of one 5-stamp and two 2-stamp batteries, is shortly to be changed to a 10-stamp mill by removing the two smaller batteries and installing another of five stamps.

Tuolumne, April 4.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—An 8-in. streak of ore has just been uncovered at the Scepter adit, near Georgetown, that assays as high as 2000 oz. silver per ton.——A. A. Hayden, manager for the Golden Glory Tunnel Mining Co., operating a group of claims on Saxon mountain, states that a compressor and machine-drills will be purchased within 30 days.——From a shipment of 20 tons of dump-matter made from the Astor mine to the Modern smelter a net settlement of $11.34 per ton in silver was realized after paying packing charges of $4 per ton, $1.50 freight, and $5.25 for smelting.——A body of ore has been uncovered in the adit being driven on the Avalanch property, at Freeland, that is from 7 to 9 in. wide, and assays 3.5 oz. gold per ton. E. M. Moscript is the owner.——From three to five cars of ore per day are being shipped from the Saratoga mine to the Modern smelter at Utah Junction.

Idaho Springs, April 2.

GILPIN COUNTY.

(Special Correspondence).—A rich discovery has just been made on the Chase property, in the Russell district. In a winze being sunk from level No. 3 a streak of ore has been cut that is from 4 to 7 in. wide and assays as high as 100 oz. gold per ton. Forbes Rickard is manager.——Ore is being shipped from the Champion-Chase mine that mills 7 oz. gold per ton. David S. Davis is manager.——The Sayre-Mammoth property was the scene last week of a promising discovery, a body of ore three feet wide having been uncovered on the fifth level that will mill better than $25 per ton in gold.

Central City, April 2.

LAKE COUNTY.

Considerable placer work is planned this spring in California gulch at Leadville. Several old-time producers are to be worked and a number of dumps are to be washed for the fine ore. At the Colonel Sellers, Moyer, and A. Y. & Minnie, the dumps are being worked and the ore shipped to the smelters.——A lease has been granted on the Baby shaft and the lessees will commence shipping lead ore at once.——Thomas Hurley and associates are shipping a carload per day of lead carbonate ore from the La Plata mine. ——Operations have been resumed at the Lime mine through the old shaft.——The shaft at the Tucson property is now 1170 ft. deep. A station has been cut at the lowest level and a drift started to the ore which the management expects to cut within 150 ft.——Work has been started in the Rock shaft, on Rock hill, and a good grade of ore is being shipped.——The adit at the Alps-Aztec property is now in 480 ft., and has recently opened a small vein of smelting ore.

OURAY COUNTY.

It is reported that the American Nettie mine, at Ouray, has been sold to the Wanakah Mining Co., which owns the Bright Diamond mines. The mill at the American Nettie will be changed to concentrate Bright Diamond ore and the product will be shipped to the Hill smelter.——The mill at the Thistledown mine, on Mount Hayden, is nearly completed and the management expects to have the stamps dropping about the middle of the month. The power-plant to develop 250 hp. has been finished and the tram from the mine to the mill will soon be completed.

SAN JUAN COUNTY.

The 200-ton mill of the Ledge Consolidated Mining Co., at Silverton, has begun operations. About 400 tons of ore is in the bins and 100 tons per day will be run through the plant for the next few weeks when the output will be raised to the full capacity of the mill.——The steady producers of the camp during the winter have been: The Sunnyside, producing about 600 tons of concentrate per month; the New Gold King, 1200 tons; the Hercules, 600; the Kittimac, 100 tons, and the Iowa-Tiger, 100 tons per month. The Highland Mary is shipping 75 tons of crude ore per month. ——The Gold Prince mine and mill, at Animas Forks, will be in operation again within a few weeks.

SUMMIT COUNTY.

Frank Wineland and C. W. Ellwood have secured a lease on the New York group and Johannesburg mill in the Breckenridge district.——The French dredge has begun operations for the season. The machinery and hull have been

overhauled and put in order for the season's run.——The mill at the Wellington has been repaired and is now running on ore from the dumps.——A gasoline engine is being installed at the O'Reilly property.——Operations have been resumed by the Reliance dredge and dredge No. 2 on the Swan river.

DOUGLAS COUNTY.

The Union Leasing Co. has secured a 5 year lease on the property of the Black Belle Gold Mining Co., in the Cripple Creek district. The drift of the leasing company has already cut the Black Belle ground opening some fair ore.—— The General Leasing Co., operating north of the Davenport shaft of the Doctor Jack Pot Mining Co., is driving north on a 3 ft. vein. Several shipments of screenings have been made.— During the month of March 50 cars of $20 ore have been shipped to the valley mills from the Jerry Johnson mine and 1100 tons of low grade oxidized ore treated in the local plants.——A 12 in. air pipe has been placed in the Rexall shaft at Victor to facilitate ventilation.——The Stratton's Cripple Creek Mining & Development Co. is installing a new compressor at its Abe Lincoln mine and the shaft will be sunk from the 700 to the 800-ft. level. W. J. Hill is operating the property under lease.——The El Paso Consolidated Gold Mining Co. paid a dividend of $24,500 on March 31.——The Isabella Mines Co. installed a steam hoist at the old McDade shaft.

IDAHO.

IDAHO COUNTY.

W. H. Stowell and J. T. Omo, of Spokane, have purchased the South Fork mine, in the Elk City district, and organized the Elk City Mines Corporation to operate the property.——A two-year option has been secured on the North Star group, southwest of Hump, by Thomas R. Sales, of Salt Lake. The price is $60,000 to be made in four payments.

The Coeur d'Alene, Idaho.

SHOSHONE COUNTY.

The adit on the Black Bear Fraction, operated by Peter Bernier, of Wallace, opened a 5-ft. body of lead ore.——Work has been resumed on the Index property, near Kellogg.——A 600 ft. adit is being driven that will tap the vein at a depth of 300 ft.——Heavy snowslides at the Paragon group swept $15,000 worth of machinery down the canyon and it is the intention of the management to replace this as soon as the snow melts.——A meeting of the stockholders of the Bunker Hill & Sullivan company has been called for April 14, when a proposition for a compromise with the Federal company will be submitted.

MISSOURI.

JASPER COUNTY.

At Carl Junction the A. & D. Co. is getting ready to put the old Ishpeming tract in operating condition. A large plant will be built. The lease is well developed.—— A new mining camp is being opened at Cliffwood near Neck City, where the Cliffwood company has a new 150 ton mill ready for operation. The shaft is down 160 ft., where ore is found in a hard white limestone which requires no timbering. The ore was first found at 87 ft. Another mill is also to be erected in the camp by the Sand Hill Co., which has a shaft in ore at 170 ft. and a number of drifts opened.——A third company is Coats Bros., who have a shaft in ore at 178 ft. Farther to the east is the northwest corner of the Neck City camp where the rich Quick Seven and other properties are operating with great success.——Operations near Carthage are promising and a number of companies are active. The Tri-City company is sinking to 200 ft., where a sheet-ground run similar to the Joplin and Webb City fields was penetrated in drilling.——The Vesuvius company is building a chat-mill to operate on the tailing from the ore which was mined at the 170-ft. level. The regular 250-ton mill already on the lease will still operate on the ore as taken from the ground.——The North Pole M. Co. has one of the few lead prospects in the Carthage field, on the Mevey farm. The company has been working the upper levels, but also has a prospect in lower ground and is sinking the shaft to the 220-ft. level.——A company operating near Porto Rico on a lease formerly a portion of the Ground and Irwin tract has a good prospect in a shaft at 182 ft., and is building a 200-ton plant. The ore is blende with a slight trace of galena. It is claimed six drill-holes showed the same formation. The face of ore is 16 ft. high and assays better than 6%.——Ed. Mallet and others have a good prospect near Zincite at 90 ft. in hard ground. The ore is treated in a custom mill.

NEVADA.

CLARK COUNTY.

The cross-cut on the 100-ft. level of the Capital mine, in the Eldorado district, has opened a 2-ft. shoot of high-grade ore. Over $100,000 has been taken from the surface workings in ore assaying from $150 to $400 per ton.

ESMERALDA COUNTY.

The annual report of T. G. Lockhart, president of the Florence Goldfield Mines Co., mailed to stockholders April 2 from the office of the secretary in Denver, with the checks for the 10c. dividend declared in February, shows that the company during the year ended December 31, 1909, made a net profit of $232,050. Two dividends of 10c. per share each totaling $210,000, were paid during the year, leaving a balance in treasury on the year's business of $22,050. Cash on hand December 31 is shown as $122,470. During the year the company handled 34,824 tons of ore of an average value of $18.42 per ton in its mill, and shipped to smelter 173 tons of an average value of $287.54. The ore that was handled in the mill was of a gross value of $641,585, from which an extraction of $591,036, or 52.12%. The net ore returns for the year are given as $533,617, the sum of $107,412 being assessed against the returns for marketing ore, including freight charges, smelting, mint charges, etc. The total expenses for the year, chargeable to mining, development, and including the above $107,412, are given as $300,551, which gives a total cost per ton for the ore handled of approximately $9.——The Goldfield Alamo company has declared another dividend of 3c. per share, payable to stockholders of record April 20. As there are 700,000 shares of stock issued, this dividend will amount to $21,000. A dividend in the same amount was paid February 1.——The

Knickerbocker lease on the Commonwealth has at last reached ore in the cross-cut from the old company adit, this being the downward extension of the ore-shoot that was cut some weeks ago in the old workings near the top of the hill. The ore now picked up some 75 ft. below where it was found above is 4 ft. wide, and composed of an oxidized sugary quartz.

LANDER COUNTY.

(Special Correspondence).—The Austin Manhattan Co. has removed the steam plant from the Frost shaft to the Ophir shaft, and will retimber the latter to the 400-ft. level. The new 60-hp. gasoline hoist will later be installed at the Ophir shaft. A contract has also been let to sink a 100-ft. shaft on the Midnight claim on Midas flat.——The King Midas has made the final payment of $12,000 on the Rowdy group and will commence more extensive operations.——The Roosevelt lease of the Maricopa Mines Co. is down 150 ft.——The Shoshone Quicksilver Co. is opening large reserves of cinnabar ore in its property near this city. The ore is said to average over 3% quicksilver, and the company is to install furnaces of 100 tons capacity this summer to retort the ore.——The Maricopa Mines Co. has installed a hoist and compressor at the Patriot and is arranging to run two drifts between the 650 and 800-ft. levels.

Austin, April 1.

LINCOLN COUNTY.

Work has been resumed at the Centennial Pioche after a temporary shut-down. Murray C. Godbe is manager.——Repairs on the railroad are being rushed and it is understood that trains will be in Pioche about May 1.——The Golden Prince, Gold & Silver Prince, and Prince Consolidated, are all blocking out ore awaiting the completion of repairs to the railroad.

LYON COUNTY.

A new 10-stamp mill is to be installed at the Ramsey-Comstock mine, near Ramsey, as the present plant is too small to handle the output. The mine is opened to a depth of 400 ft. though all the stoping is being done above the 160-ft. level. Over $20,000 worth of bullion has been taken from the property with a small rotary mill.

NYE COUNTY.

The Tonopah Extension Mining Co. has purchased the holdings of the Red Rock Mining Co. and the McKane Mining Co., in the Tonopah district. The properties total about 200 acres, giving the Extension the largest acreage in the district. The Red Rock Consolidated ground lies to the south and west of the Extension holdings, while the McKane is situated west and north. The new ground will be prospected through the Extension workings.——Drifts have been run on the shoot recently opened on the 275-ft. level of the MacNamara mine for 50 ft. showing the vein to be over 2 ft. wide. When the raise from the 300-ft. level is completed the ore will be handled easier and more rapid progress made.——Operations were suspended a few days at the Midway to repair the boilers.——At the Tonopah Belmont the face of the east drift on the 1000-ft. level is now in a good grade of milling ore averaging about 16 ft. in width.——The Montana-Tonopah Mining Co. has purchased a two-thirds interest in the Miriam group for $5000. The ground joins the northern endline of the company's holdings and contains about 50 acres. The ground is unpatented and no ore of commercial grade has been found on it.——Plans are being formulated for the reorganization of the Montgomery Mountain property, in the Bullfrog district.

STOREY COUNTY.

The retimbering of the main Sutro tunnel has been practically completed and the stave-pipe carrying the hot water from the C. & C. and Ward shafts has been covered to protect it from any falling rock.——Development work at the Comstock-Phoenix mine, on the Brunswick lode, is progressing rapidly, and a large amount of milling ore is being opened. A contract has been let to sink the winze from the 350 to the 450-ft. level. A drift has been started west on the vein to open the four shoots which have been found in the upper levels.——Work on the 2300 and 2400-ft. levels of the Mexican mine is opening ore that assays from $15 to $70 per ton.——Joe Dietrich has taken a lease on the Best & Belcher croppings and surface workings and has already made good progress in his prospecting work. Some good leads have been found and are being followed in hopes that they will develop into larger orebodies.——The raise on the 1750-ft. level of the Consolidated Virginia is up 15 ft. in ore assaying about $8 per ton. From the stope on the 1800, 190 cars per week of $7 ore is being mined.

WHITE PINE COUNTY.

(Special Correspondence).—It is reported that a merger of the Ely-Centennial, Ely-Calumet, and McDonald-Ely properties is projected.——Ely-Consolidated is driving an east drift from the American shaft, and is in 200 ft. The vein has been opened by a winze from the west drift showing a high value in lead with a fair amount of gold.——Ely-Centennial has its new compressor-plant in action and the drills are breaking 12 ft. per day in the adit.——It is reported that the Cole-Ryan interests are considering the acquisition of the Challenge and Aurora properties. The Challenge joins the Jupiter mine of the Cumberland-Ely estate.——The Richardson and Badger leases are maintaining good shipments of high-grade silver-lead ore.

Ely, April 2.

OREGON.

BAKER COUNTY.

(Special Correspondence).—One of the most prominent mines of recent development in eastern Oregon, is the Rainbow, situated in the Pedro mountains, by wagon-road, 38 miles southeast of Baker City, in the Mormon Basin district. It is owned by the Commercial Mining Co., with head office in Portland. The vein is on a contact between granite and limestone, which an adit cuts 180 ft. below the apex. From an inclined shaft, sunk from the adit-level, three other levels are driven on the vein, opening it for a total distance of 1000 ft. Where the vein is cross-cut by the adit, it is 300 ft. wide. On the limestone foot-wall, there is a porphyritic intrusion, silicified on both sides into bodies of quartz, which contain gold from $3.50 to several hundred dollars per ton, with an average value of $23. These orebodies are from 6 to 40 ft. wide. The remainder of the vein filling back to the hanging wall of hornblende granite, varies from 100 to 300 ft. in width, and averages, in gold, about $3 per ton. Further exploration now in progress in this mine is with a view to developing additional tonnage of high-grade ore, and determining the commercial possibilities of the lower grades, for the entire distance across from limestone to granite. About $200,000 have been taken from this mine to date. The Rainbow holdings cover 200 acres of mineral ground and 480 acres of timber. The property is equipped with a 10-stamp mill and Wilfley tables. From the mine to the mill the ore is conveyed by aerial tram a distance of half a mile. Machine-drills are, for the first time, being installed, and preparations are on for the operation of this mine on a large scale when the Ox Bow power-plant on Snake river is completed, whence electrical energy will be brought in 40 miles. H. C. Wilmot is general manager, and W. E. King, managing director.——On the same dyke-system, and with geological conditions similar, another property, a mile west of the Rainbow, is rapidly gaining prominence. This is the Humboldt, owned by the Humboldt Gold Mines Co. About 18 months ago this property was acquired by the present owners. The development now consists of a 200-ft. vertical shaft, drifts, cross-cuts, and raises, aggregating 4500 ft. Orebodies have been proved in these workings covering areas from 70 to 600 ft. long and to the extent of 40 ft. in width. They occur in shoots or lenses. The milling ore averages $9 per ton, principally gold. On the lower level it is base but of higher value, lead, zinc, antimony, and a little tellurium appearing. Equipment at the Humboldt comprises a modern hoist and sinking plant, a 10-stamp Allis-Chalmers mill and six Johnson concentrators. Of the milling ore, 65% of the assay value of the heads is saved by amalgamation. The concentrate assays about $80 per ton, and bring the total savings up to 93 per cent.

Baker City, April 2.

UTAH

JUAB COUNTY

(Special Correspondence.) The Yankee Consolidated Mining Co. operating in the Tintic district recently levied an assessment of 1c per share on its stock and at the sale of delinquent stock, on March 21, only 5700 shares were sold. In the course of development ore shipments have been made in small lots but the proceeds have not been sufficient to pay expenses. Exploration is being carried on from levels that connect with the new 900 ft. shaft which was sunk close to the main adit. This shaft, which has three compartments is to be sunk deeper, an electric hoist for this work having been purchased from the Gallgher Machinery Co. It is capable of hoisting from a depth of 2500 ft. B. N. Lehman has the management of the property.

Eureka, April 1.

The No. 1 shaft on the Iron Blossom mine, at Tintic, is down 1450 ft., and it is reported that a cross cut on one of the lower levels has opened a shoot of high grade gold ore. About 75 tons per day of second class ore is being shipped from this shaft to the smelter. The No. 3 shaft is expected to open the orebody worked on the 280-ft. level within the next few weeks.——Two carloads per week of first class ore are being shipped from the Gold Chain property. The management is now running three power-drills in development and stope work.——The winze recently sunk from the 260 ft. level of the East Tintic Development Co.'s property cut a small vein of ore that assays 58 oz. silver and 53% lead.

SALT LAKE COUNTY.

In an action filed in the district court, Walter Steadman asks damages from the Garfield Smelting Co. of $13,720 for injuries to his farm and stock and also to the farms and stock of 13 other farmers near the Garfield smelter, alleged to have been caused by the smoke and fumes from the smelter during the seasons of 1908 and 1909. The claims of the 13 other farmers were assigned to Steadman.——The Bingham Mines Co. is installing a complete electric generating plant near the Dalton shaft which will furnish it with power and light.——The Utah Metal Mining Co. has commenced work in the face of the 3000-ft. tunnel from Middle canyon, and will drive it 8000 ft. farther under the orebodies on the Bingham canyon side of the range. Since the company started active work last fall its forces have been employed installing the power-plant and other machinery, erecting new buildings and enlarging the old tunnel to 8 by 10 ft. At this time only two shifts of five men each are being worked in the tunnel, but with the arrival of the electric locomotive and the motor to operate the ventilating fan, three shifts of seven men each will be employed upon that work, pushing the work at the rate of nearly 400 ft. per month. Making allowance for unexpected delays, it will take about two years to complete the tunnel. ——Through experiments, re-arranging of machinery, close calculations, and a better understanding of the ore, the Utah Copper Co. is fast increasing the efficiency of the plant. This increase in efficiency has reached a point where it seems almost certain that the present mills of the company may soon be able to handle 20,000 tons of crude ore per day. At present the mills are handling close to 13,000 tons of ore.

SUMMIT COUNTY.

The directors of the Daly West Mining Co., at Park City, have just posted the regular dividend of 30c. per share. This is payable April 20 to stockholders of record April 10. Since the first of the year the company has been increasing its profits and adding to its surplus. The March earning of the company is estimated at $35,000 by the manager, Ernest Bamberger. In January, the net earning was $28,000, and in February, over $29,000.——At the Iowa Copper property the Spooner drift is being driven on a seam of carbonate ore. Nels Peterson is in charge of the work.—— In the report of the Daly-Judge Mining Co. for 1909, the manager states that the mill ran one 8-hr. shift per day throughout the year, the total receipts were $437,631, and total expenditures, $347,590. Some $100,918 were derived from the operation of the zinc plant which was run on ore both from the mine and dumps. Development work, exclusive of prospecting, amounted to 4865 ft. while that in prospecting alone approximated 1700 ft. Conditions at the New York Bonanza have been improving recently and indications point to the resumption of shipping at an early date.——The cross cut on the 900 ft. level of the Silver King Coalition opened a good body of shipping ore.

WASHINGTON.

FERRY COUNTY.

(Special Correspondence.)—The North San Poil mine has been leased to W. M. Crummer and associates for two years with an option to purchase. The same parties have obtained a lease of 50 ft. of the north end of the San Poil mine, which adjoins the North San Poil on the south.——The Republic Mines Corporation is meeting with success in working the Surprise vein, on the Pearl group, and shipping 5 carloads of ore per week.— Negotiations are pending for the purchase of 20 acres of bench land on the western limit of the city of Republic for a mill site, and there is considerable talk about establishing a custom cyanide plant.—— It is reported that arrangements have been completed for a power plant to be erected near Godfrey, on Kettle river. —A cross cut is being driven from the No. 3 adit of the Belcher mine to intersect the orebody developed on the No. 2 level.— A new body of lead-copper ore has been opened in the Kettle River mine, near Orient. A carload of machinery for the concentrator has been received.

Republic, April 1.

OKANOGAN COUNTY.

A large body of ore is reported to have been discovered in the mountains adjacent to Sinlahekin valley, on the Iron Mountain group of claims. Surface samples of ore are said to have assayed in gold and silver from $8.60 to $25.80 per ton.

CANADA.

BRITISH COLUMBIA.

The management of the Lucky Jim mine, in the Kaslo-Slocan district, is preparing to ship 100 tons of zinc ore per day as soon as the railroad will furnish the cars. The company is arranging for the erection of a 100-ton concentrator at Kalso in two 50-ton units.——A high-grade orebody has recently been opened in the Rambler-Cariboo property.——Price & Burgess have opened an orebody on the Iona property in the Ymir district.——A shipment of 100 tons of ore has been sent out from the Aurora mine on the west side of Moyie lake. The ore assays 28% zinc and 25% lead, with 2 oz. silver per ton.——The Big Casino and Bullfrog groups, in the Stewart district on Portland canal, have been sold to Vancouver and Victoria capitalists.

ONTARIO.

The Lewisohns have taken up their option on the Wettlaufer mine, at Cobalt, and are to add a 12-drill Rand compressor to the equipment.——The Ontario Government has purchased the nugget that made the Cobalt Gem Mining Co. famous for $5000, and now has it on exhibition in the parliament buildings at Toronto.——The first unit of the Cobalt Power Co.'s Hounds Chutes plant has been completed and water turned through the canal, generating 1000 hp. This is Cobalt's nearest power-plant, being only four miles from the Waldman mine.

MEXICO.

CHIHUAHUA.

The American Smelting & Refining Co. has the first of the two new furnaces at the Chihuahua plant completed and in operation. The second one is to be blown in some time in May. This will make five furnaces in the plant with a total capacity of 750 tons per day.——The steel work for the Palmilla mill, at Parral, is well under way and it is expected that this portion of the work will be completed in June.

SONORA.

At a recent meeting of the stockholders of the El Tigre Mining Co. the number of directors was increased from seven to thirteen. A number of stockholders and directors recently visited the property and plans for the doubling of the output of the mine are now being considered.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

J. Morgan Clements is at Butte.

W. F. Ferrier has gone to New York.

C. L. Wilson was in San Francisco this week.

Leon Dominian will be at New York April 15.

E. S. Pettis has returned to San Francisco from Sonora, Mexico.

F. P. Bodfish of Victor, Colorado, was recently at Twin Falls, Idaho.

W. A. Stevens, of San Francisco, is at Jarbidge, Elko county, Nevada.

R. B. Lamb has completed his work on the La Fortuna property near Chihuahua, Mexico.

G. E. Stephenson, general manager for the Palmarejo & Mexican Gold Fields, Ltd., was in San Francisco.

George W. Myers, of San Francisco, representing the Chrome Steel Works, is on a business trip through Arizona and Mexico.

C. L. Constant, Jr., has just returned to New York from Idaho, where he has been engaged in examining some copper properties.

H. C. Wilmot has been appointed manager for the Commercial Mining Co., Rye valley, Oregon, and has closed his Salt Lake office.

Maitland F. Kindersley is arriving in New York from London on his way to Peru, where he goes to examine a copper property.

Philip W. Henry, Edwin O. Holter, Marvyn Scudder, W. B. Devereux, Jr., and H. A. J. Wilkens have formed the Mines Management Co., with offices at New York City. The purpose of the company will be to report on mines, organize companies, and undertake the management of properties.

MARCH COPPER REVIEW.

By M. E. Appelbaum *

During the month of March a fairly satisfactory business was transacted with domestic consumers, and one or two large lots sold for export, but on the whole the transactions show a marked falling off as compared with previous months. The statistics published both in New York and abroad show clearly that consumption and production are running about even, but the consumers are much disappointed to find that the shut-down of the mines and curtailment of the production is not shown in the producers' figures, and have made up their minds that as long as production continues at such an enormous rate a hand to mouth policy is the safest. Assuming that the domestic deliveries will continue at the high rate established during the last few months, that the exports will represent actual European requirements, and that even these total deliveries will not come up to the production, it is hard to figure on a higher copper market. The immediate outlook, therefore, for the metal is for a steady market around the present level since the visible supply here and in Europe is quite sufficient to take care of any small improvement in business. The general uncertainty in regard to the labor situation, the poor market for bond issues, which in turn holds up construction work, and the general unrest, has made the consumers of copper very conservative. They are not in a receptive frame of mind as to buying liberally and show no disposition to take over part of the surplus carried by the producers. On the other hand, this feeling would easily be overcome once the trade was assured that a curtailment in production of 5 to 10% was taking place. The figures for the month of March, to be published on April 10, should show deliveries of about 45,000,000 lb. for export and 70,000,000 to domestic consumers, making a total of 115,000,000.

*President of the New York Metal Selling Company.

Market Reports

LOCAL METAL PRICES.

San Francisco, April 7.

Antimony	12—12¾c	Quicksilver (flask)	49½—50½
Electrolytic Copper	15¼—16¼c	Spelter	7—7¼c
Pig Lead	4.95—5.00c	Tin	36—37½c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Mar. 31	13 06	4.39	5.60	52½
Apr. 1	13.06	4.39	5.60	52¼
" 2	13.06	4.39	5.60	52⅛
" 3	Sunday.	No market.		
" 4	13.06	4.39	5.60	52½
" 5	13.06	4.39	5 60	52⅜
" 6	13.06	4 39	5.60	52⅜

ANGLO-AMERICAN SHARES.

Cabled from London.

	Mar. 30. £ s. d.	Apr. 7. £ s. d.
Camp Bird	1 8 0	1 8 6
El Oro	1 8 3	1 8 6
Esperanza	2 16 3	2 18 9
Dolores	1 8 9	1 8 9
Oroville Dredging	0 9 9	0 9 9
Mexico Mines	8 17 6	9 5 0
Tomboy	0 18 9	0 18 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, April 7.		Closing prices, April 7.
Adventure	6¾	Mohawk	52
Allouez	46	North Butte	35
Atlantic	7½	Old Dominion	37½
Calumet & Arizona	65½	Osceola	142
Calumet & Hecla	597	Quincy	153¾
Centennial	19	Santa Fe	2⅛
Copper Range	71¼	Shannon	12
Daly West	9	Superior & Pittsburg	12¾
Franklin	15	Tamarack	60
Granby	43	Trinity	6¼
Greene-Cananea, ctf	9¼	Utah Con	22½
Isle Royale	18¼	Victoria	3½
La Salle	14½	Winona	8⅛
Mass Copper	6½	Wolverine	127

(By courtesy of J. C. Wilson, Mills Building.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, April 5.		Closing prices, April 5.
Amalgamated Copper	76⅜	Miami Copper	23¾
A. S. & R. Co	81⅞	Mines Co. of America	⅛
Boston Copper	18⅜	Montgomery-Shoshone	¾
B. C. Copper Co	6½	Nevada Con	21⅛
Butte Coalition	23	Nevada Utah	1¼
Chino	14⅜	Nipissing	10½
Davis-Daly	2⅞	Ohio Copper	3⅞
Dolores	7⅛	Ray Central	3⅜
El Rayo	3	Ray Con	20⅜
Ely Central	1⅜	South Utah	2⅛
First National	2½	Superior & Pittsburg	13¼
Giroux	8½	Tenn. Copper	31¾
Guanajuato Con	1	Trinity	6¾
Inspiration	8	Tuolumne Copper	3¾
Kerr Lake	9	United Copper	7⅛
La Rose	4¼	Utah Copper	46⅝
Mason Valley	9⅛	Yukon Gold	4⅜

SOUTHERN NEVADA STOCKS.

San Francisco, April 7.

Atlanta	$ 15	Mayflower	$ 3
Belmont	2.70	Midway	30
Booth	15	Montana Tonopah	84
Columbia Mtn	7	Nevada Hills	51
Combination Fraction	48	Pittsburg Silver Peak	72
Daisy	8	Rawhide Coalition	30
Fairview Eagle	16	Rawhide Queen	22
Florence	2.05	Round Mountain	46
Goldfield Con	7.95	Silver Pick	10
Gold Kewenas	7	St. Ives	16
Great Bend	3	Tonopah Extension	86
Jim Butler	21	Tonopah of Nevada	6.80
Jumbo Extension	31	West End	33

(By courtesy of the San Francisco Stock & Exchange Board.)

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EDITORIAL.

IMPORTS entering duty free amounted during the last fiscal year to $600,000,000, being 47 per cent of the total merchandise coming to the United States from foreign countries. Of this total tin and tin oxide amounted to $26,010,356, and copper and its manufactures to $37,763,798.

CHINA as an exporter of pig iron and a serious competitor for a share in the world's business, is foreshadowed in the article on the Tayeh iron mines by Mr. A. J. Seltzer of the Imperial Mining College, at Woochang, appearing in this issue. That the great mineral resources of the 'Middle Kingdom' are already being developed in a serious way, is not always realized.

NINETEEN YEARS is not a long time in Europe or even in America, but in South Africa it spans the time between savagery and civilization. It practically covers the history of the Rand, and an interesting and impressive history it has been. The *South African Mining Journal* began in January 1890 as the *Mining and Metallurgical Review* and has grown with the great gold mining district it so ably represents. On March 12, it issued a handsome special number celebrating its nineteenth anniversary. Much of interest regarding the Rand is told, and the growing importance of Rhodesia and the 'outside districts' is also illustrated. The *Journal* has a record of which it is justly proud, and across the seas we extend our congratulations and our good wishes for its future.

INTERESTING details as to the action of carbon and cellulose in cyanide solutions are given on other pages of this issue by Mr. A. J. Clark and Mr. W. J. Sharwood. More than one metallurgist has discovered to his cost that ashes carelessly thrown over the dump cause serious losses when later the dump is re-treated. At the Oriental Consolidated in Korea, it was necessary to jig out the ashes before treating certain old dumps. At the Homestake some puzzling initial failures in extraction were traced to ashes dumped into an open pit and finally drawn through the chutes with ore. Mr. W. A. Caldecott has called attention to the bad effect of charcoal mixed with lime burned in old fashioned kilns when the latter was used to neutralize acid solutions. It has long been known to geologists and others that black shales precipitate gold from underground waters, but quantitative expression of this effect of organic matter has been lacking. The paper will be read with wide interest because of both its practical and scientific bearing.

ELECTRIC REDUCTION of iron ore, a subject comprehensively discussed in this issue by Mr. Joseph W. Richards, the accomplished professor of metallurgy in Lehigh University, is a matter of large interest in Canada and on the Pacific Coast. In the eastern and southern centres of pig-iron production where fuel is abundant, there has been no need to resort to the electric current. Since it has been in these districts naturally, that the most of the American study of the metallurgy of iron has taken place, possibilities in the use of the electric current have been overlooked. Both the North and the West have ore and water-power and in time the latter may be expected to recompense for the scarcity of fuel, in metallurgical work as well as in transportation and general manufacturing.

SWEDISH geologists and officials are making elaborate preparations to entertain the eleventh session of the International Geological Congress in Stockholm, next August. An interesting program and an attractive list of excursions are offered. The well known hospitality of the Swedish people is sure to make the occasion enjoyable entirely aside from its professional interest. We are glad to note, though, that especial effort is being made to give point and purpose to the discussions. The Congress was formed to introduce as large a measure of uniformity as possible into international geological nomenclature and literature. The great plan for a one to one million scale, international, geological map was formulated, and the map is now in process of publication. Questions of correlation and nomenclature have been repeatedly discussed and much in the direction of simplification has been accomplished. More, however, has been proved impossible.

With each meeting, the regional character of geological development has become apparent and at the session held in the City of Mexico in 1906, it became clear that of the original purposes of the Congress some had been accomplished and others must be abandoned. The social features of the gatherings had been gradually accentuated at the expense of the scientific sessions, until a change of some sort was clearly desirable. The Congress was in danger of being smothered by the hospitality of its successive hosts. Accordingly it was decided to meet thereafter at intervals of four rather than three years, and the character of the program was given earnest attention by the Council. As a result the Stockholm session will be notable, among other things, for the presentation of an elaborate compilation of data on the iron-ore resources of the world. This work was begun by the Executive Committee early in 1908. Requests for information were sent to geologists and mining engineers in every country and the responses were so numerous that the report occupies 1100 pages with numerous illustrations and maps. It will be laid before the Congress for consideration and is sure to bring out much illuminating discussion. Another piece of work undertaken by the Executive Committee, relates to climatic changes since the last glacial period. This subject, while of less immediate economic importance, is of equal scientific interest and the discussion may be expected to clear up many misunderstandings. Altogether the session promises to be extremely useful as well as pleasant and we congratulate those of our fellow workers who may find time to attend.

Geological Survey Building

Estimates have been submitted at Washington for a fire-proof building to house the Geological Survey and related bureaus. That such a building was not provided long ago is another evidence of the uneconomical and unbusinesslike manner in which Government affairs are conducted. Considered on its merits, absolutely no objection can be urged against prompt provision of adequate and safe quarters for this and other branches of the Government service. Unfortunately the matter is not considered upon its merits. Last year it was defeated by the arbitrary and unexplained opposition of one member of Congress, Mr. J. R. Mann, of Chicago. The reason that the Government continues to rent inadequate buildings at high profit to private owners hather than to build, substituting low interest charges for high rent, lies in part in the fact that Washington office buildings are largely owned by members of old families that are in position to dispense coveted social favors to new Senators and Congressmen. In this way ties are formed which, quite unconsciously perhaps, influence results. Another reason is the inertia that must be overcome to secure any legislation. The major difficulty, however, lies in a profound disagreement between the Senate and House over a building program.

A few years ago the Senate secured a report and plans for the future development of Washington along artistic lines, from a commission of architects, engineers, and artists of the highest repute. Since then it has consistently attempted to secure the adoption of this plan and has made repeated efforts to induce the House to consent to the purchase of the necessary land. Mr. Cannon and other leaders of the House have opposed this, urging that a general purchase of land would require a bond issue. Washington is unique among American cities in not being allowed to go into debt. It is admitted that buying the land as needed involves paying prices which increase with each purchase, but the House leaders have held that prices are already inflated and seem to prefer the chances of future to present bargaining. They have been roundly abused and their opposition has been held to reflect an unreasoning opposition on the part of Mr. Cannon to anything artistic as being a mere fad. However that may be, there is at least one good reason for their stand.

Much land in Washington is owned by Senators and there is a not unnatural profit in selling it to the Government. Not all Senators have the high sense of honor possessed by Mr. F. G. Newlands, of Nevada, who, when land in which he had an interest was bought as a site for a 'Hall of Records', insisted that his share should go to the Government at the price he had paid, and refused to make any

profit from the transaction. This particular piece of land, as it happens, was that selected last year for the proposed Geological Survey building, and Mr. Mann has intimated that it was bought following great public clamor for a 'Hall of Records', which clamor significantly disappeared after the land had been sold to the Government and profits taken on the transaction. All this explains a not unnatural and human feeling of resentment on the part of members of the House, but it does not justify opposition to an important and much-needed public improvement such as the building for the Geological Survey. That highly useful Bureau needs better and bigger quarters, and it is of large importance to the mining industry throughout the country that its invaluable records be preserved from destruction.

Validate the Land Withdrawals

As is well known to our readers Mr. Roosevelt while president, and Mr. Taft after succeeding him, withdrew from all forms of entry large tracts of public land supposed to contain mineral deposits or to be suitable for water-power development. It is less well known that such withdrawals by executive proclamation have been made at intervals for more than forty years. The power, it is true, had never been used in a wholesale manner until within the last few years. Recently it has been questioned. No objection would probably have been made if only lands needed for Governmental purposes had been withdrawn. In many cases, however, there has been no pretense even that this were true. Believing that the present land laws were defective and that public interests would suffer if the land remained subject to entry, the President has withdrawn various tracts "pending legislation" and has recommended to Congress the changes that he considers necessary. There is wide disagreement as to these changes.

In our Washington letter this week we present the text of the Administration bill relating to phosphate, oil, asphaltum, and natural gas bearing lands. In the Discussion department is a criticism of this bill by Mr. Roswell H. Johnson, an experienced engineer operating in the Oklahoma oilfields. Mr. Johnson is an especially competent critic since he is in complete accord with the fundamental purpose of the President and has had experience in the only territory where operations are now conducted under leases administered by the Secretary of the Interior. We believe that there is general agreement with the Administration in what it is trying to do, preserve the public domain from spoilation by individuals at the expense of the people as a whole, but there is quite as general disagreement as to the best means of doing this. Many strongly advocate a leasing system; others propose ceding the lands to the States as representing the people of the communities most affected; still others argue for sale by either the State or the Federal Government, under various restrictions as to title. It is obvious that there is no consensus of opinion as to what should be done though there is wide interest in the matter. California is especially concerned in the status of the oil lands. Idaho has a major interest in phosphate. Utah, Colorado, Wyoming, and Montana, especially, are concerned with the disposition to be made of the coal lands. All the Western States have a large stake in the conditions under which water power shall be developed in the future, and every State in the Union has some concern with the solution of the problem. It is not unfair to claim for the Western States the largest and most direct interest, and yet even in the West there is no general agreement as to what should be done. If the matter be settled now it must be on the basis of Eastern sentiment, and the people east of the Mississippi are not much, if any, more united in regard to plans than are those west of that river.

We are not disposed at this time to argue for any particular solution of the problem, nor do we believe it necessary to further impress its importance. We gladly open our columns for its general discussion and we suggest that the proper use and disposition of the public lands is the question most worthy of prominent place on this year's programs of the American Mining Congress, the Trans-Mississippi Congress, the Irrigation Congress, and the various other bodies which meet annually to assist in formulating public opinion. Let there be full and frank discussion from all points of view and we are sure a sound conclusion will be reached. If, in turn, Western public opinion unites on a program which is logically defensible, there need be no fear that Congress will disregard its mandate.

In the meantime it is of first importance that the present status be maintained. There will be no need of locking the stable door if we defer till after the last horse has disappeared. While a few remain, it would be well to give a key to the President, that terms of sale or hire may be debated with profit. Mr. Taft has stated his own doubts as to the legality of the withdrawals. That is a point about which lawyers differ and it would be well to resolve the doubt in favor of the general good. The Senate committee has reported a bill validating the withdrawals which have been made and specifying the terms and conditions under which they may be made in the future. It is required that all lands withdrawn shall be reported to Congress each year for such action as may seem wise. This temporary withdrawal of land will to some extent check development and that is an added reason for prompt settlement of the difficulties. Temporary inconvenience is the price we pay for past laxity and for being at present uninformed as to facts and ununited as to policy. Any withdrawal can hardly operate to extinguish rights where entry was made before the land was withdrawn and in those cases where entry was made in good faith after the land had been announced as withdrawn, it is probable that the entrymen will, in some way, be given preference when the land is finally re-opened to entry or lease. In view of the general complexity of the case some such solution only would be fair and just; and the American people are never willingly unfair. The immediate need is to remove all possible ambiguity by validating the withdrawals, then to get together on a carefully considered and consistent scheme of land control or lease.

The Tayeh Iron Mines

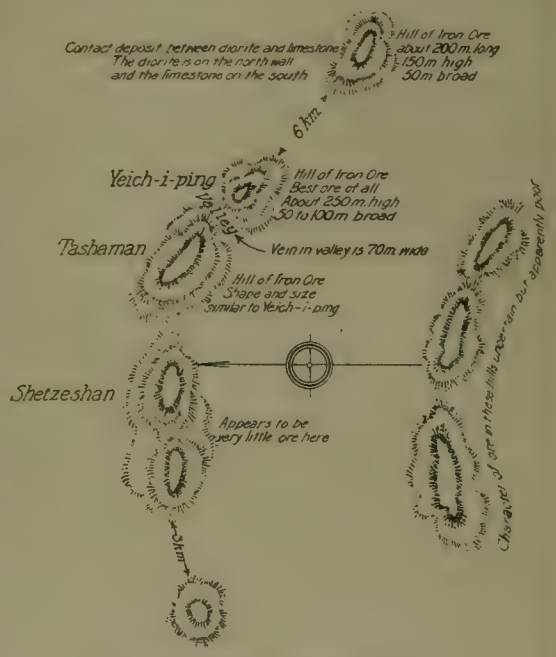
Written for the Mining and Scientific Press
A. J. Seltzer

The mineral wealth of ancient China is shrouded in mystery. In China, as well as in almost all parts of the outside world, fabulous, or at any rate, almost incredulous tales are spun by the score, concerning China's hidden treasures. Doubtless the truth of some will be demonstrated in the not distant future, but today they remain mysterious and unsolved. I dare say, the magnitude of some of them, consigns them to the land of perpetual fairyland. That there are gigantic deposits of ore and mineral, of all sorts and descriptions—and most especially of coal and iron ore—no one who has ever traveled extensively in China will deny, but there is no means to justify even a conjecture as to the quantity. Only an exceedingly small amount of prospecting or exploitation has ever been done, and even a smaller number of mines are now being operated.

The Tayeh iron mines and quarries have been worked since about 1888. This interesting iron range is situated in the eastern part of the Province of Hupe, 510 miles inland from Shanghai, and 26 kilometres southeast of the mighty Yangste river. It is one of the largest iron orebodies in China and one of the few that is being worked. The Hanyang Iron & Steel Works, at Hanyang, 145 kilometres up the Yangste Kiang from Tayeh, are being furnished with 500,000 metric tons per year from these mines and 125,000 tons are also exported to Japan. The Tayeh range is a contact deposit between a compact close-grained diorite on the north and very pure, almost white, marbly limestone on the south. The diorite being very hard and not seriously affected by weathering, has not been eroded to any great extent and lies snugly against the iron ore to its maximum height. The limestone has been seriously eroded and in many places has left the hematite near the surface; the richest part of the range has a southeast trend, but just beyond this rich part, the vein is almost barren and runs practically due east and west.

The main orebody appears in two symmetrical conical hills, each being 250 metres in height, about 50 metres in diameter at the top, and 200 at the base. The vein connecting these two hills is 70 metres wide and the distance between the bases of the hills is about 200. The ore in these two hills is a good hard hematite. It is necessary to drill and blast the greater part of it. The drilling is all done by hand and a poor driller is Mr. Chinaman. The German engineer in charge informed me that it was next to impossible to persuade a Chinese that the Western method of pointing holes is superior to and far more efficient than his own. The Chinese drillers insist on carrying out their own ideas in the matter; as they do in most things. I observed numerous holes pointed in such a manner that the least, rather than the greatest, quantity of ore would be shattered. I was informed that the drillers were instructed many times a day, in regard to the proper pointing and even have the holes marked for them, but ignore the marking and place the holes according to their own ideas. The engineer informed me that one good German driller would break as much ground as eight or ten Chinese.

The work in these hills is all open-cut. Levels are made at convenient but irregular distances. There are four levels from the ordinary ground level to near the top of the hills. The method of procedure is to go in on the limestone contact and cut out slices from one bench to the next higher, then cut back until a floor is made on this level, following this by taking a vertical slice to the level above, and so on. The hill-side presents the appearance of a gigantic stairway. As the ore is blasted, it is carried to inclined planes, in wicker baskets, two of which suspended from a 6-ft. bamboo pole are carried on his shoulders by each coolie, and dumped into one-ton


Contact deposit between diorite and limestone
The diorite is on the north wall
and the limestone on the south
Hill of Iron Ore
about 200 m. long
150 m high
30 m broad
6 km.
Yeich-i-ping
Hill of Iron Ore
Best ore of all
About 250 m. high
50 to 100 m broad
Pasheman
Vein in valley is 70 m. wide
Hill of Iron Ore
Shape and size
Similar to Yeich-i-ping
Shetzeshan
Appears to be
very little ore here
3 km.
Character of ore in these hills unknown but apparently poor

Sketch Showing Location of Deposits.

cars, which are sent down the inclined planes and trammed to the loading station by coolies. There are four inclined planes at these two hills, two at 15°, one at 18, and the fourth at 35. The descending full car pulls the empty one up. A hold-back station or break is required at the top of each plane, however, and the 35° incline has a truck and a box arrangement, so that the full car slips into it and is held horizontal in its descent. The 35° incline is 250 metres long, the 18°, 220, and the 15° planes about 300. The steepest incline is at a uniform slope of 35° but the others are at less than 18 and 15° near the top, and also near the bottom. This is to prevent the full car from attaining too great a velocity at the beginning of its descent.

The vein is barren for six kilometres southeast of the two hills. It then appears in a third hill of ore—this being somewhat larger than either of the others. The ore here, however, is of not as high grade and contains some limonite and about 7% manganese. About 400 tons per day are taken from this hill. At this point the limestone contact contains a very pure white limestone, and it is here that the limestone for

the Hanyang works is quarried. Following the vein from the opposite side of these two richest hills it is found to be practically barren for three kilometres and then a small hill containing a poor grade of ore is found. Beyond this hill three more occur in close proximity. These three hills apparently contain ore but as little prospecting or exploitation has been done upon them no accurate statement as to quantities can be made. It is quite evident, from what ore that can be seen, that the quality is poor. Beyond these three hills nothing is apparently known of the iron content of the range.

It is safe to say that the iron can be traced through the range for 16 kilometres. Of this distance along not more than 4 kilometres is the ore rich enough to be worked. The richest ground has an extent of not more than one and one-third kilometres. I was informed that the company has done practically no prospecting or exploitation, and practically nothing is known of the depth of the vein, or its iron content other than at the three hills that are at present being worked. No deep drilling has been done and the width of vein and its grade below even the ordinary ground level is unknown. The only information obtainable in regard to the quantity of ore is that the ore in sight is sufficient to maintain the present output about 70 years. There are indications which lead me to believe that the vein is not only richer at depth, but also wider. The three hills now being worked are solid iron ore, and it is, indeed, a striking spectacle to see the thin contact of limestone cut away and the huge mass of bright hematite exposed to view, for a height of 250 metres. At present the total output from the three hills is about 1200 metric tons per day, but it is soon to be increased to over 1600.

When the ore-cars reach the bottom of the inclines, they are pushed by coolies to the head of the loading station, where they are sent down a short incline and dumped to the ground from a steel trestle. From here the ore is again loaded into small cars and pushed over to the tipples and dumped from an ordinary coal tiple, into the 11-ton cars and transported to the Yangste Kiang in trains of 12 cars each. Here it is loaded on the company's lighters and towed up the river to Hanyang, by steam launches. One launch tows two lighters, containing 350 tons of ore each—one lighter being roped alongside, the other towed astern.

At these mines there are about 3000 Chinese employed, mostly men, though there are several hundred boys. The following is the schedule of wages per day of ten hours: miners, 250 to 300 cash, equivalent in United States currency to 8 or 9.5c.; loaders, trammers, and car tippers, 100 to 150 or 3.25 to 5c.; small boys and old men who carry the ore in small wicker baskets, from 80 to 120 cash, or 2.65 to 3.65c. The cost of mining one ton of ore is 270 cash, or 9c. gold. Stripping costs 30 cash, or 1c. gold, per ton, and tippling costs 10 cash, or 0.33c. per ton. Most of the work is done by contract and one large contract is sublet to a large number of small contractors. This eliminates a great many labor difficulties which is no small matter in China. It also prevents an exhaustive drain on the patience, temper, and optimism of the foreigner. There is, of course, no scarcity of labor in China, but the efficient handling of Chinese labor presents difficulties and perennial problems that are rather mysterious to the average Westerner. The Chinese laborer resembles the Mexican in many respects, and especially, in that he will work enough days per month to provide sustenance, but no more. The average number of the days per month which the 9000 men employed at these mines at the Hanyang Iron & Steel Works, and the Pinghsiang coal mines and coke ovens work, has been found to be 21 days.

The following are the analyses of the ore and limestone at Tayeh and the raw and finished products of the Hanyang works:

	Tayeh Hematite %	Tayeh Brown Iron Ore %	Magnetite %
Fe	62.00	48.00	65.00
Mn	0.50	7.00	0.13
SiO_2	1.00	6.00	3.00
Al_2O_3	2.00	....	....
S	0.02	0.01	0.06
P	0.05	0.03	0.12

Tayeh limestone, 96% $CaCO_3$, 2.5 SiO_2.

Hanyang Blast-Furnace Slag %		Foundry Pig Iron %		Siemens-Martins Pig Iron %	
SiO_2	33.0	C	3.80	C	3.90
Al_2O_3	16.0	Si	2.50	Si	0.65
CaO	16.0	Mn	1.00	Mn	1.10
MgO	2.0	S	0.01	S	0.045
Fe	1.0	P	0.20	P	0.25
Mn	0.6				

Samples of Martin steel:

	First Sample %	Finished Steel %
C	3.340	0.400
Si	.....	0.085
Mn	0.260	0.089
P	0.240	0.055
S	0.045	0.028

The percentage of carbon in the second sample was 0.64; in the third, 0.50; fourth, 0.46; fifth, 0.44; sixth, 0.42; seventh, 0.27; eighth, 0.26; ninth, 0.22; tenth, 0.30; and in the finished steel 0.40.

Analyses of other samples of steel gave:

	Per Cent.	Per Cent.
Si	0.095	0.079
Mn	0.790	0.900
C	0.330	0.470
P	0.058	0.065
S	0.025	0.035

Rail and bolt tests made for the Peking & Hankow railroad gave the following results:

	85-lb. Rails.		Strength of Bolts.		
Strength	61 kg.	69 kg.			
Tensile strength	37.3 kg.		39.0 kg.	38.0	38.5
Elongation	17.5%	15.0%	27.0	29.0	30.0%
Elastic limit	35.0 kg.	35.0 kg.	28.8 kg.	27.0	27.5 kg.
Contraction	39.0%	36.0%	63.0%	62.0%	60.0%

Since the Hanyang Iron & Steel Works is the only one in the whole of China, that is making steel, a few words concerning it may be of interest. The company owns the Tayeh mines and the Pinghsiang collieries. This plant was built by one of the Viceroys, in the early '80s, and at first made only pig-iron, for local use. The Government attempted to produce steel, but being unsuccessful and also failing to keep the works on a paying basis, they abandoned the attempt and, in 1893, the plant passed into the hands of Chinese capitalists. Mining engineers and metallurgists were engaged from Belgium and France, the plant was re-modeled and partly re-built, Siemens-Martins open-hearth steel-furnaces were installed and the plant, thus re-modeled, began producing steel in 1894.

At present there are two 125-ton blast-furnaces in operation, four 30-ton Siemens-Martins steel-furnaces, a 100-cm. blooming mill, a 75-cm. reversing rail-rolling mill, and straightening and truing machinery. His excellency, V. K. Lee, is the general manager, but all of the engineers, metallurgists, and heads of departments, are either Germans or Frenchmen. The lesser foremen and contractors are Chinese. The thing that impresses one most, on entering the works, is the almost swarming mass of native workers, surrounding every operation and it is next to impossible to understand why they are not burned, scalded, crushed, and killed by the score. Each operation requires from eight to twelve times as many men as one is accustomed to seeing in a similar works in the West.

The company is just at present completing a most excellent modern German blast-furnace, of the latest design, and intend blowing it in this spring. It will have a capacity of over 250 tons per day, is 32 metres high, the diameter of the crucible is 3.15 metres, and there are 16 tuyeres, 8 to be used at a time, the other 8 being held in reserve. The interesting thing about this furnace is the method of cooling it. Small cast-iron pans 45 cm. long, 42 wide, and 11 deep, are set into the brick-work, around the outer circumference, giving the outer circumference the appearance of almost a net-work of these pans from the tuyeres to within three metres of the top of the furnace. The pans are placed in hodizontal rows around the circumference. The rows are 75 cm. apart, and the horizontal distance between pans is 100 cm.: the pans are so arranged that each in a row is not directly under a pan of the row next higher, but the space is so divided as to expose as little of the brick-work as possible. A slit or open space is left in the outside end of the pans and through this a 3-cm. iron pipe passes, to supply cooling water. Another similar pipe leads out of the bottom of the pan at the other side and delivers the water to the next lower pan, and so on through the system. The water is kept in circulation throughout this net-work of pans. When the water has traveled through four pans, it is conducted to troughs which pass around the circumference and is taken out of the system.

To give an idea of the slowness of construction in China, it might be mentioned that it has required three years to construct this furnace. There are many interesting incidents and illustrations of the intense superstition of the Chinese people, which might be related in connection with this plant, but as the purpose of this article was to be a brief description of the Tayeh mines, I am compelled to omit them.

It might be interesting to add that several large shipments of pig iron from the Hanyang works have gone to New York. In November, 50,000 metric tons started for America, and another shipment was made about six months previous. This company is able to lay pig iron down in New York, for less than the price quoted in Pittsburg. Shipment of Chinese pig-iron to Pacific Coast ports is not unusual. This works has a bright future, and present plans call for extensive improvements. Doubtless Tayeh iron is destined to be widely known.

HALF DOME OF THE YOSEMITE VALLEY

By F. E. Matthes.

* The Half Dome, like the other domes of the Yosemite region, represents a huge granite monolith that has survived the reduction of the more fissile rocks about it by virtue of the superior resistance to disintegration offered by its undivided mass. It is unique in that its dome form is a partial or incomplete one, being abruptly trenched on the northwest by a straight and sheer cliff face 2000 ft. high. The curving back and sides are entirely normal, having evidently evolved through progressive exfoliation, like the bulbous exteriors of all domes. Their smooth sweeping curves are indicative of maturity; for it is only through long continued shelling that a monolith of irregular shape is reduced to a continuously rounded mass. At the same time, the prevailing flatness of the back and its trend, parallel with the northeast-southwest system of joints, prominent throughout the region, are clearly inherited from the structure planes that originally bounded the monolith on that side.

For the origin of the sheer front of the dome, three hypotheses have been advanced: (1) The present mass is a true half dome—that is, a remnant of a much larger monolith, the other portion of which has caved off, perhaps owing to glacial undercutting in the Tenaya trough. (2) The monolith extended originally but little farther to the northwest, and has suffered reduction on that side, as on the other sides, merely through normal exfoliation. Only, the shells on the northwest side were plane instead of curved, because the initial bounding surface was plane. (3) The present front coincides essentially with the plane fissure that from the first constituted the boundary of the monolith, and has only comparatively recently been exposed through the rapid scaling off of the thin plates of a zone of vertically sheeted rock.

The first hypothesis seems at once to be inadmissible, inasmuch as massive granites inherently break off by conchoidal fractures and not by plane fractures of the magnitude of the dome front. The hypothesis must therefore be rejected.

The second finds some support in the overhanging shells on the top of the dome, for these plainly indicate the former extension of the monolith for a short distance to the northwest. The existence, however, of a great mass of plates clinging to the northeast end of the cliff face in the form of a conspicuous shoulder, together with the strongly accentuated fracture that separates them from the body of the monolith proper, is held to demonstrate conclusively that the monolith never did extend beyond its present front, but was actually bounded there by a zone of thinly sheeted rock. Only toward the top of the front has exfoliation set in and commenced its rounding off process (under the overhang), as is patent from the profile view of the dome obtained from the Quarter Domes.

* Read before the Washington Geological Society and abstracted from *Science*.

Electrical Reduction of Iron

By Joseph W. Richards

*Electrical reduction of iron ore is a topic, one which a few years ago could only have been discussed in a speculative manner, and by one with the prophetic gift highly developed. The reduction of iron ore by means of the energy of fuel, in blast-furnaces, is constructed on such a stupendous scale, and with such great economy, that the blast-furnace has been frequently called our most perfect furnace, and the possibility of electrical energy taking any part in this industry appeared visionary. When electric furnaces were first developed on a commercial scale, it was generally admitted that if they entered the iron industry at all their best chance was in the production of highly expensive special quality steels, costing $500 to $1000 per ton, and that their poorest chance would be to compete in the manufacture of pig-iron costing $10 to $15 per ton. Yet inside of five years, those who have watched the development of the electrical iron and steel industry have seen small furnaces turning out fine steels succeeded by larger ones successfully manufacturing common steels, such as steel-castings and rail-steel, and finally the operation of a larger electric shaft-furnace manufacturing pig-iron on a commercial scale.

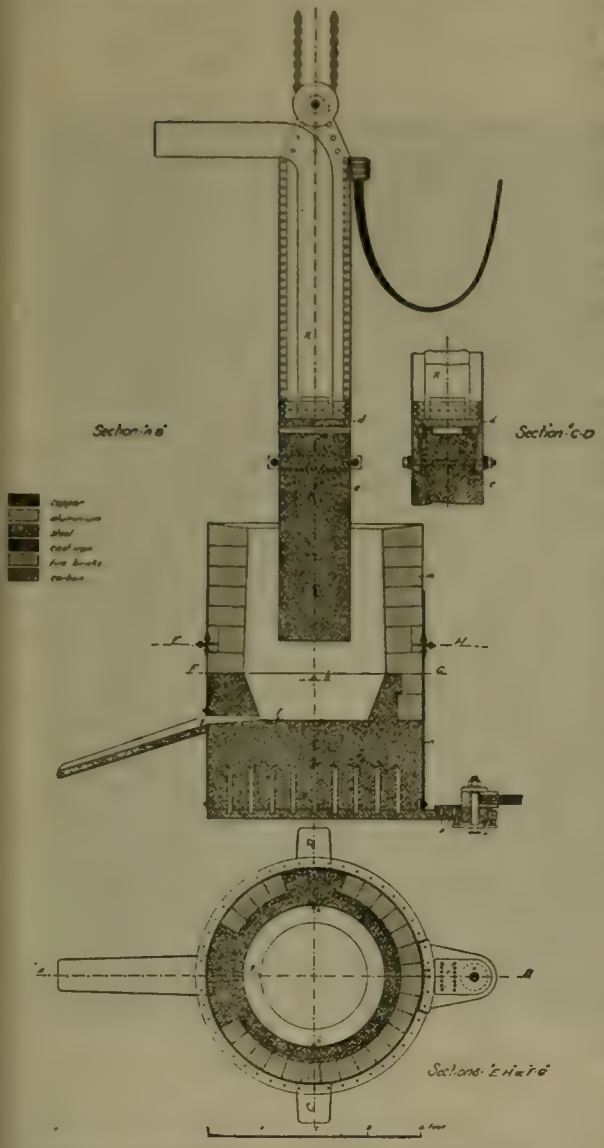


Fig. 1. Experimental Furnace Used at Sault Ste. Marie.

Most of the credit for the recent advances in the electrical production of pig-iron should be given to the far-sighted interest of the Canadian Government in this subject, principally, under the influence of its active Director of the Department of Mines, Eugene Haanel, of Ottawa, and to the enterprising Swedes, principally Assar Grönwall, Axel Lindblad, and Otto Stalhane, who have founded the company 'Aktiebolaget Electrometall', of Ludvika, Sweden. If to these we add the names of H. H. Noble, of the Northern California Power Co., and his able assistant, D. A. Lyon, who have constructed and operated an electric pig-iron furnace in Shasta county, California, the list of active workers in this field is nearly complete.

When, in January, 1904, the Canadian Government sent a commission, under Dr. Haanel, "to investigate the different electro-thermic processes for the smelting of iron ores and the making of steel, in operation in Europe," the commission found and reported upon a number of different electric steel furnaces in commercial operation, but found not a single electric pig-iron furnace at work. From the voluminous and valuable report of this commission (published by the Canadian Government, August, 1904), it is stated that several of the European works were persuaded to make experiments on the production of pig-iron. Some of these tests are described briefly in the following extracts from the report: At La Praz, France, Mr. Héroult was good enough to make some experiments in smelting iron ores. The furnace employed was exceedingly simple. These experiments were made by Mr. Héroult for the purpose of demonstrating the simplicity of the process of reducing iron ores by the electric process, and it was not intended to demonstrate a figure of cost per ton of pig-iron produced by this process. It appears from the data given that this test was crude and poorly arranged. Too little carbon for reduction was used in the charge, the furnace was run too cold, and the power-consumption ran up to 0.525 hp. per year per ton of pig-iron obtained.

At Livet, France, the works of Keller-Leleux et Cie., possessed furnaces constructed for the reduction of ore, and used for manufacturing ferro-silicon and ferro-chromium. These were placed at the disposal of the commission, and two long runs were made of 55 and 48 hr. each, with all the data carefully controlled and checked. The complete details of these runs, with illustrations of the furnace used, can be found in the report of the commission. It is of the resistance-type, with two shafts, each with its vertical electrode embedded in the charge, and connected by a well in which metal and slag collect. The current passes from the electrodes to carbon blocks embedded in the base of the furnace. The lining was a rammed-in mixture of dolomite and tar, similar to

* From the *Journal* of the Franklin Institute.

that of a basic-lined bessemer converter. The electrodes were square, 280 mm. (11 in.) on the side and 1400 mm. (56 in.) long. The 55-hr. run was interrupted to put in a watt-meter, and the metal set in the furnace, so that the power-consumption for this run, 0.52 hp. year per metric ton of pig-iron, was abnormal. In the second run of 48 hr. no interruption occurred, the furnace "working quietly, and without the slightest accident: the gases discharging on top in flickering flames," showing that the gas resulting from the reduction of the ore escaped at a low pressure. The workmen were ordinary Italian laborers, without any special training." This second run was successful in producing, at will, different classes of pig-iron, gray, white, and mottled, and in setting a definite figure for the amount of electric energy required per ton of pig-iron produced. The furnace was nominally of 300 hp. capacity, but running with 350 hp.: it consumed 0.25 hp. year per metric ton of pig-iron produced, using 41% of fuel. This is a satisfactory figure, and is partly attributable to running the furnace hard, that is, above capacity.

On the return of the Canadian Commission from Europe, and the publication of its report, the Canadian Government placed at the disposal of Dr. Haanel and his staff $15,000 for investigating the suitability of the electric process for reducing Canadian iron ores. The experiments were carried out early in 1906, and may be found recorded in detail in the report published in February, 1907, by the Mines Branch, Department of the Interior, at Ottawa. An analytical discussion of these experiments, and the results obtained, was later presented by myself to the American Electrochemical Society at its meeting in New York City, October 18, 1907, and published in the Transactions of that Society, vol. xii, p. 81. The furnace used is shown in Fig. 1. The following conclusions from the author's analysis may here suffice: (1) Too much carbon was used in every case, not allowing a good utilization of the heat of oxidation of carbon in the furnace. A smaller proportion of carbon, more perfectly consumed to CO_2, would have generated more heat and thus have helped the furnace more. (2) The electric current furnished about two-thirds of the energy required for all purposes, the carbon one-third. (3) The consumption of fixed carbon was 24 to 38% of the weight of pig-iron, giving ratios of CO to CO_2 in the gases of 4.5 up to 9, by volume, whereas a ratio of 1 is possible, would require far less carbon, and would produce more heat in the furnace. For the details of this analysis reference is made to the original paper. One thing is particularly worth noting, the Sault Ste. Marie furnace was small and was worked hard, a condition favorable for small conduction and radiation loss, and economy of power.

The experiments at Sault Ste. Marie bore fruit first in Sweden, by inciting experimenters there to construct a large electric shaft furnace for the regular commercial production of pig-iron. Messrs. Grönwall, Lindblad, and Stalhane, conducted preliminary experiments at Ludvika, Sweden, in the summer of 1907, with a small furnace of 300-hp. capacity; in the summer of 1908 a larger furnace of different type was constructed, and in the autumn of 1908 a still larger furnace, embodying the results of all their experience, was completed. This furnace was designed for 1500 kilowatts, and may be truly termed the pioneer electric pig-iron furnace. The best description of this furnace and its working are to be found in a paper by Dr. E. Haanel in the Transactions of the American Electrochemical Society, vol. xv, p. 25, and in the subsequent report of Dr. Haanel published by the Canadian Department of Mines, in October, 1909, entitled 'Investigation of an Electric Shaft-Furnace at Domnarfvet, Sweden'. The following details and illustrations (Fig. 2 and 3), are taken from Dr. Haanel's publications: The total height above the ground-level is 25 ft.: the crucible is 7 ft. high, the shaft, 18. The entire weight of the upper shaft

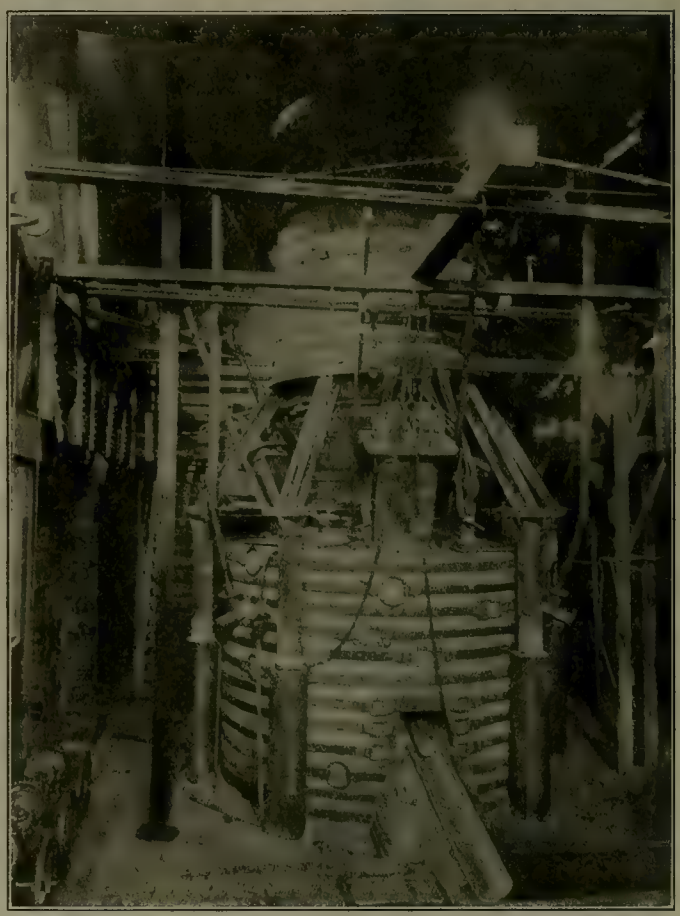


Fig. 2. Electric Furnace at Ludvika, Sweden.

is carried on 6 cast-iron columns, none of it rests on the arch covering the crucible. This arched roof has openings for the three electrodes, each composed of two carbons 11 in. square by 63 in. long, making each electrode 11 by 22 by 63 in. The electrode holder is a steel frame into which the electrodes are fastened by copper wedges. The electrodes pass through water-cooled stuffing boxes. The crucible is lined with magnesite-brick, a material never found usable in blast-furnaces. Some of the escaping furnace-gas is pumped back by means of a fan into the free space under the crucible arch, for the purpose of cooling off that arch and so preserving it from the intense radiated heat. The electric current is supplied as 3-phase current to the three electrodes by three transformers of 500 kilo-volt-amperes each, transforming the current down to $^1/_{14}$ its primary voltage, and capable of regulation between 20 and 85 volts. The especially novel features are the arch over the crucible, the projecting downward of the electrodes through this arch into contact with the charge as it spreads out from the central shaft into the crucible, the magnesia lining, and the return of part of the throat-gases into the crucible under the arched roof. It can readily be seen that a large amount of thought and experience are embodied in the details of this furnace.

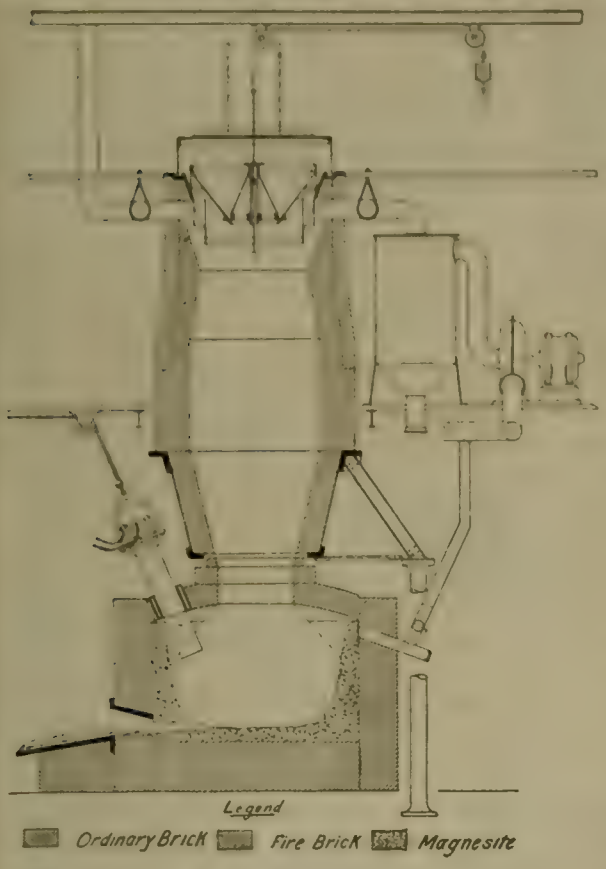


Fig. 3. Section of Ludvika Furnace.

A trial run was made under Dr. Haanel's inspection starting with the cold furnace. Besides the handicap of starting cold, and with all the masonry fresh, the furnace was insufficiently supplied with power. Instead of the 1500 kw. which it was designed for, only about 400 could be gotten. Under these circumstances, the losses of heat by radiation and conduction were probably almost as great intrinsically as they would have been with full power, which means that they were relatively or proportionately, to the energy used, probably three or four times as great. The result of the test is, therefore, far from indicating the maximum commercial efficiency of this furnace.

In spite of these adverse conditions, pig-iron was made from the ore at the rate of 0.40 electric horse-power year consumed per metric ton of pig-iron. The fuel consumed for reduction was 27.5 kg. of coke per 100 of pig-iron, and of electrodes 5 kg. It is altogether reasonable to assume that the power-consumption, when in regular running, will not exceed 0.3 electric horse-power year, and on this basis, counting power at $12 per electric horse-power year and charcoal (83% carbon) at $8 per metric ton (2204 lb.), Professor Odelstjerna, of Stockholm, has estimated that pig-iron can now be made in Sweden in this furnace at $1.50 per ton less than in Swedish blast-furnaces. It is my opinion that this furnace, if run at 3000 kw., could make pig-iron at 0.2 electric horse-power year per ton of output, making a further saving of $1.20 per ton. With a prospective saving of $2.50 per ton, the Swedish blast-furnace industry stands a good chance of being superseded by the electric furnace, as soon as the latter gets into proper working order.

The accompanying diagrams are intended to illustrate the fundamental principles of electric furnace-reduction of iron ore. They are entirely dependent upon the rate at which the furnace is run and the proportion of CO to CO_2 in the gases. In the latter respect, a proportion of 1 to 1 by volume is entirely practicable and should be attained in electric smelting, although 2 to 1 is the usual ratio in blast-furnace practice. A kilogram of oxygen burning carbon to CO gives up 1820 heat units, but if burn-

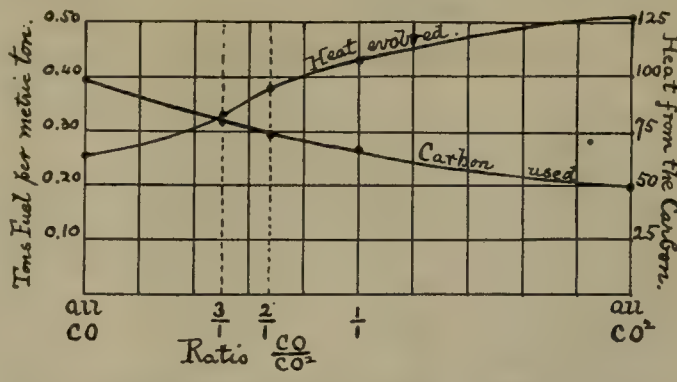


Fig. 4. Variation of Fuel Required, With Composition of Waste Gases Produced.

ing only half as much carbon to CO_2 it gives up 3075 calories. Since there is a definite amount of oxygen to be removed per ton of pig-iron made, more assistance is obtained from the combination of carbon and oxygen the more CO_2 and the less CO is formed. Fig. 4 shows the heat evolved, in units of 1000 calories, as the ratio of CO to CO_2 varies from all CO to ratios of CO to $CO_2 = 3$, 2, and 1, and extended to the supposed case of all CO_2 being formed. It shows graphically the fact that the smaller the amount of carbon used the more heat is obtained from its oxidation, because it is being burnt by a fixed quantity of oxygen.

Experiments on the reduction of iron oxides in currents of CO gas render it improbable that a lower ratio of CO to CO_2 than 1 to 1 can be obtained in practice, even under the most favorable electric furnace conditions. This corresponds to 0.26 ton of carbon per ton of pig-iron made, and a thermal assistance from the carbon of 1,111,500 calories (1750 horse-power-hours) per ton of iron.

Fig. 5 shows the variation of horse-power required per ton of pig-iron with the ratios of CO to CO_2 in the gases. It shows distinctly how wasteful of power it is to run a furnace with too much carbon. With a certain amount of carbon charged it is practically impossible to utilize it except it burns mostly to CO, and then the high power-consumption is the result of the lack of proper thermal assistance from the carbon. The power-curve of the Swedish furnace is above those of the Sault Ste. Marie runs, for the same fuel-consumption or ratio of CO to CO_2, because the former furnace was being run at not over one-fourth, possibly nearer one-sixth, of its proper power-supply, while the latter furnace was small and was pushed hard. The difference of 0.1 hp. year per ton of pig-iron made is probably entirely ascribable to high radiation and to conduction losses, due to the relatively slow running.

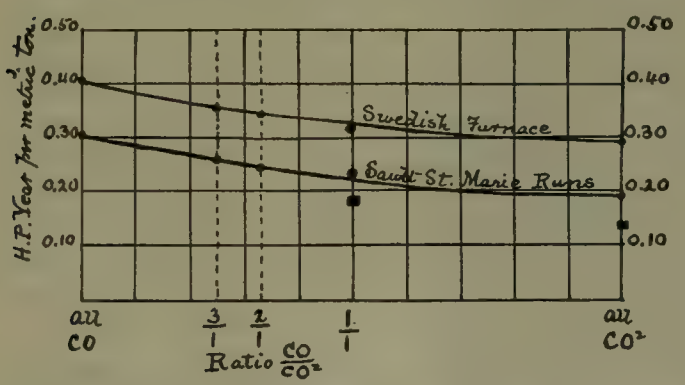


Fig. 5 Variation of Power Required, With Composition of Waste Gases Produced.

Dr. Haanel gives sufficient data for forming a good idea of the heat distribution in the large Swedish furnace, the charges being, ore, 220; coke, 37.4; lime, 4.4. The data are as follows:

ORE	Per Cent.
Fe	62.96

COKE	Per Cent.
S	0.55
C	85.00
Ash	14.45

SLAG			
SiO_2	26.54	CaO	54.48
S	0.78	Fe	0.35

PIG-IRON			
Fe	94.485	C	3.20
Si	0.075	Mn	0.33
P	1.900	S	0.01

GASES	Vol. %
CO_2	25.00
Co	65.00
H	10.00

From the above data it can be calculated, assuming the gases escaping at 250°C. and the pig-iron and slag at a little above the blast-furnace temperature, that the energy received and distributed by the furnace is about as follows, per 100 kg. of pig-iron:

HEAT DEVELOPED	Calories.
Carbon oxidized to CO	52,318
CO oxidized to CO_2	44,785
Formation of slag	2,058
Carburization of iron	2,256
Total heat of chemical reactions—31%	101,417
Heat energy of 0.041 e.h.p. year—69%	223,171
Total available energy	324,588
Average required in blast-furnaces	400,000

HEAT DISTRIBUTION	Calories.	Per Cent.
Reduction of iron oxide	155,221	48.00
Reduction of other oxides	10,174	3.50
Evaporation of water	1,025	0.30
Sensible heat in waste-gases	4,075	1.30
Sensible heat in pig-iron	32,500	10.00
Sensible heat in slag	8,600	2.70
Radiat'n and conduct'n loss (diff.)	112,850	33.20

The last item of the above schedule is much larger than it should be. Some modern blast-furnaces run with one-tenth that much. The trouble with this furnace was that it was run only about one-tenth as fast as it should be for heat economy. If it be assumed that this furnace is run fast and carefully, so as to get a ratio of CO to CO_2 in the gases of 1 to 1, it can be estimated what will be the probable running of a large electric pig-iron furnace, such as will undoubtedly be in steady operation in the near future. The requirement for power will be that necessary to furnish the needed heat, less that furnished by the chemical reactions.

These will be, per ton of pig-iron produced:

HEAT AND POWER REQUIREMENTS	Calories.	Horse-power Hours.
Needed for reductions	1,655,000	2600
Sensible heat of pig-iron	300,000	470
Sensible heat of slag	60,000	100
Radiation and conduction	100,000	160
Total	2,115,000	3330
Furnished by chemical reactions	1,111,500	1750
Needed from electric current	1,003,500	1580

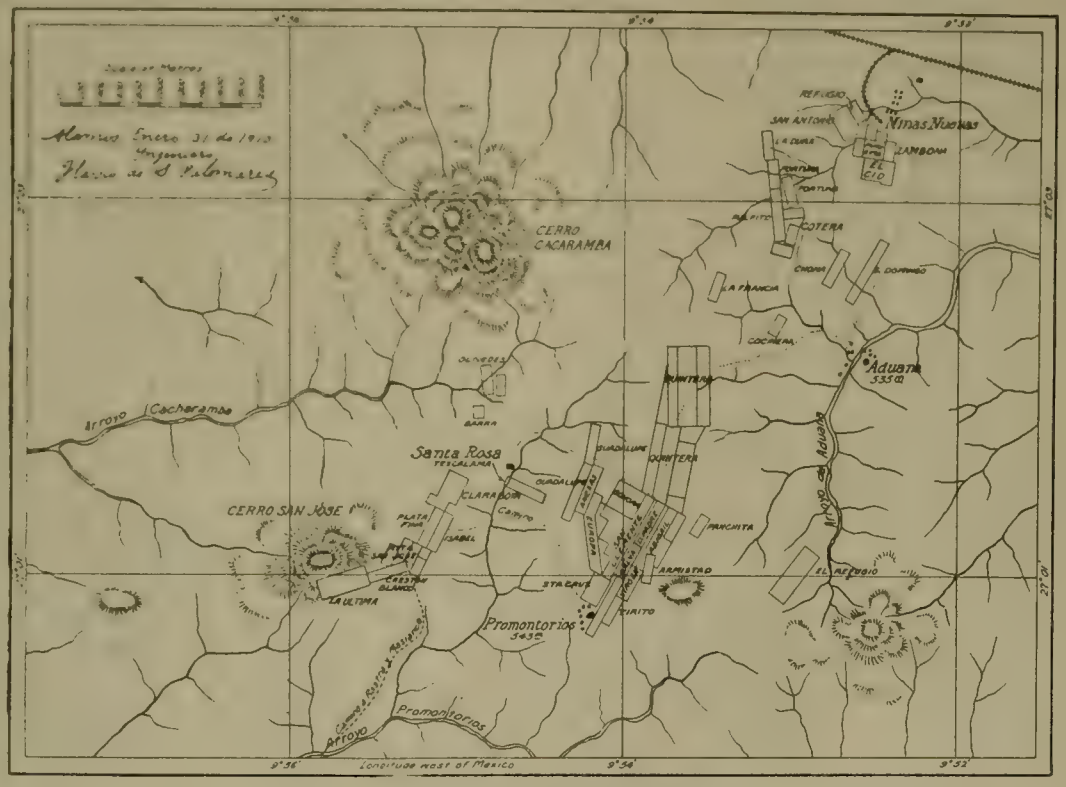
The following is therefore the conclusion of this investigation: If a larger electric shaft-furnace is run rapidly, with abundant power, and the gases escaping contain at least as much CO_2 by volume as CO, the minimum power-requirement which will be approximated is 1580 hp.-hours, or 0.18 hp.-years, per metric ton (2204 lb.) of pig-iron produced. One ton per 0.226 hp.-year has already been reached in an experimental run.

Alamos-Promonitos District

Written for the Mining and Scientific Press
By T. P. Brinegar

The mines which constitute this group are on the mineral zone which crosses the Alamos mountains about seven miles west of Alamos, Sonora, Mexico. The heart of the zone lies within a rectangular surface 1½ miles wide by 4 long, which commences at the Zambona mine, near Minas Nuevas, on the northeast, and extends southwest to include the Old Promontorio and San José mines. Precious metals were discovered in this region early in the eighteenth century, and the quantities yielded by this group alone have exceeded $100,000,000 in value. According to Gamboa's 'Treatise on Mining', one remittance, in 1799 under charge of Alvarez, amounted to more than 1600 bars of silver. Humboldt noted in his records, 1808, that he "passed a train of one thousand mules loaded with bars of silver from these mines on their way to the City of Mexico." The production became so great that the Government was induced to establish a mint in Alamos for the special purpose of coining the metals produced at this point.

The geological formation is clearly revealed. The basal rock of the region is granite which has been disturbed by powerful deep-seated forces. From these earth-disturbances originated two well defined fissure-zones. The uplift of the earth-crust on the southeast formed the Alamos mountains, and its subsidence on the northwest resulted in many irregular folds, which were covered by extensive volcanic eruptives, chiefly of an andesitic type. In turn this was covered by sediments, the larger part being limestone. The conditions were favorable for erosion, which reduced the elevation several thousand feet. The fissure-zones, under present surface conditions, are about 5000 ft. apart, striking in a northeast direction. Both have granite 'floors' or footwalls, and dip toward each other. Between them is a 'core' of andesite porphyry which forms the hanging wall of each vein-zone. This core was the centre of subsequent dynamic activity, shown by the evidences of upheavals and the rearranged condition of the strata. In it are found many igneous dikes. Constant movements between the walls of the fissure-zones served to keep them open to the free circulation of mineral-bearing solutions. Cerra Cacharamba, a volcanic 'neck' 3700 ft. above sea-level, is the land-mark of the district, and Humboldt during his visit to the camp in 1808, wrote figuratively that, "Cacharamba rests on a bed of silver." It seems that the past hundred years of mining near its base has demonstrated that the great scientist was not far amiss in his rhetoric.



The Alamos-Promontorios District.

The fissure-zones have been designated as east and west contacts. The east contact is the 'mother lode' of the zone, and is generally known as the Promontorio-Quintera vein. The names of the productive mines situated on the several big ore-shoots of the vein are, Old Promontorios, Quintera, Santo Domingo, and Zambona. The Púlpito on the north and the Nueva Promontorio on the south are new properties in course of development and which have mineralized veins that promise future productiveness. Generally, mixed ores are extracted from mines on the east contact, which are found in the form of

oxides near the surface and turn into rich sulphides in depth. Some of the ore-shoots are over 700 ft. long, and in many places over 40 ft. wide. Gray copper is the principal ore from this lode, and its fabulous quantities and high silver content are almost unparalleled in the annals of mining. These mines are owned by different companies, each of which has more 'likely' ground than it will explore in a score of years.

The west contact is best known as the San José-Claraboya vein. Through the past two centuries it has remained comparatively unexplored. The Mineral de Santa Rosa (Claraboya) is said to be the oldest in the camp, and from the large drill-holes found in the old *tajos* (open-cuts), one can give credence to the tradition that "it was the rich mine of the early fathers." The San José-Claraboya is a well defined vein of creamy to reddish-brown quartz, as shown in the workings on the lower levels of the two mines of the same names. In the upper workings or shear-zone, the vein branches into seven parts, all of which unite in depth forming a body about 40 ft. wide. The groups of mines which have been under process of development during the past year are: Claraboya, San José, San Clemente, and Plata-Fina. El Ultimo, Barra, and Olvidos are held as important prospects. The ores from the mines on the west contact yield native silver, oxides, and gold. They are very docile, and readily yield to simple economic treatment. The assay values range from 15 to 5000 oz. silver and up to $70 in gold. The old dumps of the Claraboya have been very profitable to the owner who has been reworking them during the past two years. He is developing the mine with an adit which is giving good results. The San José is regarded as the 'mascot' of the camp. It was bought by G. W. Du Bes about a year ago, since which time he has been developing and shipping ore, and erecting machinery. The Plata-Fina is between the San José and Claraboya, adjoining them. It is being developed by a shaft on the junction of the several veins. The San Clemente is owned by Rafael Ibarra, president of the town of Promontorios. The ore extracted more than pays expenses, and the owner regards it as the best prospect he has ever owned. These new workings, along with the Púlpito and Nueva Promontorio on the east contact, go to show what great possibilities await the judicious investment of capital along these two great fissure-veins. Side by side with these great mines are many undeveloped prospects that, judged by surface indications, warrant exploration.

The district possesses favorable economic conditions for mine operations. The altitude averages about 2000 ft. above sea-level, and gives a climate, modified by the gulf-breezes, that is as healthy as any place on the Pacific Coast. Water is abundant and of the best quality. The west part of the zone has access to the wooded hills to the southwest where such fuel is cheap. The transportation facilities are now good, as the recent completion of the Southern Pacific Railroad of Mexico affords an outlet from Minas Nuevas, and good wagon-roads lead to Masiaca, also on the railroad, and to the nearby seaport of Agiabampo. The cost of living and freighting is low.

Carbon and Cellulose in Cyanide Solutions

By A. J. Clark and W. J. Sharwood

*These notes contain the results of a series of experiments and observations made by the authors at the Homestake mine, Lead, South Dakota, together with information on the subject gathered from various sources.

Two sets of experiments were made on the precipitating effect on gold-bearing solutions of various precipitating substances, with the results tabulated below under series A and B. In each experiment 300 c.c. of solution was taken. In series A, 5 gm. of the precipitant was added; the mixture was stirred vigorously for a moment and filtered, with further agitation each time the funnel was refilled with the liquid. After filtration the filtrate was passed through the filter again, being thus exposed to the sediment retained by the filter a second time. In series B the conditions were the same as in A except that a larger quantity of precipitant (which was not weighed, but was at least 20 gm.) was taken, and there was only a single passage through the filter.

Series.	Precipitant.	Original Assay of Solution.	Assay of Filtrate.	Gold Precipitated.
				%
A	Graphite (Dixon's flake)	$2.63	$2.65	0.0
	Bituminous coal (40 mesh)	"	2.45	7.0
	Coke (40 mesh)	"	2.11	19.6
	Charcoal (pine, 40 mesh)	"	1.92	27.0
	Calcium carbide	"	2.50	5.0
	Zinc dust	"	0.02	99.3
B	Graphite	2.73	2.73	0.0
	Coal	"	2.13	22.0

Repeated tests have shown similar results. Pure graphite, whatever its source, seems to be entirely without effect on the gold in cyanide solutions, and anthracite coal nearly so. The semi-bituminous or sub-bituminous coals of the Western United States have a feeble precipitating action. Well burned coke is fairly effective and charcoal much more so. Lubricants containing graphite with mineral oil, intended for use in rock drills, and the clean graphite extracted from them, are entirely without effect after several hours' contact with solution. Either a sufficiently long contact with, or a slow percolation through, a relatively large amount of bituminous coal, removed as much in some cases as 99% of the gold in a cyanide solution, but the efficiency of the coal as a precipitant fell off with repeated use, as is the case with charcoal.

Experiments on the effect of wood ashes containing a small proportion of charcoal on the cyanide extraction of gold from tailing containing pyrite were made in percolators upon pyritous tailing, to which various proportions of ashes were added, together with a suitable amount of lime (about 5 lb. per ton), the charges being thoroughly mixed. The cyanide solution was in actual contact with the charges four days, but the charges were drained dry once during the treatment, as well as at the conclusion. The tailing assayed about $1.75 in gold per ton, and upon

*Abstract from Trans. Chem., Met., & Min. Soc. of South Africa.

it, under normal conditions, without the presence of wood ashes, an extraction of at least from 70 to 75% would have been obtained. The results of the experiments were as follows:

Ashes Added to Pulp	Gold Extracted by Cyanide
%	%
0.47	62.8
9.8	46.0
1.56	60.8
8.0	51.1

At the Homestake cyanide plants, when similar ashes or charcoal have been inadvertently introduced into the treatment vats a very small percentage has been found to lower the gold extraction from 70 to 75% to less than 60. As to the origin of these ashes, in one case it had been traced to an old stope, into which they had been dumped from the surface some years before; in another case charcoal had been produced by the charring of timbers in a former mine fire, and had become mixed with the ore treated. Sometimes charcoal and cinders have been introduced into the plants by the dumping into the mill launder of ashes from a heating stove; at other times accumulations of ashes and clinker, produced by the burning of chips (collected from the mortars), had been run through the batteries.

Some years ago heavy losses were reported in the cyaniding of ore at an Australian mine, at which crushing and amalgamation were facilitated by heating the ore by burning it like limestone in a furnace with alternate layers of cordwood, and quenching the heated ore with water. A similar kiln treatment has been used successfully at some small California mines, rendering refractory ore containing pyrite and tellurides more amenable both to crushing and amalgamation in an arrastre, but it seems to have proved fatal to cyaniding in the former instance, probably owing to the presence of charcoal. Park ('The Cyanide Process', 1897 ed.) states that in New Zealand it was found advisable to hand-pick charcoal from dried ore prior to crushing and cyaniding.

Several instances have been reported where 'graphitic' ore (usually slate or schist) has caused re-precipitation. Most likely this is due to the fact that the carbon in such carbonaceous schists is often far from being completely converted into graphite, and may exist largely in the form of hydrocarbons, in a condition similar to that of partly burned coal or wood.

Some floating rubbish, consisting of charcoal and charred pieces of wood, as well as some clean chips and twigs which came from a settling dam and creek bed, and particles of coke which came from the smoke-stacks of the locomotive and steam-shovel, was skimmed from the surface of the cyanide solution in a slime agitator vat. The solution contained approximately: gold, 0.023 oz. per ton (47c.); silver, 0.28 oz. per ton (14c.); and potassium cyanide, 0.02%. The skimmed rubbish was rinsed twice with water, and dried at 100° C. It was then divided into two portions, one containing the charcoal and charred wood and the other the clean chips and twigs. The two portions were then weighed, some of each being burned in clean roasting-dishes in a muffle. The substances were assayed before and after burning, with the results tabulated below.

As neither of the two classes of material contained more than its own weight of solution, when removed from the vat, obviously a considerable precipitation had occurred in proportion to the weight of the material, the coke, charcoal, and other material precipitating the gold content of approximately 100 times their weight of solution, and the twigs precipitating 10 times their weight, the corresponding amounts for the silver content being 27 and 10 respectively. In reply to a suggestion by W. A. Caldecott that these chips, and the like, might have been partly burned or charred, it may be stated that they were to all appearance unaltered. It is possible, however, that some of them had been in the dam or creek for months, or even for several years, so that actual decay may have commenced.

Number.	Material.	Proportion of Total Weight of Original Sample.	Ounces per Ton.		Value per Ton.		
			Gold.	Silver.	Gold.	Silver.	Total.
1	Coke, charcoal, and charred wood	40%	2.25	7.50	$46.57	$6.75	$49.02
2	Ash of same	2 or 2½% of total ash	18.00	60.00	365.40	30.00	395.40
3	Clean chips and twigs	60%	0.21	2.70	4.87	1.35	6.22
4	Ash of same	1 or 75% of total ash	0.96	10.80	19.48	5.40	24.88

That decaying wood is an active precipitant for gold in cyanide solution was evident from a series of samples taken from a residue dam, the sand discharged into which contained appreciable amounts of solution as well as traces of dissolved gold, so that the aeration consequent on discharging no doubt resulted in the dissolution of a little more gold. While the average assay value of the sand was lower than that of the residue as discharged, the lower strata were slightly higher in gold content, as might be expected from the leaching that had since taken place. At two points, however, a decided concentration was noted. One of these was found to be in the neighborhood of a pine post, and another around the decaying stump of a tree that had been killed by the residue. Mr. Caldecott's suggestion that the effect of the wood fibre itself is practically nothing, and that apparent precipitation by wood is due merely to absorption of solution, is confirmed by our next series of determinations.

Several writers have published experimental results[1] showing a large decomposition of cyanide and also a considerable precipitation of precious metals, due to contact with wood, canvas, cocoa matting,

[1] A. Simon, MINING AND SCIENTIFIC PRESS, Dec. 2, 1893, pp. 67-356.

F. L. Bosqui, *The Engineering and Mining Journal*, Feb. 26, 1898, pp. 65-284.

A. Forsyth and G. H. Clevenger, S. Dakota School of Mines, Bulletin 3; also MINING AND SCIENTIFIC PRESS, Sept. 9, 1899, pp. 79-285.

A. N. Mackay, Trans. Inst. Min. & Met., 1905, pp. 14-41; also MINING AND SCIENTIFIC PRESS, June 17, 1905, pp. 90-378.

S. H. Williams, *The Engineering and Mining Journal*, Sept. 9, 1905, pp. 80-435.

and other fabrics used as filters, being all forms of cellulose. Some of the writers, working on a laboratory scale, had failed to take into account the ratio of the surface of the precipitating material they used to the volume of solution experimented upon, and did not then compare this ratio with that which would have resulted by working on a large scale. Consequently some operators have been misled, believing that discrepancies in cleaning up were attributable to precipitation by the wood of tanks or filter bottoms, and therefore were induced to hope that at some future date the burning of the material would reimburse them for their supposed losses. As these writers differed considerably either in their opinions or in experimental results, we give some of our results obtained by examination of materials that had been exposed to gold and silver-bearing solutions for considerable periods.

(1) Materials from a sand leaching tank. This was nearly 40 ft. diam., the bottom having an area of 1200 sq. ft. It had been in use over a year when the first tests were made. The quantities given represent the contents of the entire material in the tank, through which many thousands of tons of solution had circulated, carrying up to $6 per ton in gold, and up to $2 silver.

(*a*) Bottom filter cloth of canvas: 8-oz. duck, 1200 sq. ft., in use for 8 months. Entire cloth: gold, 5c.; silver, 2.

(*b*) Bottom filter of cocoa matting; 1200 sq. ft., in use 12 months. Entire filter: gold, 46c.; silver, 3.

(*c*) Wooden slats. These supported the filter, and were of unpainted Oregon pine, 3800 running feet with a cross-section of 2.5 by 1.5 in., about a quarter of the material being crozed out; altogether about 75 cu. ft.; in use 12 months: entire material, gold, $16.60; silver, $5.90; wood per cubic foot, gold, 22c.; silver, 8.

(*d*) Fine slime. This had accumulated under and between the filters during 8 months, and consisted of fine ore together with precipitated carbonate of lime; altogether 200 dry pounds; entire material: gold, 20c.; silver, 4. In the last case, and probably in all, most of the gold and silver was contained in solution absorbed and not necessarily precipitated.

(2) Tank staves. (*a*) The staves of a similar large leaching tank, after use between three and four years, with sand averaging $3 gold and $1 silver per ton; made of California redwood, originally painted inside with two coats of P. & B. paint, and outside with red oxide of iron in linseed oil: a slight coating of carbonate of lime had formed on the inside; a large sample from these staves, burned and assayed, yielded only traces of gold and silver.

(*b*) Similar staves from a leaching tank in use at another plant for four years contained 40% moisture: the dried wood contained gold, 47c. per ton; silver, 3.

(3) Precipitating box. A precipitating box of 1½-in. lumber was painted inside and out with P. & B. paint, and used three years to precipitate low-grade cyanide solutions with zinc shavings, the slime averaging $4 to $5 per pound. Samples were taken by boring completely through the wood at various points in sides and bottom, and were burned and assayed. A little zinc slime was visible on the surface. The average value of the material, including a trace of adhering precipitate, was, sides, 0.75c. per square foot; bottom, 2.

(4) Mine timber. A piece of blackened but sound timber (yellow pine) which had been some time underground, and contained ferrous and ferric sulphates derived from mine-water, was tested. At the time of the test it contained 56% of water. Kept in contact with about three times its weight of cyanide solution, which assayed $1.20 per ton in gold, no precipitation took place in 20 hr. It seems evident, therefore, that wood, when well painted with any suitable protective medium, absorbs little more than traces of precious metal from cyanide solutions of ordinary value.[2] As dry pine and redwood absorb about their own weight of water, one would expect such wood, if dried after a thorough soaking in solution, to assay the same per ton as the solution taken up, evaporation and precipitation excluded. Alternate soaking and drying, or evaporation on the outside of wooden tanks in a dry climate, might be expected to result in a distinctly higher assay value in the wood. Adhesion of rich telluride slime or floured amalgam may also cause an increased value. It is difficult, however, to reconcile the results obtained by the following experimenters, and only those of F. L. Bosqui are at all in line with our own experiences. The other writers worked entirely on a laboratory scale. S. H. Williams found that an 8-in. wooden launder, 75 ft. long, used 7 months at a cyanide plant in New Mexico, having passed 63,000 tons of solution, worth $3 per ton, contained 2.766 oz. gold and 32.646 oz. silver in 15.5 cu. ft., or 0.18 oz. gold and 2.1 silver, per cubic foot, or a total value of about $4.65 per cubic foot. An apparent typographical error in the original article makes the value $60.45 per cubic foot. A. N. Mackay states that red pine, from a tank used 18 months, in which had been treated only 1200 tons of ore containing 20 dwt. gold per ton, yielded 12.4 oz. gold per ton of wood. F. L. Bosqui experimented with pine and redwood, dressed and rough, both with intermittent exposure and drying, and with continuous immersion, for periods up to 12 months, using solution which averaged $5 gold per ton and some silver. The highest absorption was with rough pine, exposed altogether about 12 months; $5.18 gold and 14c. silver.

On the whole, it seems probable that the precipitative effect of charcoal may be from occluded gases, but definite proof is lacking. S. Brussow, in a recent article, attributed the precipitation of gold from haloid salts by charcoal to absorption. This seems most unlikely, as he admits that the chlorine of gold chloride remained almost entirely in the solution; and we have found that charcoal which has been in contact with solutions of either chloride or double cyanide of gold, is thoroughly impregnated with metallic gold, easily distinguishable with a good lens.

[2] When launders of unpainted wood are used in the Plattner chlorination process they absorb gold enough to make it worth while to burn them to recover it. The same is true of canvas used for concentration in mills where floured amalgam escapes the plates, or where the tailing contains fine gold or rich tellurides. Absorption of silver similarly takes place in hyposulphite leaching. This is preventable by soaking the wood in hot paraffine or painting with asphaltum.

ELEVENTH INTERNATIONAL CONGRESS OF GEOLOGISTS, STOCKHOLM, 1910

This congress is to be held in Stockholm, August 18-25. The deliberations will be principally concerned with the following questions:

1. Geology of the Pre-Cambrian Systems. The discussion is divided into the debate of the following special questions: a to what extent can it be proved that the characters of Archean rocks are due to a deep-seated metamorphosis? and (b) the principles of a classification of the pre-Cambrian formations. The following gentlemen will participate in this discussion: F. D. Adams, Ch. Barrois, F. Becke, U. Grubenmann, J. F. Kemp, A. C. Lane, J. J. Sederholm and P. Termier.

2. Abrupt Appearance of the Cambrian Fauna: Ch. Lapworth, G. F. Matthew, A. Rothpletz, C. D. Walcott, and J. Walther have promised contributions.

3. Changes of the Climate Since the Maximum of the Last Glaciation: As an introduction to this discussion three Swedish scientists (G. Anderson, G. De Geer, and R. Sernander) published last spring observations in Sweden, in explanation of the postglacial climatic deviations in that country. These three essays were sent to a considerable number of foreign scientific men that have occupied themselves with the question of postglacial climate, and these gentlemen were requested to co-operate in an international discussion of this problem. Already several treatises have been sent in and scientists from the following countries have promised their co-operation: Austria, Belgium, Canada, the Cape Colony, Denmark, Egypt, England, Finland, France, Germany, Hungary, India, Italy, Norway, Russia, Sweden, Switzerland. Reports on the arctic and antartic regions have also been received. The treatises will be collected in a single work: 'The Changes of Climate Since the Maximum of the Last Glaciation.' This publication, which will probably be ready in the course of the month of April, will form the basis of the coming discussion. It will be sent free of cost to the contributors. It will also be procurable, at a price not yet fixed, from the publisher, 'Generalstabens Litografiska Anstalt', Stockholm 3.

4. The Iron Ore Resources of the World: In the beginning of 1908 the committee of the congress sent to the national geological institutions and to the mining geologists in the different States invitations to take part in an exhaustive investigation of the above question. This request has everywhere met with so much attention that, at present, reports from nearly all the iron-ore producing countries of the world have been received. These will be collected in one work: 'The Iron-Ore Resources of the World.' This publication, consisting of about 900 pages in quarto, with numerous plates and illustrations in the text and accompanied by an atlas of 40 map-sheets, will shortly be ready. It will be sent free of cost to the governments of the co-operating States and to the collaborators, and it will also be procurable from the above-mentioned publisher at a price of £3.

5. Geology of the Polar Regions: This subject will be treated in a series of special lectures, of which the following may be announced: H. Darner, 'The Geological Results of the *Denmark* Expedition to Northeastern Greenland'; A. G. Nathorst, 'The Climatic Testimony of the Fossil Floras in the Polar Regions'; J. F. Pompeckj, 'The Jurassic Deposits of the Arctic Region'; N. V. Ussing, 'The Eruptive Area of Thunausak, Western Greenland'. One of the geologists of the last British Antarctic Expedition will also give a report on its geological results. In connection with the discussion there will be an exhibition of the geological collections brought home by Swedish expeditions from the arctic and antarctic regions.

The debates of the congress will principally relate to the discussion of the above questions. Isolated lectures, of which the committee has been informed, will be placed in one of the following sections: (1) General and regional geology. Tectonic matters. (2) Petrography and mineralogy. (3) Stratigraphy and paleontology. (4) Quaternary formations. Recent glaciers. (5) Applied geology.

In connection with the congress the following excursions will be arranged:

A. Excursions before the Congress. 1. Spitzbergen, July 25 to August 17. Leader: G. De Geer. 2. Norrland (over-thrusts, eruptives, iron ore fields), July 27 to August 17. Leaders: A. G. Högbom, Hj. Lundbohm, and P. J. Holmquist. 3. Iron-ore fields of Gellivare and Kirunavaara, August 6-17. Leader: Hj. Lundbohm. 4. Quaternary geology of the Torneträsk, August 6-17. Leader: O. Sjögren. 5. The Alps of Sarek, July 27 to August 17. Leader: A. Hamberg. 6. Quaternary geology of Angermanland and Jämtland, August 9-17. Leader: A. G. Högbom. 7. Peat-moors of Närke, August 10-16. Leader: L. v. Post.

B. Excursions during the Congress. Several excursions of one day, principally in the environs of Stockholm.

C. Excursions immediately after the Congress. 1. The Archean rocks of middle Sweden, August 26 to September 4. Leaders: A. G. Högbom, P. J. Holmquist, A. Gavelin, and H. Hedström. 2. Silurian deposits of Gotland, Dalarne, and Västergötland, August 25 to September 6. Leaders: H. Munthe, H. Hedström, C. Wiman, and E. Warburg. 3. Quaternary geology of southern Sweden, August 26 to September 8. Leaders: G. De Geer, H. Munthe, and A. G. Nathorst. 4. Ore fields of middle Sweden, August 26 to September 6. Leaders: Hj. Sjögren, W. Petersson, and H. Johansson. 5. Morphology of middle Sweden, August 26 to September 4. Leaders: O. Nordenskjöld and S. De Geer. 6. Plant-containing Mesozoic deposits in Skaane, August 26-29. Leader: A. G. Nathorst. 7. Cretaceous system in Skaane, August 25-29. Leader: A. Hennig.

D. Excursion in Skaane, after the conclusion of group C. Silurian deposits, September 7-13. Leader: J. C. Moberg.

A second circular of the congress containing full particulars about the excursions and a statement of costs is promised. All correspondence relating to the congress to be addressed to the secretary-general, Professor J. G. Anderson, Stockholm 3.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Some Words and Their Meaning

The Editor:

Sir—In a brief article by me recently published in your paper, the proof-reader changed the words 'overlies' and 'overlain' to 'overlays' and 'overlaid'. As there seems to be a difference of opinion among some geological writers as to which usage is correct for these much employed terms, it occurred to me that the following little table might be instructive to those who consider the question a debatable one. A clear understanding of this minor point of grammatical usage is certainly desirable and would smooth the way for both editor and author:

Intransitive verb *to lie*	Transitive verb *to lay*		
Correct usage.	Correct usage.	Correct usage.	Incorrect usage.
The bed of sandstone *lies over* the bed of limestone. (Primitive form.)	The jeweler *lays* enamel *over* gold. (Primitive form.)	The cabinet-maker *lays* holly in mahogany. (Primitive form.)	The bed of sandstone *lays over* the bed of limestone. (What does it lay over the limestone?)
The sandstone *overlies* the limestone. (Derivative form.)	The jeweler *overlays* gold with enamel. (Derivative form.)	The cabinet-maker *inlays* mahogany with holly. (Derivative form.)	The sandstone *overlays* the limestone. (With what?)
The sandstone once *overlay* the limestone.	The jeweler *overlaid* gold with enamel.	The cabinet-maker *inlaid* mahogany with holly.	The sandstone once *overlaid* the limestone. (With what?)
The limestone is *overlain* by sandstone.	The gold is *overlaid* with enamel. (By the jeweler.)	The mahogany is *inlaid* with holly. (By the cabinet maker.)	The limestone is *overlaid* with sandstone. (By whom?)

A little attention to the derivations, uses, and analogies suggested by the table makes evident the fact that the writer, whose sentence reads, "This formation is overlaid by conglomerate", is confusing the verbs *to lie* and *to lay*, and may consistently be expected to exclaim, 'Oh, go lay down!'

F. L. RANSOME.

Washington, February 27.

Leasing Public Oil Lands

The Editor:

Sir—Senate Bill No. 5488 is the administration measure on oil lands and has received the general approval of Mr. Gifford Pinchot, president of the Conservation Commission. It is desirable to enact a bill providing for permits to prospect and for leases on public lands for oil and gas in place of the present 'oil-placer' law. Yet I find a number of objections to this bill. If the bill should pass in its present form it will greatly retard the development of oil and gas in the Rocky Mountain States. Inasmuch as the oil produced in these is in such great demand as to bring $1.50 to $2 per barrel in comparison with the 35c. of Oklahoma, and the approximate 63c. of California, this clearly would be opposed to the public interest. The words "to which patents have not been earned" may do serious injustice to oil-placer mining claims that were located prior to the passing of this bill and on which the term in which assessment work must be done and discovery made, has not elapsed. It would seem desirable to add a provision that oil-placer mining claims upon which location had been made prior to the signing of the act may be patented when the provisions of that law have been fulfilled. Section 2 fails to make clear that the person taking out a permit to prospect shall have a preference right to lease the land that he has demonstrated under that permit to be oil-bearing. The bill is lacking in not stipulating further upon this point.

The provision that 320 acres may be leased is general, applying to all classes of oil lands, although there is the utmost variation in their nature. In the case of wildcat wells in Rocky Mountain States many miles from any producing well, some larger reward than this should be offered the prospector for the expensive drilling of a pioneer well. A classification of oil lands should be adopted so that the size of a lease may be greater in such sases.

It is also unfair to the driller of an oil well to concel his lease at the end of ten years. The oil operator must be able to recoup himself amply on large successful wells to pay for the losses of failures and small wells. The leases should read "as long as oil and gas are found in paying quantities" which is the usual form of commercial leases. This also prevents the hasty and too close drilling of a lease in the effort to get as much oil as possible in the ten years. In the interests of conservation the operator should not be hurried, once a lease is shown to be productive. The tendency to over-production is too great as it is.

The Secretary of the Interior should not be given authority to cancel a lease for failure to operate inasmuch as provision for the payment of rental is provided for in the bill, and such a liability makes the value of a lease so uncertain and arbitrary as to seriously interfere with values. This proviso flies directly in the face of the spirit of conservation manifest in many other parts of the bill. Any operator who will pay the Government a rental year by year to protect a lease is performing a service for conservation and should not be disturbed. The bill is also faulty in lacking provisions against wasteful operations. The drilling of wells within a specified distance of the boundary line of a lease, say 200 ft., should be prohibited.

It is very gratifying to find, in spite of these defects, arising from failure to grasp the complexity

of the situation, that with the exception of the two clauses which have been pointed out the spirit of conservation dominates the bill. There has been an apparent opposition between the presidential attitude and that of the Department of the Interior in the matter of conservation. The Department has forced, and is still forcing, wasteful drilling in Oklahoma on Indian leases by demanding annually advancing payments and requiring drilling within five years regardless of the demand for oil. Evidently in the elaboration of this bill the presidential attitude has prevailed.

Roswell H. Johnson.

Bartlesville, Oklahoma, April 2.

Estimation of Cyanide in Solution

The Editor:

Sir:—In your issue of January 15, which has just reached me, I note a discussion by Algernon Del Mar on the above topic in which he quotes the different quantities of $AgNO_3$ recommended by different writers for making the $AgNO_3$ standard solution, and asks which is the correct quantity to use in practical cyanide work.

Consideration of an example or two based on the chemical equation representing the reaction of $AgNO_3$ with KCN may serve to show what effect the apparent discrepancy would have on practical work. Assume a mill solution containing a given amount of KCN per ton, and also assume that an $AgNO_3$ solution of 13.043 gm. per litre is the correct one. Titrate 20 c.c. of the mill solution and suppose that it requires 1 c.c. of $AgNO_3$ solution to reach the end point. Then evidently the mill solution contains 1 lb. KCN per ton. Now for comparison titrate an equal sample of the same mill solution with an $AgNO_3$ solution of 13.07 gm. $AgNO_3$ per litre. As this solution is stronger than the first it is evident that it will require a less number of cubic centimetres. The amount required may be calculated by solving the following simple proportions:

0.01307 gm. : 0.013043 : : 1 c.c. : X c.c.
or X = 0.99898.

That is, using the last solution we have an error of 0.00192 c.c. which is manifestly too small to be noted on the burette. In round numbers the error is 0.2%. If titrating a 20-lb. solution of KCN the second $AgNO_3$ solution then would give 19.96 c.c., or 0.04 c.c. less, which in this particular titration means absolutely nothing because of the indefiniteness of the end point caused by the influence of substances other than KCN that are always found in working solutions, besides being an amount that can not be read with accuracy on the ordinary burette. It is useless to carry refinements based upon difference of atomic weights of the same element as they have been determined in the last decade, into the mill laboratory for the daily determinations, whose value do not so much depend upon their accuracy to within 0.2% of the true amount, but upon their true relative relations. What is needed in the laboratory is accuracy and care, in weighing, titrating, and other manipulations, balancing their relative importances. The nearer work in the laboratory approaches the construction of the 'One Horse Shay', the more uniform and efficient will it become.

D. C. Woodward.

Petorca, Chile, March 5.

COAL-MINING AND COKE-MAKING AT DAWSON, NEW MEXICO

By E. W. Parker

*The plant of the Stag Canyon Fuel Co., which represents one of the highest types of coal mining development in the United States, is located at Dawson, Colfax county, New Mexico, in townships 28 and 29 N., R. 20 E., and T. 28 N., R. 21 E. The coal property embraces part of the Raton Mountain region, and includes operations in and about Trinidad, Colorado, and Raton, Koehler, Van Houten, and Dawson, New Mexico. There are two workable beds in the field, only one of which is being mined at the present time. The Dawson mines are on the lower of the two workable seams, known as the Raton or Blossburg bed. It lies nearly level and varies from 6 to 11 ft. thick, with an average of about 7 ft. The mining company is a subsidiary organization of the Phelps, Dodge & Co., Inc., and the idealistic character of the plant is due to the influence of James Douglas, the president of the company, and to the administrative genius of E. L. Carpenter, its general manager. The mining methods of the company, and the arrangements for handling the coal and preparing it for the coke ovens, are strictly modern throughout. Instead of the ordinary bee-hive coke ovens, modified underflue ovens are employed by which the gases from the coking operations are used for heating the ovens and also for generating the power used in the operation of the mines, the heating of the office, and other company buildings, and for furnishing electric light to the town. Not a pound of coal is used in the power plant, which is a model of neatness and efficiency.

Special provisions are made for the safety of the miners and other employees, and no shot-firing is done while any of the miners are within the mines. Careful supervision is exercised over the methods of undercutting and shearing coal and of placing shots, in order to avoid any possibility of windy or blown-out shots. A checking system is employed by which it is known that all employees are out of the mines before the shot-firers enter. The shot-firers make the electric connections, and after they have left the mines, the entrances are closed by iron gates and a red light is exposed in front of each gate in order to warn persons away and thus avoid accidents from flying débris, in case an explosion should occur. The Stag Canyon Co. further trains its men in first aid to the injured work; conducts a rescue station in which men are instructed in the handling of rescue apparatus, and a hospital service, provided for the employees at a minimum expense.

* Read before the Washington Geological Society and abstracted from *Science*.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Heat and light are both forms of undulatory waves and are transmitted through space at the same rate, 186,000 miles per second.

At the present increasing rate of production the available and easily accessible supplies of iron ore in the United States will approach exhaustion before the middle of the next century.

Oil placer-claims may be held by doing annual labor on one for the benefit of not to exceed five claims. The number of claims which may be held as a group by annual labor within or outside of them is immaterial in the case of other placer locations, so long as the character of the work is such as court decisions have shown to be acceptable.

Conflict between two claimants arose as follows: A located a quartz lode claim on June 1, 1909, and B located another, crossing A's at right angles, on July 1, 1909. A failed to perform the annual labor necessary to hold his claim in 1910, and B then claimed the area under conflict at the crossing of the claims. The junior location (B's) acquired no rights in the area in conflict at the time of location, and consequently the area in dispute could be obtained only by re-location.

Mercury is no longer extracted from its ores by pot-roasting with lime or iron. It can only be done at a profit when the ore is extremely rich. It is also open to the serious objection of imperilling the health of the workmen, who are necessarily exposed to the mercurial vapors. This difficulty does not exist with shaft-furnace distillation, the vapors being at all times confined in flues and chambers which under-exhaust so that passage to the outer air is prevented.

Notices of location of lode, placer, tunnel, or mill-site claims in California must be recorded within 30 days from the date of location in the office of the County Recorder for the county in which the location is situated. There still remain a number of mining districts organized as provided in the Federal mining law, and where such exist it is desirable to avoid possible cloud of title by having notice of location recorded with the District Recorder as well as with the County Recorder.

Weathering action of the air is partly due to its ordinary oxidizing power, but even more to the carbonic acid which it contains. Although amounting by weight to only about 0.034% as against 21 of oxygen, the carbonic acid in the atmosphere shows surprisingly powerful chemical properties. Under conditions controlled by the chemist, carbonic acid may be regarded as the weakest of inorganic acids, but when dissolved in surface or other waters, and particularly when absorbed merely by moisture where it has the maximum surface action, it possesses the power of gradually decomposing most of the rock-forming silicates. Under such conditions, silica itself is only a weak acid and is readily expelled from many of its compounds and carried away in solution as free silicic acid in colloidal or other form or as an alkaline silicate, to re-appear in one or other of the many forms of which vein quartz, chalcedony, agate, jasper, opal, and the like, are familiar examples.

Antimony ore is generally liquated in reverberatory furnaces. The ore should be broken to about the size of walnuts, and brought to a low red heat. At that temperature the antimony sulphide melts and flows out from the ore, and can be drawn from the sloping hearth of the furnace. At a higher temperature the antimony sulphide is volatilized. If much fine ore is present this process is not successful. Cylindrical revolving furnaces are also used for the liquation of antimony ore.

Pegmatite may be regarded as a giant variety of granite, the essential minerals occurring in very large crystals. Pegmatites have probably been produced by igneous intrusions around granite masses, and it would seem that heated vapors and solutions, forming part of the intrusions, are in a large measure responsible for their formation. This view is supported by the frequent occurrence of pegmateites of a variety of rare minerals, few, if any, of which occur in the surrounding rock. The pegmatites supply the feldspar, mica, and some of the quartz of commerce, these minerals being present in such form as to admit of easy separation.

Relative cost of electric and steam power at isolated plants varies according to conditions. For a specific case they may be calculated as follows: With a 160-hp., non-condensing, slide-valve engine; coal screenings costing $2.50 per ton of 2000 lb.; labor, $3.50 per shift; operating time, 11 hr. per day; cost of electric power, 2c. per kw. hour, and assuming, (1) continuous full load, (2) boiler evaporating 6 lb. of water from and at 212°F. per pound of coal, (3) feed-water heater delivering water at 200°F.; (4) no allowance for oil, waste, supplies, water, or interest on plant; (5) steam consumption of engine, 35 lb. per hp. hour; (6) steam pressure, 100 lb. per sq. in. Then steam required per hour equals 160 (hp.) by 35 (lb.) = 5600 lb. per hr. With feed-water at 200° and 100-lb. pressure, 1 lb. coal will evaporate 6 (lb.) ÷ 1.0523 (factor of evaporation) = 5.70 lb. The pounds of coal required will, therefore, be 5600 ÷ 5.7 = 965. This amount per hour, 965, by 11 (hours per shift) = 10,615 lb. or 5.3 tons of coal per day. This coal 5.3 (tons) at $2.50 per ton, will cost $13.25 per day. If to this $3.50 be added to cover wages for one man, the total cost for fuel and labor will be $13.25 + $3.50 = $16.75 for steam power. The cost of electric power may be figured as follows: 160 hp. = 120 kw. which for 11 hours = 120 × 11 = 1320 kw. hr. per day, 1320 × 2 (cents per kw. hr.) = $26.40 per day for electric power. Under the assumed conditions the steam power would evidently be cheaper. By substituting other figures to correspond to other assumptions, the cost under a variety of cases can be readily found.

Special Correspondence

WASHINGTON, D. C

Administration Bill for Leasing Phosphate, Oil, Asphaltum, and Natural Gas-Bearing Lands.

The administration bill (S 5488) for the disposal by lease of the phosphate, oil, asphaltum, and natural gas lands, changes existing law in so many particulars that it may be quoted entire. The bill was introduced in the Senate by Mr Nelson, of Minnesota, and is now before the committee on public land. It reads as follows:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That all lands within the United States or the Territory of Alaska to which patents have not been earned and which contain deposits of phosphate, oil, asphaltum, or natural gas, and the phosphate, oil, asphaltum, or natural gas therein, are hereby reserved from all forms of entry, appropriation, and disposal, except under the provisions of this Act.

SEC. 2. That any person above the age of twenty-one years who is a citizen of the United States, and any association of persons, corporate or otherwise, on the payment in each case of an application fee of $10, may apply under the following provisions of this Act for the exclusive right to prospect for or lease any phosphate, oil, asphaltum, or natural gas deposits owned by the United States: *Provided*, That to prevent monopoly, the Secretary of the Interior is hereby authorized to limit the number of permits or leases issued to any individual, association, or corporation under the provisions of this Act or deny any application for the right to prospect or for a license or lease if he shall find that such application is not made in good faith by the applicant or is an attempt to monopolize or control the said deposits or the output or price thereof.

SEC. 3. That the Secretary of the Interior is hereby authorized, in his discretion and under such rules and regulations as he may prescribe, on the payment of a rental of not less than 10c. per acre, but not less than $10 in any case, to grant to any qualified applicant a prospecting permit, which shall give the exclusive right for a period of not exceeding two years, to prospect for phosphate, oil, asphaltum, or natural gas on a specified area, in compact form, not exceeding 1280 acres in case of phosphate, or 640 acres in case of oil, asphaltum, or natural gas, of any lands wherein the phosphate, oil, asphaltum, or gas is reserved to the United States by this Act, and to lease not more than 640 acres in case of phosphate, and not more than 320 acres in case of oil, asphaltum, or natural gas, under the provisions of this Act.

SEC. 4. That the Secretary of the Interior is hereby authorized, in his discretion and under such rules and regulations as he may prescribe, to execute in the name of and on behalf of the United States and to issue to any qualified applicant a lease for not more than 640 acres in case of phosphate, and not more than 320 acres in case of oil, asphaltum, or gas, in compact form, and of such shape as he may fix, in legal subdivisions, subdivided into ten-acre tracts where advisable, conforming to the public-land surveys, and, if on unsurveyed lands, to the rectangular system thereof, in tracts of ten acres or multiples thereof, conveying the right to develop, extract, and dispose of phosphate, oil, asphaltum, or gas from any lands subject to the provisions of this Act, under such conditions conserving the public interest, including among others covenants relative to mining methods and waste, to a period of preliminary development and quality of production, as he may prescribe: *Provided*, That the first period of any lease shall not exceed 30 years in case of phosphate, and 10 years in case of oil, asphaltum, or gas, but any lease may be extended in periods of 10 years in case of phosphate, and 5 years in case of oil, asphaltum, or gas, on such terms, conforming to prevailing commercial practice, and under such conditions as the Secretary of the Interior may prescribe: *Provided further*, That in the lease to any tract a royalty not exceeding 10c in case of phosphate and 15c in case of oil, asphaltum or gas of the gross value of the output at point of production shall be stipulated and that there shall be paid in advance a rental of 50c per acre in case of oil, asphaltum or gas for the first calendar year or fraction thereof and $1 per acre thereafter during the continuance of the lease and in case of phosphate 10c per acre for the first calendar year or fraction thereof, 25c for the second year, 50c for the third year, 75c for the fourth year, and $1 per acre thereafter during the continuance of the lease but the rental for any one year shall be a credit on the royalty for that year: *Provided, nevertheless*, That the Secretary of the Interior may reserve authority in any lease to cancel such lease for failure to operate or mine

SEC. 5. That * * * all payments * * * shall be made to such officer as the Secretary of the Interior may designate

SEC. 6. Provides for bonds for payment of all moneys or damages which may accrue, and "for the faithful performance of all Acts, duties, and obligations imposed by such permit or lease, and for indemnification of the United States against mechanics' or laborers' liens, taxes, or assessments."

SEC. 7. That no lease shall be assigned, mortgaged, or sublet, except with the permission and approval of the Secretary of the Interior and under such conditions as he may prescribe * * *.

SEC. 8. That a lease may, in the discretion of the Secretary of the Interior, be terminated upon the written request of the lessee to the Secretary of the Interior, and after due opportunity has been afforded to said Secretary to examine into the condition of the property.

SEC. 9. That in case a lease is terminated, either by the expiration of the period fixed therein, by relinquishment, or by forfeiture, the right is reserved to the retiring lessee to dispose in the open market of such of the buildings, machinery, and other improvements as in the opinion of the Secretary of the Interior can be removed without injury to the leasehold; but the retiring lessee shall forfeit all right to so much of these improvements as the Secretary of the Interior may deem necessary to withhold: *Provided*, That if the Secretary of the Interior shall re-let the remainder of the phosphate, oil, or gas covered by the former lease, he shall provide that reasonable and just compensation shall be paid by the new lessee to the former lessee or his representatives for remaining structures, fixtures, or improvements. If the retiring and incoming lessee can not agree as to the price, each shall appoint one member of a board of appraisers, and the Secretary of the Interior shall appoint a third, and the decisions of this board shall be accepted as final.

SEC. 10. That any person or persons to whom the Secretary of the Interior shall grant a permit to prospect for or a lease to develop and extract phosphate, oil, asphaltum, or gas, under the provisions of this Act, shall have the right to use so much of the surface as shall be determined from time to time by the Secretary of the Interior to be necessary for the proper prospecting, development, extraction, handling, treatment, and transportation of such phosphate, oil, asphaltum, or gas; but such permittees and lessees shall compensate all settlers, entrymen, and owners of any lands embraced in their permits or leases for all loss or damage sustained by such settlers, entrymen, and owners by reason of such prospecting, development, extraction, handling, treatment, and transportation; and, whenever such settlers, entrymen, or owners, and such permittees or lessees shall fail to agree on the amount of any damage or loss claimed under this section, the amount of such damage or loss, if any, shall be determined by appropriate proceedings instituted by either of said parties in the United States courts having jurisdiction over the subject-matter.

SEC. 11. That the Secretary of the Interior may withdraw from entry, occupation, or settlement any unappropriated public lands, the surface of which he may deem necessary for use in connection with the production, handling, or transportation of phosphate, oil, asphaltum, or gas under this Act. Such lands shall be withdrawn only in areas necessary for the purpose, which may include tracts less

than the usual public land subdivisions, and the Secretary of the Interior may cause to be made, in any manner he may decide, surveys necessary for such segregation. Upon the release from withdrawal of any tract which lies within the limits of any area for which entry has been made, the entryman shall have the right to amend his entry to include such tract, making additional payment when it would have been required if the tract had been included in the original entry; and, if patent has issued, the patentee, or his successor in interest, shall be entitled to a patent for such tract upon like conditions. In case of failure to apply for such amendment of entry or patent within six months after such release, the tract shall be subject to appropriation under the public land laws.

SEC. 12. That a failure of any lessee to comply with the terms and conditions of the lease shall work a forfeiture and cancellation of the same; and the Secretary of the Interior shall have the power to declare and enforce, by appropriate judicial proceedings, such forfeiture and cancellation.

SEC. 13. That leases executed and issued under the provisions of this Act shall also fix maximum prices or rates beyond which the lessee shall not charge the public for phosphate, oil, asphaltum, or natural gas extracted under the lease, and appropriate provisions for re-entry or forfeiture in case of violation of such provisions; and such prices or rates may be graduated during the term of the lease.

SEC. 14. That the laws of the State or Territory in which the land is situated for control of inspections and the operations of mining shall apply to operations under the leases herein authorized, in so far as they are applicable, except where such laws are in conflict with the provisions of this Act, and the Secretary of the Interior may also from time to time promulgate reasonable rules and regulations as to the methods of mining, the character of machinery or safety appliances to be employed, and requiring the most approved methods and devices for the safety and protection of the miners and other employees in the operations conducted under such lease, which regulations shall be binding upon the lessees in like manner as if set forth and contained in the lease.

SEC. 15. Gives the Secretary of the Interior or his agents the right to require written statements of any and all acts performed or of any and all moneys received, and to examine all books and records relating to corporate organization or to transactions under such leases.

SEC. 16. That to mine, produce, or remove phosphate, oil, or gas belonging to the United States, without authority derived from the Secretary of the Interior, shall constitute a trespass, punishable upon conviction by a fine not exceeding $1000 or imprisonment for not exceeding one year, or both.

SEC. 17. That the Secretary of the Interior is hereby authorized to perform, or cause to be performed, any and all acts, and to make such rules and regulations as he may deem necessary and proper for the purpose of carrying the provisions of this Act into full force and effect, and all leases, foreclosures, purchases, or assignments shall be subject to such rules and regulations.

SEC. 18. That all unappropriated and unreserved public lands within the United States and the Territory of Alaska may be settled upon, entered, located, or selected under any of the non-mineral public land laws applicable thereto, notwithstanding the existence of deposits or phosphate, oil, asphaltum, or natural gas therein, and may be patented upon satisfactory proof of due compliance with the laws under which such lands are claimed; but all patents for such lands shall contain a reservation to the United States and its lessees of all phosphate, oil, asphaltum, or natural gas therein, and of the right to the free use and occupation of such of the surface of the lands so patented as may be necessary to the mining, removal, and sale of such phosphate, oil, asphaltum, or natural gas: *Provided*, That the Secretary of the Interior may withhold from settlement, entry, location, or selection the surface of any lands classified as containing phosphate, oil, asphaltum, or natural gas until such time as, in his opinion, said surface may be disposed of without detriment to the prospecting for, or removal in the manner provided in this Act, of such deposits of phosphate, oil, asphaltum, or natural gas.

SEC. 19. That no phosphate produced under any lease authorized by this Act shall be exported or taken from the United States or the Territory of Alaska, except that phosphate so produced in Alaska may be brought into and used within the United States.

SEC. 20. The jurisdiction to determine the issues and matters which are by this Act committed to the courts is hereby conferred upon the United States circuit and district courts for the districts in which the lands, leaseholds, or property are situated or located.

SEC. 21. Repeals conflicting laws "except as to valid claims existent at date of the passage of this Act."

DENVER.

Boulder District Active. — San Juan Projects. — Supreme Court Decision.—Land Fraud Case. — The Oil Industry. — Cripple Creek Items.

Mining operators in the Boulder district have been especially favored during March. It is now one of the most active camps in the State. The warm open weather has permitted construction to be pushed rapidly, and many of the mines are now in position to take advantage of the high price of tungsten which is above that of any time since 1907. Many of the gold-producing mines report new ore-shoots as the result of the development during the winter. The operators are just now a little worried lest the impending coal strike in the northern fields put them short of coal before power is available from the lines of the Northern Colorado Power Co. The Logan group of claims at Crismen, owned by the Clinton Mining Co., has been sold to A. S. Cox and associates. Mr. Cox was formerly superintendent of the property.

The San Juan region is still in the grasp of winter, and development is about all that can be done. The recently incorporated Colorado Smelting Co. is to erect a small plant two miles south of Ouray to treat the ores from the Black Diamond and Pony Express mines. Opinion seems to be changing again in favor of small smelting plants situated at or near the mines instead of the large centrally situated plants. It is noticeable that the large well equipped smelters at Pueblo, Salida, Leadville, and Denver are all running below capacity. The famous old Argo plant has ceased to operate and is being demolished. With the failures of the first craze for small smelting plants to guide them it is to be hoped that this second crop of small plants may be successful.

The Supreme Court has handed down an important decision regarding the cutting of timber on public lands. It has long been contended, and the contention upheld by the lower courts, that the law governing the cutting of timber for mining purposes gave the right to cut timber on the public lands in any part of the State. The Supreme Court decided that mine owners can cut timber for mining purposes on the public domain only in regions that are mineral in character, and that for use in that immediate district only. As a result of this decision, a shipment of timber for mining purposes has been seized at Canon City, and the Government has begun proceedings to recover the stumpage price on about 2,000,000 ft. of timber which has been cut from public land and used in different parts of the State.

Another land fraud case was begun at Cheyenne, Wyoming, March 31. The Government seeks to recover title to coal lands in the Elk Mountain district, and to iron lands in the Seminole. The lands are valued at $5,000,000. The suit has been brought against John D. Milliken and Charles S. Johnson, respectively, of the Northwestern Land & Iron Co., and the Denver, Laramie & Northwestern Railroad Co. It is alleged that the lands were secured by dummy entry practices.

In the Boulder oilfield an attempt is being made to confine the gas escaping from several wells in the field and pipe it to Boulder and surrounding towns. The chief dif-

ficulty anticipated is the separation of the gas and oil at the wells. The Hoeland syndicate operating in the Dallas field near Lander, Wyoming, has let a contract for 25 new wells, 19 of them to be finished by June 1. The oil from this field finds a ready sale as locomotive fuel. Prospecting for oil has been carried on north and east of Colorado Springs for about two years with practically no results. Encouraging reports have lately come from near Falcon, and there is hope that a new field may be discovered.

The March production from Cripple Creek shows a gross value of $1,758,405. This is an improvement over February both in average grade of the ore and in tonnage. The local mills, however, treated somewhat less, due to the closing down of the cyanide mill owned by the Isabella Mines Co., and also to the suspension of treatment at the milling plant constructed on the property of the Trilby company. The directors of this company refused to accept the mill for alleged breach of contract and failure to make the guaranteed recovery. The Deep Drainage tunnel was advanced 344 ft. during March, and now measures 12,946 ft. from the portal. The breast of the tunnel is still in the hardest kind of Pike's Peak granite. The Doctor Jack Pot and El Paso Consolidated companies paid March dividends amounting respectively to $15,000 and $24,500. The El Paso Consolidated is still controlled by Allan L. Burris who won over S. S. Bernard at the recent annual election.

LONDON.

San Francisco del Oro.—British South Africa.—Nundydroog.

The directors of the San Francisco del Oro have at last decided on the new system of treatment to be adopted. The company was originally formed in London in 1903 for the purpose of acquiring mines situated 14 miles southwest of Parral, Mexico. The surface ores were profitable to local owners who treated them for the silver content. Subsequently sulphides came in, and the ore became a complex mixture of blende, galena, and pyrite. It was attempted to smelt it in the Mexican furnaces and afterward some was sorted and shipped, but the owners decided eventually to sell, and to leave the burden of solving the metallurgical problem to other people. The English company which then took hold of the property found its way beset with difficulties and several methods were tried, such as chloridizing-roasting. There was always sufficient rich ore that could be shipped and enough has been sold to pay expenses. This policy was, however, considered a bad one, for not only did it mean leaving much ore behind but the cost per ton of extracting the rich ore was made high owing to so much unsalable ore having to be mined as well. It was in those days impossible to concentrate by jigs owing to the scarcity of water, and a trial of a dry table was made. This was a failure on account of the large amount of middling produced. Then a stroke of good fortune came to the mine in the form of an inflow of water at the lowest level, and by its means the mine was provided with a regular supply of 220 gal. per min. It was accordingly decided to adopt water concentration of the usual type and with large ore reserves it was felt justifiable last year to reconstruct on the basis of an assessment of 3s. on 330,000 shares. It was known fairly well that, by jigging, a good quality of lead concentrate could be obtained, but the question was to evolve a method of dealing with the zinc content. About 60% of the ore is sulphide, and 40% gangue, which latter consists of quartz, slate, calcite, and fluorspar. Of the silver content 50% is in the blende, 35 in the galena, and 15 in the gangue. The sulphides are intimately mixed and their separation involves the production of much slime. As regards the presence of calcite, experiment soon showed that acid-oil flotation processes would not help, while the fluorspar greatly diminishes the value of the zinc concentrate. This concentrate is not liberally treated by buyers in the matter of silver content, not more than 50% being paid for. Seeing that so much of the silver of the ore is in the zinc product, it is obviously to the advantage of the company to treat this product itself eventually.

The experimental operations have been conducted by Percy Larbutt & Co., consulting engineers, W. S. Harrison, manager, and James Wilding, consulting metallurgist, on ore brought over to the Elmo works near Swansea. It is reported that the smelting of the zinc product can be satisfactorily effected. A good extraction of the zinc and silver is obtained and the fluorspar content has been reduced to the required maximum. There are, however, many details still to be settled in connection with the zinc metallurgy, and the company has wisely accepted in the meantime an offer to purchase the zinc product made by a firm of zinc smelters. The terms of purchase will be sufficient to yield a small profit, and for a time, until the company erects a smelter of its own, the deal is satisfactory.

The company will immediately proceed to erect a concentrating plant of sufficient capacity to treat 300 tons per day. This, and the necessary outlay on power and extension of the railway, will cost £46,000. With zinc at £20, lead at £13, and silver at 2s., the production of lead and zinc concentrates is expected by the engineers to yield an income of 37s. 6d. per ton of ore, and the total cost of mining and concentration is estimated at 16s. 6d., but close figures are not given in the report.

The British South Africa Co.'s report for the year ended March 30, 1909, has just made its appearance, and the meeting of stockholders was held this week. As regards mining history there is not much new in the report, for it is published a long time after the conclusion of the period covered. The important part of the report is that the accounts show a balance in favor of revenue. It now seems certain that from an administrative point of view Southern Rhodesia has arrived at a self-supporting stage, and that no more capital will be required. The revenue for the year was £551,789 and the expenditure £524,470. For the current year ending March 31, 1910, the expenditure was estimated to be £565,560, and it was proposed to spend all this and the balance from last year. It is stated that the results are proving to be better than the estimate; that the income will reach £600,000, and that there will be a saving in the expenditure. Northeastern Rhodesia and northwestern Rhodesia have not yet come forward and their revenues are small. The revenue and expenditure of the former during the year were £22,446 and £49,207, respectively; and of the latter £64,195 and £86,644. During the current year the figures for the former will be much the same as a year ago, but for the latter there will be slight increases in both income and expenditure.

The Nundydroog, in India, paid its largest dividend in 1909. Started in 1882, it was not until 1887 that production became active, and dividends were first paid in 1888. Since than the profits have gradually increased, though there were trifling waves of depression in 1893 and 1898. During 1909, the amount of ore crushed was 90,100 tons yielding 78,661 oz. bullion, and 84,240 tons of tailing gave 795 oz., the total value of the gold won being £346,470. The profit was £163,238, £113,200 has been distributed as dividend, being at the rate of 40%; £23,000 written off, and £20,000 placed to reserve fund. The formation of a reserve fund is in continuation of the new policy of paying for all expenditure out of profits instead of issuing new capital, and it will put the company in a strong position. The mine continues to develop satisfactorily, and the reserve on December 31 was 126,244 tons, an increase during the year. In January, 1909, operations were greatly impeded by a fire in one of the shafts. Considering this drawback, the excellence of the year's results is even more notable. It is interesting to mention that since the commencement of operations the mine has yielded gold to the value of £3,645,989, and distributed £1,540,535 as dividends. The company has acquired additional land between its mine and the property known as the Oriental block, which latter was purchased in 1904. By obtaining this extra piece of ground it will be possible to gain access underground to the Oriental block, and so the development will be facilitated. The company a year or two ago became interested in the Anantapur goldfield and last year took an option on the South Jibutil block. The developments this year have been promising and there is every prospect that the option will be exercised.

GOLDFIELD, NEVADA.

Consolidated Production.—Florence Development.—Combination Fraction.—Minor Leases.—Consolidated Mill Burns.

Production from the Clermont is now at the rate of 300 tons daily with about 200 tons each from the Mohawk, Combination, and Red Top shafts. An even production is maintained from the 260 and 330-ft. levels of the Red Top and the output from the Combination, including ore of good grade, has been increased. The deeper horizons of the Red Top vein will be developed by means of drifts from the Clermont workings. The stopes of the Mohawk continue to produce rich ore but a comparatively small amount of the high-grade is being broken. It is said that the orebody exposed on the 750-ft. level of the Clermont will average $500 per ton for a width of 6 to 10 ft., and a length of 200 ft. The entire mass, 25 ft. wide, is of excellent mill-grade, and the quality is well maintained on the 600-ft. level which is also yielding a large tonnage for the mill. High-grade ore has been developed in the Mohawk vein to a point near the boundary line of the Combination Fraction but no ore of commercial value has been opened by the long cross-cut driven at a depth of 600 ft. to the west from the Fraction and across the Combination claim. In the Lucky Boy claim the northwest lateral from the Clermont 600-ft. station has exposed some good milling ore.

The annual report of the Florence Goldfield Mining Co. has been issued. A marked improvement in the results of ore treatment is shown. Early in the year, when the first section of 20 stamps was placed in commission, the recovery was but 68.13%, but in December this had increased to 95.05%. The territory in which development has been centered is 650 ft. in length, but ore has been exposed almost continuously for nearly 1000 ft. in the main Florence vein where the vein matter is in some places 100 ft. wide. Low-grade ore has been cut in driving to the north toward the old Reilly lease workings over 1000 ft. north of the main shaft, and this drift, on the 350-ft. level, will shortly be connected by means of a raise with workings in which good ore is exposed from the 260-ft. horizon to the surface. Large bodies of mill ore have been exposed in old lease workings 400 ft. south of the shaft, and stopes are opened at intervals for a distance of 600 ft. One large vein, yielding assays up to $160 per ton, has been passed through in driving a connecting lateral between shaft 17 and the main shaft at a depth of 530 ft. This shaft is being enlarged from the 530-ft. level to the surface. The southern extremity of these workings is now in ground where a large amount of excellent ore is exposed to a depth of 570 ft. No development has been done at any point, except in this winze, below the 500-ft. level. One orebody of excellent character and marked uniformity in value has been opened for a length of 100 ft., and upward for 50 ft. above the 200-ft. level and is 12 ft. wide. Only ore exposed from two shafts has been sent to the mill and that developed from 13 others has not been touched. A considerable tonnage of good mill ore has been taken from the dumps of former leases, all of which operated under agreements making ore, valued at $30 per ton or less, the property of the Florence company. The Florence mill was first designed as a 20-stamp mill, with two tube-mills for regrinding and the necessary amalgamating, concentrating, and cyaniding equipment. Twenty auxiliary stamps were installed as a measure of protection against accident. Later experiments indicated that the equipment and capacity could be enlarged with small cost and resulted in the installation of four amalgamating plates, four Card concentrators, and one tube-mill. These changes resulted in increasing the capacity of the mill from 50 to 60% and in greatly increasing its efficiency. The report states that every variety of ore known to exist in Florence ground has been put through the mill. Experiments have been made having in view the construction of a plant for the treatment of concentrate on the ground by a process similar to that employed by the Consolidated company, but thus far the results have not warranted building such a plant.

Goldfield Consolidated Mill.

Development on the Combination Fraction, according to the manager, is meeting with highly satisfactory results at three levels. The orebody exposed on the 285-ft. level is being opened from the west lateral at 300-ft. depth, and has a good appearance. The best showing is on the 500-ft. level where the orebody is 15 ft. wide and of good grade. An improvement is noted in the assays taken from the quartz vein cut at the 750-ft. station and apparently a part of the Mohawk vein. A drift is being driven from this station to connect with the Clermont workings of the Consolidated for ventilation and to afford another outlet for production. On the Black Butte the company work is now confined to driving from the old shaft, which has been unwatered, to cut the vein exposed in a winze from the northern adit. This will reach the vein some 200 ft. below the adit-level. A shipment of good ore has been made from a lease on the western end of the Goldfield Daisy on ground formerly embraced in the Toplitz lease. Ore of milling grade has been secured in the cross-cut of the Precious Metals lease on the Atlanta at a depth of 730 ft. Shipping ore is being saved in the MacKay-Ford lease on the St. Ives claim of the Merger Mines Co. The Grizzly Bear shaft, now down 1150 ft., has cut stringers of ore and a cross-cut will be driven from the new station at the 1020-ft. level to penetrate the Mohawk vein. The Annex shaft on the Polverde claim of the Jumbo Extension Co. is produc-

ing ore of shipping grade from the raise above the drift on the 500 ft. level and the orebody is apparently of large dimensions.

An explosion of oil in the refinery of the Goldfield Consolidated mill started a fire that destroyed the refinery, the belt conveyor from the railway ore bins through the sampler to the stamp feed bins, the storehouses and contents, the sampling department and equipment, the change house, and the southeast corner of the mill proper. Of the 100 stamps 20 are completely tied up, but the other 80 could be started at once if there were any way of getting the ore into the mill. Duplicate parts have been ordered by telegraph and work commenced removing the wrecked portion of the mill. In the meantime the ore from the Consolidated properties will be treated at the local mills and the products usually handled by the refinery shipped to Selby or the mint. The damage has proved to be much less than at first anticipated. The loss is less than $200,000 and the entire plant will be again in operation within sixty days. Within thirty days it is expected that the destroyed belt conveyor from the crusher house will be replaced and operations with 80 of the 100 stamps will be resumed. Little if any gold was lost in the refinery. A considerable amount of bullion was contained in the retorts which were not injured and there was some precipitate in this department. During the period of reconstruction production will be curtailed, but development will be extended in all directions. Both Mr. Wingfield and Mr. Howe declare that the loss is not serious and that one week's mill run can readily be made to pay the amount of the damage. After the quarterly dividend of 50 cents per share is paid on April 30, the company will still have over $1,000,000 remaining in its treasury.

NEW YORK

Market Conditions. — Copper Surplus Increases. — Calumet & Hecla Changes.—Bisbee Results. — United Copper.

The collapse of the Granby; the formation of the Anaconda merger, without any particular opportunity for market action; the depression of Nevada Consolidated, evidently a move on the part of the Guggenheims to accumulate stock and complete their control of the company; these, in conjunction with generally unfavorable market conditions, have caused a slackening of interest in mining affairs, and an apathy which seems almost complete. The daily cables from London telling of furious business in rubber shares and oil shares has lent encouragement to some of the interests handling California oil properties and a strong effort is being made to interest the public in oil leases, and in developing companies. There is glib talk of gushers, dusters, drills, rigs, pumps, and casing by many promoters who really do not know whether oil is sold by the bale, bag, or bushel. The climax of the rubber hysteria in London seems to have been reached and the wild markets of the past two or three days seem to have resulted principally from the desire of some pessimist to count his profits in real money instead of on paper. The Copper Producers' Association figures for March, made public April 10, showed 120,066,000 lb. production; 62,844,000 domestic consumption and 40,584,000 exports. The surplus increased 16,638,000 lb. This added to the stock on hand makes 123,825,992 lb. These figures were a considerable disappointment, since it had been claimed that consumption was now at the high rate of 750,000,000 lb. per annum. There were numerous increases in production and the expected larger domestic consumption failed to materialize. The Calumet & Hecla production for March was 12,277,142 as against 11,358,545 lb. Rio Tinto's copper sales during 1909 amounted to 35,496 tons (70,992,000 lb.), from which the net profit derived was £1,209,389 ($5,901,818). The management, which is looked upon as of the highest authority in copper metal circles, says, "The situation for 1910 gives promise of improvement, consumption all over the world being good." The copper conditions abroad are improving, the visible supply in London on April 1 was 111,440 tons, as against 112,730 tons on March 15 and 113,450 tons on March 1. The claim that copper supplies now are larger than ever before in the history of the metal is not taken seriously. Comparing the situation today with that of ten years ago the statement is made that at that time Amalgamated alone had an accumulation of 300,000,000 lb., while today the accumulated surplus of the world is not more than 50,000,000 lb. in excess of that figure. Alexander Agassiz's successor, as president of the Calumet & Hecla Mining Co., is Quincy A. Shaw, who was elected at a meeting held in Boston this week. Mr. Agassiz's son, R. L. Agassiz, was added to the board of directors. Mr. Shaw is the son of the late Quincy A. Shaw, who, for many years, was Mr. Agassiz's principal associate in carrying the affairs of the big company, which they guided so successfully, while the younger Agassiz, as well as the new president of the company, has been active in the affairs of the Calumet & Hecla for some years. Mr. Agassiz's death is counted a personal loss by every miner in the upper peninsula of Michigan. It is said that he took a greater pride in holding the loyalty and affection of the workers in the mines and in the fact that he never had a strike or even a walking delegate to contend with, than he did in the dividend record of the company over whose destinies he presided. T. L. Livermore, vice president of the company, has resigned. Mr. Livermore has served the company for twenty one years and has for some time been planning to retire, but he will remain in active service some months longer to give such assistance as may be needed to his successor. The annual report of the Calumet & Arizona shows an output for 1909 of 37,630,100 lb. of copper, sold at an average price of 13.047c., which compares with 28,050,000 for 1908; 30,500,000 for 1907; and 37,370,000 in 1906. The banner year as to profits was 1907 when the output was sold at an average price of 18.102c. There is a great deal of interest being shown in the results of the diamond drilling being done at Bisbee. Indications are that the life of mines is to be greatly prolonged and the productive area much widened. An assessment, or rather a call, of $1.25 per share is to be made by the First National Copper Co., which operates the Balaklala property in California. The shares of the present company, given in exchange for Balaklala, were issued with $2.50 unpaid and subject to call. It is necessary now to take up or refund some notes and a small outstanding bond issue of the Balaklala company and by making the call as outlined the liabilities can be met without incurring interest charges. A circular was recently received by holders of United Copper from the Western Development Co., a concern which took over the remaining assets of Otto Heinze & Co., who failed after the explosion of a bunch of fireworks in United just before the 1907 panic. The letter conveyed the information that a large number of stockholders had agreed to exchange United Copper for Anaconda share for share, and ended with an inquiry as to whether such a proposition would appeal to the recipient. The response was a unanimous affirmative, coupled with an energetic inquiry as to the possibility of such a move. United Copper's assets are largely an unknown quantity, it has paid no dividends and its prospects are poor. As such an exchange would mean a clear market gain of $20 or $30 per share, the proposal seemed too good to be true; a view evidently held by the officials of the Anaconda, who, promptly and emphatically, denied all connection with any such deal or any other deal looking to the absorption of Mr. Heinze's company. The new Anaconda may develop a wide flung mantle of charity, but of a certainty it will never be extended to cover F. Augustus Heinze or any of his institutions. One particular trait of the Standard Oil Co. and of its affiliated organizations is a long memory, and assuredly Mr. Heinze gave them much to remember. A bill has been introduced in the New York Assembly, intended to curb the pernicious activity of mining promoters, whose ability lies in writing alluring advertisements. The measure will make it a misdemeanor to sell or offer to sell any shares in any mining, oil, or natural-gas enterprise, unless a proper statement shall have first been filed with the Secretary of State, giving both physical and financial details.

General Mining News

ALASKA

The report of the Alaska Treadwell Gold Mining Co. for the month ended states that the 240-mill ran 25 days, 16 hours, and crushed 27,104 tons of ore. Of this 590 tons of concentrate, valued at $37,524, was saved, and $59,414 as free gold. The operating expenses amounted to $64,781 and construction, $8056. The yield per ton of ore milled amounted to $3.77.——At the Alaska Mexican mine, the report for the same period gives the mill run 21 days, 2 hours, ore crushed, 12,397 tons, concentrate saved, 235 tons, valued at $17,748, base bullion, $1940, and free gold, $22,512. The operating expenses amounted to $26,482 and the yield per ton of ore milled, $3.40.

ARIZONA

COCHISE COUNTY

(Special Correspondence).—The adit being driven into Sacramento hill by the Copper Queen company, in the Warren district, has failed to cut the ore anticipated, and raises

Bisbee, Arizona.

will be started to prospect the altered ground nearer the surface. At the Uncle Sam a new orebody has been opened on the B level.——Development at the shaft of the Denn-Arizona has been confined lately to the 1350-ft. level where drifts have been started toward the Junction shaft.

Warren, April 9.

Sinking has been resumed in the Briggs shaft of the Superior & Pittsburg Copper Co., at Bisbee. The Junction shaft is now 300 ft. below the Briggs so no trouble is anticipated with the water which was the main drawback in the past. At the Hoatson there is probably more ore blocked out than any other shaft in the district. On the 1200-ft. level the orebody has been opened for a length of 700 ft. by a width of 100; on the 1300-ft. level, 700 by 120, and on the 1400 two sets above the level 175 by 90. About 325 tons per day are being drawn from this shaft which averages 7% copper.——The retimbering of the Oliver shaft of the Calumet & Arizona Mining Co., at Douglas, has been completed and the ore is now being hoisted there. While this work was being completed the company was hoisting about 900 tons per day through the Irish Mag shaft.——The Bisbee Extension Development Co. is now sinking below the 800-ft. level and cross-cutting on the 400.——The Nebraska & Arizona Copper Mining Co. has resumed work on the Morrow & Chamberlain group in the Paradise district.——At the California & Paradise, the boiler and hoist have been installed, and pumping resumed in the shaft.

GILA COUNTY

(Special Correspondence).—The Warrior Development Co. is shipping 105 tons per day of chrysocolla ore to the El Paso smelter. Practically all of the mining operations are confined to the 250-ft. intermediate level stopes and the 300-ft. level.——Three drifts and a raise are being driven at the Live Oak mine and the sinking of the vertical shaft is progressing rapidly. All the drifts now being advanced are on the third level. The two longer drifts are in ore of exceptionally good grade, and of excellent concentrating quality, while the third is in ore averaging about 2.5% copper.——The winze sunk from the fourth level of the Gardner workings of the Superior & Boston mine is 40 ft. deep and has been in ore averaging about 8% copper continuously. Drifts east and west from the winze on the fourth level have been in ore of about the same grade as that found in the winze.—The vertical prospecting shaft being sunk on the Blackbird claim of the Arizona-Michigan property is 140 ft. deep, and is still following a well defined vein containing much iron and manganese between limestone walls. The cross-cut driven south from the Telfair shaft on the fifth level is 700 ft. long, and still in shale, with very little mineral in evidence.——The cutting of a station at the 660-ft. level of the Williams shaft on the National Mining Exploration property is now under way.

Globe, April 9.

MOHAVE COUNTY

Two shipments were brought in recently from the Gold Road and Tom Reed mines, which establish new records for these properties. The Gold Road output, consisting of nearly 600 lb. of precipitate, is valued at approximately $25,000, and represents an 11 days' run of the 200-ton mill. The Tom Reed sent in 159 lb. of bullion worth about $37,000 which is the result of a 12 days' run in a 10-stamp mill. Flint pebbles, used for fine grinding in tube-mills, have been found along the Colorado river, and during the last few weeks they have been thoroughly tried out in both the Gold Road and Tom Reed mills giving excellent results.

PINAL COUNTY

The Calumet & Copper Creek M. Co. has been organized to take over options on 36 claims in the Bunker Hill district held by F. J. and R. Sibley. The property was formerly worked by the Calumet & Arizona M. Co. which gave the options to the Sibleys who have erected a 250-ton concentrator and are now building a reverberatory furnace to treat the concentrate.——The Guggenheim interests have taken over the old Silver Queen mines, near Florence, and a pipe-line to convey oil for fuel to the property is being laid.——The Montezuma and Gold Hill mines, four miles from Florence, have been consolidated and will be operated by the Montezuma Gold Mining Company.

YAVAPAI COUNTY

(Special Correspondence).—The recent discovery in the Little Daisy claim, at Jerome, proves to be the most important find for many years in this district. J. J. Fisher states that the orebody has been cross-cut 81 ft., and the wall has not yet been reached. The ore consists of red oxide of copper, native copper, and considerable glance.——The Jerome-Verde property is to resume development work at once under the direction of Thomas E. Campbell. This property adjoins the United Verde Extension group, on the east.

Prescott, April 8.

The Mildred Gold Mining Co. is erecting the 10-stamp mill which it removed from the Humboldt claim to its group in the Weaver district. There are two shafts on the property

which are to be connected on the 140-ft. level and the mill is so placed that the ore may be trammed to gravity from either. Dan B. Gehring is manager. —— E. L. Bartholomew and James Ross operating the Devonshire mine in the same district have opened a 2-ft. shoot that assays $60 per ton. Arrangements for the installation of a compressor and air drills are under way. —— New machinery has been installed at the shaft of the Arizona Bonanza Mining Co. and sinking resumed at a depth of 140 ft. There are four claims in the group which is situated about three miles from McCabe. —— Arrangements have been made to ship from 100 to 150 tons of ore per day from the United Verde mine to the Humboldt smelter. The United Verde ore is an excellent flux for the ores of the Humboldt district. —— Unwatering of the Triangle mine, at McCabe, temporarily stopped a few weeks ago on account of litigation, has been resumed and the property will be thoroughly sampled. The shaft is down 400 ft. with several hundred feet of drifts run on the ore.

YUMA COUNTY

A gasoline hoist capable of hoisting from a depth of 1000 ft. has been installed by the Inland Copper Co. at its property near Planet, and a contract let to sink the shaft from the 150 to the 250 ft. level.

CALIFORNIA

INYO COUNTY

W. W. Smith has succeeded Clarence S. Beall, who resigned recently, as manager of the Casa Diablo mine, near Bishop. The shaft is now below the 250 ft. level, and the main adit is expected to cut the Granite Mountain vein in a short time.

KERN COUNTY

(Special Correspondence).—The Red Dog mill, at Johannesburg, has installed a concentrator for treating tungsten ore. Christensen & Dolbear have found placer tungsten on a number of quartz claims in the Stringer district and have treated ore at the mill producing tungsten concentrate to the value of $800. —— The Atolia Mining Co. is about to install an electric light plant and is contemplating the erection of a stamp mill. The company has now about 30 men working on its Churchill property where a good vein of scheelite yielding a high grade tungsten has been opened. —— Len Cunningham has the contract on the new adit of the Consolidated Mining Co. About 100 ft. has been completed. —— The Sunshine Leasing Co. has completed a considerable amount of dead work and is now blocking out an orebody. —— Shipsey & Dickinson have a lease on the Little Butte but have done chiefly dead work up till now. The ore on the Little Butte and on the Butte occurs in lenses. These are rich and easily worked but are far apart. Benson & Bryan, who are working a lease on the 200-ft. level of the Butte, have struck a large orebody which they are stoping. Watchman & Watchman, leasing on the 160-ft. level, milled 6 tons this week which yielded $300. Montgomery & Norton sent 3 tons to the mill the other day which plated $84 per ton.

Randsburg, April 10.

NEVADA COUNTY

(Special Correspondence).—The copper mines in the Spenceville district are again attracting attention. Local capitalists are developing a number of properties near the Iron Mountain, which was taken over last year by the United States Smelting, Refining & Mining Co. In addition to copper the ores contain considerable gold. —— E. L. Fields and associates are arranging for the resumption of activities at the Gold Mound. New machinery will be installed immediately. —— The shaft at the Empire is down 3650 ft. and the ore showing is said to be good. —— The hoist at the Mountaineer has been completed and hoisting is under way from the 400-ft. level. It is expected to have the tramway completed within ten days. —— It is understood that the Central Consolidated will commence sinking soon. A new skip and 1100 ft. of iron cable have been installed. C. N. Bailey is manager.

Grass Valley, April 11.

The raise from the adit at the Blue Lead mine, at Relief, cut the gravel when up 30 ft. and drifts have been started toward the rims of the channel. The gravel is the blue lead and pans well. J. O. Jones is manager. —— Work has been resumed at the Mayflower mine on Canada hill and the old adit which is in 2000 ft. is being retimbered and a shaft is to be sunk at its face. The mine was formerly a good producer and supplied ore for the 20-stamp mill on the property. —— The force at the Giant King mine, near Washington, is to be increased and the mill started about the first of May. Throughout the winter the company has been blocking the ore out by the adit last fall and now has several hundred feet of backs ready for stoping.

PLACER COUNTY

F. B. Norton, superintendent of the Crandell property, has sunk three 60 ft. shafts on the vein opening some fair ore. —— The raise at the Red Sea mine, in the Auburn district, has opened the channel showing the gravel to be a portion of the old blue lead. —— A large body of gravel has been opened in the Home Ticket mine, near Last Chance. —— Work is to be resumed this spring on the Imperial property. —— At the Rawhide the adit is in 1500 ft., the face having a vertical depth of 900 ft. Portions of the vein exceed 70 ft. in width.

SIERRA COUNTY

(Special Correspondence).—The Rainbow has opened a rich shoot of ore in the main adit. It runs from 10 to 30 in. wide, with ore assaying from $50 to $5000 per ton. Some of the ore is exceptionally high-grade. The rich stuff is being sacked for shipment to the Selby smelter, while the low grade is being treated at the 10-stamp mill. —— The Oakes claim has been bonded by Homer Gould and E. Pegg, of Downieville. —— The Eastern interests controlling the Dreadnaught, Rose, General Sherman, and other properties have taken a bond on the Gold King at Alleghany. Development will be started immediately under charge of Daniel McGonigal.

Alleghany, April 11.

The Oriflamme mine at Alleghany has been sold by F. B. De Lanney and George W. Taylor to the Oriflamme Mining Co., of which C. C. Ward is manager. —— The drift at the Wonder mine has cut quartz that pans well and the management expects to open the shoot within a short distance. —— A raise to the surface has been completed at the Sixteen-to-One securing better ventilation and a shaft commenced that will cut under the rich ore opened last spring. —— The drift at the Twenty-One is in a good grade of milling ore. —— A new compressor is to be installed at the Cleveland mine. —— Work is to be resumed at the Oakland mine, in the Gold Lake district, in a few days. The company opened a good shoot of ore last summer and erected a small mill. —— A shaft is to be sunk 100 ft. on the shoot at the Standard mine in Sailor ravine.

SHASTA COUNTY

At a recent meeting of the officials of the Shasta County Farmers' Protective Association and the Balaklala Copper Co., at Redding, it was agreed upon that the smelting company would install the Cottrell process in its plant instead of building a bag-house as the Mammoth company is doing.

TRINITY COUNTY

(Special Correspondence).—In the Indian Creek district D. C. Dedrick has just made a satisfactory clean-up on the Texas Jack quartz mine. —— Morris Brothers & Fields' are washing gravel on their claims. —— Collin Brothers are preparing to resume operations on their Spring Gulch property and about to run some ore through their mill for J. M. Briscoe. —— F. O. Hollingsworth, superintendent of the Calmich mine, at Deadwood, has gone to the Yellow Jacket mine, in the East Fork district, and taken a force of six men to commence operations under an option held by M. R. Bacon, of Michigan. This property has been idle for some time. —— The lessees on the Gifford mine, in the Eastman Gulch district, have struck some rich ore averaging $5 per lb. —— Leas & Nicholson, lessees on the Brown Bear mine, at Deadwood, have a fine orebody with over 100 ft. of backs. The Brown Bear company is preparing to start up the mill. —— The Calmich company is install-

ing a compressor and as soon as this is completed will start the mill.——In the Weaverville district the Testy Brothers, Hupp Brothers, Armentrout, and La Grange placer mines are all running on full time, but present indications are that the water season this year will be short as the snow on the mountain is nearly gone.

Weaverville, April 11.

TUOLUMNE COUNTY

(Special Correspondence).—C. H. Thomas, acting for the company which recently acquired possession of the Providence mine, has put a small crew of men at work repairing the shaft and making other preparations for underground operations on a large scale.——Driving each way from the bottom of the shaft, 115 ft. deep, is now in progress at the Yrma mine, near Algerine.——The new shaft at the property on Indian creek recently bonded to L. B. Harris, of San Francisco, has reached 60 ft. and is in good-grade ore. ——A contract has been let for sinking the shaft at the Reed mine, near Big Oak Flat, an additional 100 ft. A hoist was lately installed.——An 8-hp. gas-engine is being installed at the Ida Klein mine, near Stent, and unwatering will begin soon.

Tuolumne, April 11.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence).—The Conqueror Mining & Milling Co., operating the Conqueror mine on Covode mountain, in the Georgetown district, will shortly start work in the construction of a 100-ton concentrating plant. W. S. Pryor is manager.——Since the Ocean Wave vein was intersected by the Capital adit, 6000 ft. from the portal, it has been driven through for 30 ft. The ore taken averages $16 per ton gold.——The new compressor plant at the Bellevue-Hudson, was put in operation last week, and work is under way sinking a 500-ft. shaft from the Rochester adit level.——The adit at the Lombard mine in the Alice district has intersected the vein 200 ft. under the upper workings, opening a good grade of milling ore.——On the Elliott-Barber lode operated by the Tanquay Mining Co. a body of ore 3 ft. wide has just been cut in the heading of the lower adit that assays from $10 to $17 per ton in gold.

Idaho Springs, April 9.

GILPIN COUNTY

(Special Correspondence).—Work was resumed this week in the advance of the Newhouse tunnel, two shifts being employed. The next vein to be reached is the Prize, a former heavy producer. It will be necessary to drive 1000 ft. before the Gunnell vein is intersected, which is the proposed objective.——A Rand 15-drill compressor of the Imperial type has been installed at the Topeka mine in Russell district.——The shaft of the Quaker City mine on Quartz hill has been unwatered to the 150-ft. level.——At the London mine in the Twelve-Mile district, a streak of ore has been cut that is from 8 to 12 in. wide and assays 7 oz. gold, 53 oz. silver, and 4% copper. W. R. McLeod and W. S. McConnell are operating under lease.

Central City, April 9.

LAKE COUNTY

At the Gold Basin property in the Leadville district the lessees are stoping on the 350-ft. level and shipping ore that averages about one ounce gold and eight or ten ounces silver per ton.——The Cleveland and Vinnie shafts of the Monarch Mining Co. continue to be the most productive of the district producing 75 tons per day. A new pump has been ordered for the Cleveland shaft and will be installed about the first of May. The Monarch shaft of the same company is to be unwatered this summer.——Lessees have resumed work on the Carbutt mine and are now sinking the shaft.——The Siwatch adit in Sugar Loaf mountain is now in 400 ft. and the management expects to complete the work at the rate of 200 ft. per month with the new compressor and drills recently installed.——The Western Mining Co. has installed a new 1000-gal. pump at the 1000-ft. level of the Wolftone shaft.

OURAY COUNTY

The Colorado Smelting Co. has announced that its plant at Ouray will be ready to blow-in by July 1, and that the company will commence receiving ore in a short time to insure a large supply when the furnace is ready for operation. Arrangements have been made to treat the Bright Diamond and Newsboy ore at this plant.——Operations are to be resumed at the Genessee mine in the Red Mountain district about May 1. F. M. Jackson is shipping $100 ore from the Wedge mine which he is operating under lease. ——In the shaft of the El Mahdi mine a new shoot has been opened that has the appearance of developing into a good body of shipping ore.

TELLER COUNTY

The Elkton Consolidated Gold Mining Co. of Cripple Creek declared the regular bi-monthly dividend of 1c. per share and an extra dividend of ½c. per share payable April 24. This will bring the total dividends paid by the Elkton company up to $2,554,460.——Work at the E. Porter mine on Gold hill has been resumed by a number of lessees and the mine will soon be on the shipping list.——Frank Seeley, of Victor, operating a lease on the Favorite property opened a shoot of ore that assays from $20 to $140 per ton, when driving a drift on the 500-ft. level of the Logan shaft.—— The Vindicator Consolidated Gold Mining Co. of Victor has declared its regular quarterly dividend of 3c. per share payable April 25.——A shoot of high-grade ore has been opened in the stope from the east drift on the 350-ft. level of the Henry Adney mine on Beacon hill. This is the second rich shoot cut within the past three weeks in this property.—— The Gaylord mill shipped a 24-lb. retort to the United States mint at Denver recently which represented the clean-up on the run of 1000 tons of low-grade ore from the Jerry Johnson mine.

IDAHO

IDAHO COUNTY

At the Crackerjack mine in the Buffalo Hump district 10 stamps are dropping steadily and 10 more will be started in a short time. In the mine both the winze and raise from the main level are in ore that assays $60 per ton.——F. W. Bradley has secured an option on Harmon & Morrow's Lone Pine group in the Ten Mile district. The recent discoveries of high-grade gold ore in this district has caused considerable excitement and a number of claims have been staked in the past month.

KANSAS

CHEROKEE COUNTY

(Special Correspondence.)—A mill is under construction in the Galena camp by the Mess Mining Co. which will have a capacity of 200 tons.——A company working on the Templar land south of Galena has opened a good deposit. The ore proved so rich that it sold at $8 per ton in the rough.——The Baxter-Quapaw camp is more active than it has been for some time. Old prospectors are increasing their workings and new ones are beginning operations. The Red Wing made a turn-in last week after being reopened, and has the same run of ore extending across its workings as is found in the White Eagle.——One of the largest sales of ore ever made in the Baxter camp was made last week from the Okla mine, consisting of 6 large cars bringing approximately $8.——The Old Abe mine will be started this week and the large amount of underground development at this mine will be sufficient to supply the mill continuously.

Galena, April 11.

MISSOURI

JASPER COUNTY

(Special Correspondence).—The capacity of the Alabama mine Porto Rico has been increased by the installation of a new 75-hp. motor. This plant is operated entirely by electricity, a 100-hp. motor being used to drive the mill and two of 37 hp. each to drive the hoisting apparatus. A 20-ft. face of ore is being worked at a depth of 185 ft.——The Bradford-Kansas City mine famous for containing one of the largest open pits in the field, has discovered a lower run of ore below the old workings at 187 to 211 ft.——The Mandarin in the south Joplin field has now become a heavy producer after a long period of prospecting.——A rich dis-

covery has been made on the Old Cardinal ground by Frank Watkins. A shoot of ore 2½ ft. thick is available all over the tract.—The old Bumblebee property southeast of Joplin, one of the famous mines of a few years ago, is being drained and will be opened as soon as possible. A medium sized concentrating plant is on the ground.—The Millard lease in the Porto Rico camp was last week sold to New York interests for $25,000 and preparations are being made by the new owners for the immediate development of the property and the enlargement of the mill.—The St. Paul company, one of the largest land owners of the district, has started drilling on land south of Joplin and has put down 20 drill holes, 18 of which showed ore assaying from 2 to 6%.—A new mill has been started at Four Corners by J. L. Babson. A large amount of development work was done while the mill was being erected and the ore on the dump is sufficient to keep the mill busy for some time.

Joplin, April 9.

Zinc Mining and Smelting Centres.

MONTANA

BROADWATER COUNTY

(Special Correspondence.)—The Ohio-Keating Gold Mining Co. has just made the final payment on its property in the Radersburg district. It is also announced that the control of the Ohio Keating has been taken over by the Radersburg Consolidated Mining Co., a new corporation formed under the laws of South Dakota, with a capitalization of $1,000,000. It is explained that the new company was organized as a holding corporation, and in addition to holding a majority of the stock of the Ohio-Keating holds control of the Manhattan-California Gold Mining Co. which is reported to own 400 acres in the mother lode district of California near Placerville. It is said that both the Montana and California companies will immediately begin mining and shipment of ore under the new management.——The Radersburg district will likely have railroad connection in the course of a few months. The mine operators have taken the matter up with the Northern Pacific company with the result that two surveys are now being made to determine the most feasible route.

Radersburg, April 8.

SILVERBOW COUNTY

An accident to the hoist at the Neversweat mine in Butte wrecked the engine and killed the engineer. One cage was dropped into the sump and the other hung up between the 1800 and 1600-ft. levels. The accident has thrown 300 men out of work and it is thought that the mine will be shut down several months to repair the damage which amounts to nearly $100,000.

NEVADA

CHURCHILL COUNTY

(Special Correspondence.)—The Nevada Hills and Fairview Eagle companies have consolidated, and in future both mines will be operated under one management. It is planned to erect a large milling plant. Water rights sufficient for all purposes have been secured, while electric power will be secured from the United States Government power plant which will be erected at Fallon, in connection with the Carson-Truckee irrigation project. Nevada Hills is opening good ore on the 600 and 750 ft. levels, and two or three carloads of high grade are being sent to the smelters each month.—The Nevada Wonder management announces that work on the power line will soon commence and that a milling plant will be erected in the summer.—Two 40 hp. traction engines have been ordered for traffic purposes between Fallon and Wonder.

Fairview, April 9.

CLARK COUNTY

The lower adit of the lessees on the I. X. L. property in the Searchlight district is in 180 ft. and a sample taken across the 30 in. vein at the face gave an assay of $40 per ton.—A contract has been let by the King Bee Mining Co. to sink a 5 by 7 ft. shaft on its property in the Eldorado Canyon district.—George Bergman is to add three stamps to his mill which is now crushing the ore with one Huntington.—Operations are to be resumed at the Rich Hill mine in the Eldorado Canyon district.

ESMERALDA COUNTY

The Weber-McLaughlin lease on the Booth property in the Goldfield district, cut 6 ft. of milling ore and a raise has been started to see if the shoot will develop into ore of shipping value. The Lind lease cut 4 ft. of quartz in the dacite and development work will be started on this later.—Development on the 500 ft. level of the Combination shows the orebody recently opened there to be between 8 and 10 ft. wide. On the 280 ft. level some rich stringers have been found which the management believes to be the continuation of the rich orebody opened in the upper levels of the mine.

LINCOLN COUNTY

At the Flagstaff group 11 miles north of Pioche several fissures of silver-lead-copper ore have been opened while doing the assessment work on the claims. Over a ton of ore containing considerable chloride has been hauled to Pioche.—William Fanchini and Joseph Vietti who have been operating the old Delamar mill under lease are crushing good ore and expect to clean about $5000 worth of amalgam off the plates.—The Gold Chief Mining Co. is tearing down a number of cyanide tanks at the mill and will remove them to the Panaca mine. E. L. Gluyas is in charge of the work.

LYON COUNTY

The preliminary work on the Mason Valley smelter has been delayed on account of the recent illness of Jules La Barthe who was to have started operations in March. It is now thought that the grading will be started some time this month and the foundations will be built in June and followed immediately by the installation of the machinery. In the mine work has been started on the 600-ft. level blocking out ore, the richest so far discovered being found on this level.——The grade for the Nevada Copper Belt railroad is completed to Smith valley and work has been started on the remaining eight miles to the Morningstar mine.

NYE COUNTY

The directors of the MacNamara Mining Co. operating in the Tonopah district declared a dividend of 2½c. per share amounting to $18,362 payable May 2. There will still be a large balance in the treasury which it is reported will be distributed in a short time. The raise from the 300 to the rich ore opened on the 275-ft. level has been completed and the drifts on the vein are being advanced more rapidly. The company is shipping about 250 tons of ore per week.——At the Montana Tonopah considerable cross-cutting has been done the past week in the Martha and Triangle veins opening good ore in both places. Work in the mine is well ahead of the mill which is dropping 40 stamps continuously.——The work at the Tonopah Belmont is mainly concentrated on the big orebody first opened on the 1100-ft. level. Drifts on this are being advanced on the 900, 1100, and 1160-ft. levels and a winze has been started at the 1160. This is down 15 ft. showing the vein to be over six feet wide and of good milling grade.——The Tonopah Extension report for March shows 15 bars of bullion valued at $17,250, 14 tons of sand concentrate valued at $500 per ton,

and 20 tons of slime concentrate valued between $250 and $300 per ton shipped. The ore from the mine is being mixed with a much lower grade from the dumps bringing the general average below that mined.——At Round Mountain a number of lessees are operating on the Blue Jacket property and shipping good ore.——After a long period of idleness the Elspass mill has been started on 750 tons from the Morrin & Perrine lease.

STOREY COUNTY

The report of the superintendent of the Silver Hill mine in the Virginia City district shows that a $3000-bar was shipped to the Carson City mint as the result of crushing 400 tons of ore. The tailing which assays high in gold and silver has been stored and will be sold in the near future. Raises have been started in ore on the 100 and 150-ft. levels.——The new transformer for the auxiliary pumping plant at the C. & C. shaft has been installed at the 2350-ft. station and the power has been turned through the motors which drive the new pumps. The old Cornish pump will now be pulled out of the shaft and the sinkers lowered. ——Company work has been discontinued in the Overman mine and leases let on the mine workings.——The 20-stamp mill at the Butters property has been started one day per week on ore from the Comstock Phoenix mine though the cyanide plant is being worked continuously on pulp from the tailing reservoirs. Later the mill is to be run on ore from the leased workings of the Monte Cristo and Collar-Potosi mines.

WHITE PINE COUNTY

James McDonough and E. Pursel have obtained a contract to supply the Steptoe Valley Mining & Smelting Co. with 200 tons of silica and are working at their claims across the valley from Ely. The company uses from 200 to 300 tons of silica per month.——Fred Becker and H. W. Lowrie have obtained a lease on the tailing from the plant of the Nevada United Mines Co. and are installing a cyanide plant to handle the material.——The officials of the Eureka & Palisade railroad have given out a statement that the road which was badly damaged by the heavy storms the past winter will not be rebuilt and plans are now being considered for a broad-gauge line from Ely to Eureka.——A complete 10-stamp mill for the Amalgamated Nevada Mines Co. has been landed at Ely and will be hauled to the company's property at Blackhorse. The plant will be erected near the Mabel and San Pedro mines which were recently acquired at a sheriff's sale for $102,000.

NEW MEXICO

EDDY COUNTY

The H. C. Hammond well near Dayton, which was brought in a short time ago, is now producing from 20 to 40 bbl. of oil per day. Pumping has been stopped temporarily on account of the lack of storage facilities, but two large cement reservoirs will be completed in a few days when operations will be resumed. The well of the Giant Gas & Oil Co. in the same district is down 750 ft. and is expected to cut the oil-bearing strata any time.

GRANT COUNTY

Over 3500 ft. of development work has been done at the Cleveland group eight miles north of Silver City opening several veins of zinc carbonate ore. The main vein is 40 ft. thick and assays from 20 to 40% zinc with a small amount of silver and gold. There are some 5000 tons of ore on the dump and arrangements are being made to erect a mill at the property.——Considerable work has been done at the Red Cross property which adjoins the Cleveland and a good grade of ore opened.

OREGON

BAKER COUNTY

The drift on the lower level of the Climax mine in the Cracker Creek district opened the rich shoot of ore that was cut in the upper level several weeks ago, giving the company 300 ft. of backs.——Considerable work is being done on the Listen Lake property near Sumpter and a good body of copper ore is being opened at a depth of 300 ft. Should this prove to be a good smelting ore it will go a long way toward settling the problem of obtaining sufficient ore of proper grade at the Sumpter smelter.——A number of prospects are being opened in the New Eldorado district which is a portion of the Greenhorn and Middle Fork districts.

PHILIPPINE ISLANDS

A recent sampling of the San Maricio mine in the Paracale district resulted in the average of $26 per ton. The company started its 20-stamp mill the latter part of February and is now preparing to build a small tram to convey the concentrate to the coast and supplies to the mine. Monthly shipments of bullion will be made to Manila and of the concentrate to some of the Pacific Coast smelters. In the mine a station has been cut on the second level and a cross-cut started toward the vein. A. W. Cole who was formerly superintendent of the Benguet Consolidated is now in charge of the mill.——The East Batan Coal Mining Co. is producing 6000 tons of coal per month and is preparing to install machinery that will greatly increase this output. It is estimated that the company has in sight enough coal which sells for $3.25 per ton at the mine to produce 300,000 tons annually.

TEXAS

EL PASO COUNTY

(Special Correspondence).—A streak 18 in. wide that assays more than 90 oz. silver is being developed in the Tama mine in the Quitman mountains. This mine is being worked by John Moffitt under bond and lease from Thomas O'Keefe.——An adit that was driven at the Lula B mine in the Quitman district cut the vein a few days ago. The mine is owned by T. McKinney and William Crosby of El Paso.——A wide pay streak of high-grade sulphide that assays well in gold and silver was opened a few days ago in one of the mines of the Little Lightning group situated near Lasca. These mines are producers of ore that assays from 12 to 18% copper, several cars of which have been shipped to the smelter at El Paso. All of this ore was taken from a 45-ft. drift at the bottom of a 25-ft. shaft. The group is owned by John C. Gilcrease.

Lasca, April 9.

CANADA

BRITISH COLUMBIA

(Special Correspondence).—A few more drills are being started at the Le Roi mine in the Rossland district which will no doubt make heavier ore shipments in the near future.——Harris Brothers of Rossland have sold another property near Hazelton that they are interested in for $35,000.——It is announced from Ottawa that the Dominion Government has decided to make a general codification of the mining laws of Canada, which should do away with the present confusing state of affairs. Committees have been appointed to start this important work.——The Blue Bell mine in the Nelson district has been closed down. This is a low-grade zinc-lead property which has been concentrating about 900 tons of ore per week, most of which has been taken from above the adit level. It is known that there is a large tonnage below this level, but the mine at present is not equipped to handle this ore economically.——Several good discoveries have recently been made in the Slocan district. In addition to the find of good ore at the Rambler Cariboo, a body of galena averaging approximately 55% lead and 200 oz. silver per ton has been opened on the Hidden Treasure claim of the Slocan Star group.——At Coleman the McGillivray Creek Coal & Coke Co. has its new tipple in operation and will double its output. Electric fans have been installed and work on the new adit begun.——The British Columbia Copper Co. treated about 45,000 tons of ore in February and made a net earning of approximately $41,000. Copper was produced at a cost of 7.88c. per lb., which included all costs of development work at the mines. The company is making preparations to install a tram from the No. 7 mine to the mill-site at Boundary Falls, where preparatory work is being done toward the erection of the concentrator.

Rossland, April 9.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

H. V. Winchell is at New York.

Lionel Lindsay is at San Francisco.

James Douglas is at Bisbee, Arizona.

R. H. Channing was in San Francisco.

Jesse J. MacDonald is in San Francisco.

Courtenay De Kalb has gone to Arizona.

F. Lynwood Garrison is in San Francisco.

C. W. Purington is at Brookline, Massachusetts.

Corin C. Brayton is in Mexico examining placer ground.

H. F. A. Riebling is in Iowa examining a fire clay property.

S. F. Shaw has been making an examination in Sonora, Mexico.

L. J. Hohl has gone to St. Gall, Switzerland, for a few months' trip.

John W. Mercer landed in New York, returning from Europe, April 8.

Forest B. Caldwell is leaving Santa Lucia, Sinaloa, for Woodland, California.

A. M. Yongo has moved to Richmond, Virginia, from San Mateo, Costa Rica.

S. F. Brethergon is in Plumas county, California, on professional business.

George J. Young of the Mackay School of Mines has been visiting Freiberg, Saxony.

E. McCormick has returned to Calumet, Michigan, from an extended visit to the East.

Robert Scott has returned to San Jose from a visit to the quicksilver mines of Morelos, Mexico.

C. Barnes Hoadley, of Searchlight, Nevada, is making an extended tour through the mining districts of Mexico.

Bernard MacDonald is general manager for the Veta Colorada M. & S. Co., at Villa Escobedo, Chihuahua, Mexico.

L. G. E. Bignell, sales manager for the Denver Engineering Works Co., has returned to Denver from Salt Lake, Utah.

I. H. France is in Chalchihuites, Mexico, making an examination of the National Smelting property for the C. L. Constant Company.

John Perry, chairman of the Board of Directors of the Palmarejo & Mexican Gold Fields, Ltd., is on his way from London to Chinipas, Mexico.

Hal. M. McLaughlin is now general manager of the mines and smelter of the Central Chili Copper Co., Ltd., at Panulcillo, Coquimbo, Chile.

Donald F. Irvin is leaving thet Standard Con. M. Co., at Bodie, California, to accept a position with the Vulture Mines Co., Vulture, Arizona.

Charles H. Shamel is delivering the annual course of lectures on mining law to the senior law class and the mining students of the University of Washington at Seattle.

OBITUARY

Thomas F. Walsh, who died at Washington, D. C., April 8, was one of the best known mining men in America. He was born in Ireland in 1851, and educated in the public schools. He came to America at the age of 19, going almost directly to Colorado and taking up mining. His first success was at Leadville, and he worked in the Black Hills of South Dakota, but it was in the San Juan that he won fame and fortune. Mr. Walsh will probably be best remembered as the discoverer of the Camp Bird mine. His success was not fortuitous but was founded on hard work and intelligent study. As is well known, the Camp Bird had been located, worked, and abandoned before Mr. Walsh was attracted to it. His predecessors had looked only for the particular type of silver ore found in adjacent properties and had overlooked the possibilities of the thin streak of quartz which since has yielded so many millions of dollars in gold. He had the foresight and patience to examine the whole vein, and the business acumen to properly equip and develop the mine after he had obtained possession. After selling the Camp Bird, Mr. Walsh lived at Washington, D. C., and took an active part in public affairs, though he never, in pleasing contrast with other millionaires, bought his way into political office. As commissioner to the World's Fair in Paris he came into contact with King Leopold, of Belgium, and he was influential in promoting development of the mineral resources of the Congo. The Trans Mississippi Congress, the Irrigation Congress, the American Mining Congress, the Conservation Commission, have all had his help in their work. He was a liberal and consistent giver not only of money, but of service and was deeply interested in the mining industry. As founder of the Vinson Walsh research fund at the Colorado School of Mines, he greatly stimulated the search for, and study of, rare minerals and in this and other directions his influence will work for good long after he, as an individual, has been forgotten. Mr. Walsh represented the best type of the sturdy pioneer and prospector. He was a likeable companionable man, and to those who had known him as a miner, he remained always the same friendly 'Tom Walsh', and was genuinely glad to do so.

Franklin R. Carpenter, who died April 1, at Chicago, was widely known as an expert in smelting. He was born at Parkersburg, West Virginia, in 1848, and graduated at the University of Ohio at Athens. He spent some years teaching in Colorado and South Dakota, and it was while serving as Director of the South Dakota School of Mines that he first seriously took up the problems of pyritic smelting, the field in which he was best known. He built the Deadwood & Delaware Smelting Works, at Rapid City, making them the first commercial success of pyritic smelting. In 1900 he returned to Colorado where his services were in large demand in consulting work. He built the Rocky Mountain Works at Florence, and the Clear Creek Mining & Reduction Works at Golden, operating the latter, in connection with the Saratoga mine, for some years. He found time not only to experiment and to operate, but to contribute frequently to the technical press and in determining the limitations of pyritic smelting did much excellent work.

PUBLICATIONS RECEIVED.

Any of the books noticed in these columns are for sale by, or can be procured from, the Mining and Scientific Press.

The Innoko Gold-Placer District of Alaska, with accounts of the Central Kuskokwim Valley and the Ruby Creek and Gold Hill Placers. By A. G. Maddren. U. S. Geol. Surv., Bull. 410. Pp. 83, ill., index, maps. Washington, 1910.

An excellent general account of a region which will attract much attention this summer. Prospectors and others intending to enter this territory should have a copy, which, as usual, may be obtained free on application to the Director, U. S. Geol. Survey. Washington, D. C.

Report of the Governor of the District of Alaska for 1909. By W. B. Hoggatt. Pamphlet. Pp. 69. Washington, 1909.

It is recommended that a law be enacted defining the length of tunnel or depth of shaft which shall be required as assessment work and also requiring that such work shall be done within 90 days after location. It is also suggested that association claims should require eight times the work done on one claim. These changes, it is held, would throw open vast areas of placer ground now held for speculative purposes under location by power of attorney or in association claims.

COMMERCIAL PARAGRAPHS

S. B. Gregory has been appointed Pacific Coast manager for the Arrow Electric Co., of Hartford, Connecticutt, with offices at 629 Howard street, San Francisco.

The American Machinery & Export Co., of Tientsin, China, announces that it is prepared to accept agencies for American mining, milling, and railway machinery in North China. Only American agencies will be accepted by this firm, as the handling of American business by British and German firms has proved unsatisfactory in practice. Affiliated with the firm are six American engineers, and it is prepared to advise on plant required and to design and erect power and reduction plants of any nature. Communications should be addressed to the manager, E. K. Lowry, Tientsin.

The Mines Management Company, 40 Wall street, New York, has been formed for the purpose of furnishing to bankers, brokers, underwriters, and syndicates, reports and appraisals on mining stocks or properties. This company will also undertake the organization or re-organization and consolidation of mining properties, and it is its further purpose to undertake the management of mines and to supply engineeering, managerial, and other services to those interested in mining. This company will maintain a New York office having connections with well known consulting engineers in North and South America. In many respects, the organization will follow closely that of the well known firm of John Taylor & Sons, of England. The directors of the Mines Management Company are Philip W. Henry, president; Edwin C. Holter, vice-president and general counsel; Marvyn Scudder, secretary; W. B. Devereux, Jr., treasurer, and H. A. J. Wilkens. F. A. Provot is consulting engineeer. Among the engineers associated with the company are J. Gordon Hardy and E. Coppee Thurston. At present the Mines Management Co. is managing the Achotla mine, one of the Ortiz properties in the State of Guerrero, Mexico. The mine is 8 miles north of the Balsas river, and 50 miles from the terminus of the Guernavaca branch of the Mexican Central railroad. It is producing gold-silver bullion which is sold in Mexico City.

CATALOGUES RECEIVED

The C. O. Bartlett & Snow Co., Cleveland, Ohio. Catalogue No. 31. 'Soft Mud Brick Machinery, Low Pressure Brick Dryer, and Automatic Pallet Conveyor'. Illustrated. 6 by 9 inches. 32 pages.

Trojan Powder Co., New York. A little booklet setting forth the advantages of Trojan powder and containing much of interest to users of high explosives. Illustrated. 4 by 9 inches. 20 pages.

T. H. Proske, Denver, Colorado. Catalogue showing the salient features and advantages of the Ajax Drill Sharpener. It contains a great deal of information that everyone using rock-drills should have. Illustrated. 6 by 9 inches. 20 pages.

Williams Patent Crusher & Pulverizer Co., St. Louis, Missouri. General catalogue showing crushing, pulverizing, granulating, and shredding machinery. An interesting installation of Williams machinery has recently been made at Cananea, Mexico, where Colonel Green, of Cananea Copper Co. fame, has a stock food plant of from 2 to 3 tons per hour. Illustrated. 10 by 13 inches. 62 pages.

L. Vogelstein & Co., give the following figures of German consumption of foreign copper for the months January and February, 1910:

	Tons.
Imports of copper	29,465
Exports of copper	1,095
Consumption of copper	28,370

as compared with consumption during the same period in 1909 of 23,019 tons. Of this quantity 26,563 tons were imported from the United States.

Market Reports

LOCAL METAL PRICES.

San Francisco, April 14.

Antimony	12—12¾c	Quicksilver (flask)	49—49½
Electrolytic Copper	16¼—16½c	Spelter	7—7¼c
Pig Lead	4.75—5.70c	Tin	36—37½c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Apr. 7	12.94	4.38	5.58	52⅛
" 8	12.81	4.38	5.56	52¼
" 9	12.75	4.38	5.55	52⅛
" 10	Sunday.	No market.		
" 11	12.69	4.38	5.54	53
" 12	12.69	4.38	5 53	53⅛
" 13	12.69	4 38	5.51	53⅛

ANGLO-AMERICAN SHARES.

Cabled from London.

	Apr. 7. £ s. d.	Apr. 14. £ s. d.
Camp Bird	1 8 6	1 8 6
El Oro	1 8 6	1 8 3
Esperanza	2 18 9	2 15 0
Dolores	1 8 9	1 8 9
Oroville Dredging	0 9 9	0 10 6
Mexico Mines	9 5 0	9 0 0
Tomboy	0 18 9	0 18 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, April 14.		Closing prices, April 14.
Adventure	7	Mohawk	53
Allouez	49	North Butte	21¼
Atlantic	8	Old Dominion	10¼
Calumet & Arizona	66½	Osceola	38
Calumet & Hecla	590	Parrot	15⅝
Centennial	20	Santa Fe	1¾
Copper Range	71	Shannon	12¼
Daly West	8¼	Superior & Pittsburg	13
Franklin	1½	Tamarack	60
Granby	45⅛	Trinity	6¼
Greene-Cananea, ctf	9¼	Utah Con	21⅝
Isle Royale	17¼	Victoria	3½
La Salle	57⅛	Winona	8½
Mass Copper	7¼	Wolverine	126

(By courtesy of J. C. Wilson, Mills Building.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, April 13.		Closing prices, April 13.
Amalgamated Copper	76¾	Miami Copper	24¼
A. S. & R. Co.	84⅜	Mines Co. of America	½
Boston Copper	18⅛	Montgomery-Shoshone	¼
B. C. Copper Co.	6¼	Nevada Con.	21⅛
Butte Coalition	23⅜	Nevada Utah	1
Chino	13¾	Nipissing	10⅛
Davis-Daly	2¾	Ohio Copper	3¾
Dolores	6¼	Ray Central	3⅜
El Rayo	3	Ray Con	20
Ely Central	1	South Utah	2⅛
First National	2⅞	Superior & Pittsburg	13½
Giroux	8¾	Tenn. Copper	32½
Guanajuato Con	1	Trinity	7½
Inspiration	7½	Tuolumne Copper	3½
Kerr Lake	8⅝	United Copper	67⅛
La Rose	4¼	Utah Copper	47⅛
Mason Valley	9	Yukon Gold	4⅛

SOUTHERN NEVADA STOCKS.

San Francisco, April 14.

Atlanta	$ 15	Mayflower	$ 3
Belmont	2.65	Midway	31
Booth	16	Montana Tonopah	85
Columbia Mtn	6	Nevada Hills	50
Combination Fraction	50	Pittsburg Silver Peak	75
Daisy	8	Rawhide Coalition	36
Fairview Eagle	20	Rawhide Queen	24
Florence	2.00	Round Mountain	50
Goldfield Con	7.75	Silver Pick	10
Gold Kewenas	7	St. Ives	15
Great Bend	3	Tonopah Extension	85
Jim Butler	17	Tonopah of Nevada	7.00
Jumbo Extension	33	West End	36

(By courtesy of the San Francisco Stock & Exchange Board.)

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EDITORIAL.

SYMPATHY from the entire profession goes out to Mr. D. W. Brunton on his distressing automobile accident near Fort Collins. We are glad to report that he is resting easily at the hospital in Denver and recovering as rapidly as could be expected.

RAILWAY building is active in the Northwest. The Great Northern has already awarded contracts for a track over Hope mountains on a line from the Boundary district of British Columbia to the Coast. The Canadian Pacific is to continue its line from Midway to Penticton and is expected also to build over Hope mountains to Vancouver.

CONGO COPPER production has been much discussed and tales as to future enormous outputs have been widely circulated. Rapid progress is undoubtedly being made as is instanced in the order just placed with the Allis-Chalmers Company by the Union Minère du Haut Katanga for a crushing, concentrating, and smelting plant to handle 900,000 tons yearly.

A TESTIMONIAL DINNER is to be given to Dr. Rossiter W. Raymond at New York, April 30, in celebration of the seventieth anniversary of his birth. His friends are far too numerous and widespread to be more than represented even by the goodly company which will doubtless assemble on this occasion. We shall hope to present later some account of the affair; for the present we extend congratulations and good wishes mingled with keen regret that distance prevents our active participation. There are times when the United States seems over large.

ZINC mining conditions are improving. The effect of the tariff is discussed elsewhere in this issue by Mr. Otto Ruhl. At Joplin the average base price for the seven months before the law went into effect was $40.21. For the corresponding period after, it was $47.74. That difference makes it profitable to re-work old ground and to open additional mines. One interesting example of the new work is that undertaken near Galena by the Boston Mining Company which is re-opening 440 acres previously mined by shallow shafts. It is proposed to install steam-shovels in open pits and to treat the ore in a 600-ton mill; all of which indicates a material change from old conditions. The directors of the new company are conservative business men, experienced in Joplin mining so that the success of the enterprise seems assured.

LAND THIEVES are to have a rest. The famous million dollar appropriation to the Department of the Interior for investigating irregularities in land claims has all been spent and the Special Agents are being furloughed. An additional appropriation of three-quarters of a million has been asked and something doubtless will be granted. There is need for a sufficient force of Special Agents to promptly investigate all claims, but large special appropriations are rarely justified and can even more rarely be used without waste. What is needed in Government service is adequate continuous appropriations rather than alternate periods of feast and famine.

The Coal Miners' Strike

The suspension of work in the bituminous coal mines is only indirectly important to metal miners. The larger plants that are dependent on coal for fuel chance to be mainly so situated as to draw from collieries worked by non-union men. Others accumulated in advance a sufficient stock to last through even a prolonged period of suspension. In Illinois the men have agreed to an arrangement whereby mines supplying coal to the Steel Corporation but not entering the general market, may continue in operation. In Alabama and in the non-union portion of West Virginia and Colorado, the collieries are in full operation. At Joplin gas and electricity are now largely used. In Utah and Montana there is no trouble, and in California, coal and coke are brought in by water. It seems likely that the metal mining industry will feel the effects of the suspension first, if at all, in difficulties over transportation of ore and supplies. The railways use more coal than does any single industry. Directly and indirectly they afford the largest market for bituminous coal and in the last analysis the price paid coal miners is fixed by the railway managers. The needs of the railways and the plans of the railway owners will determine how long the mines remain idle and on what terms the men shall resume work.

It does not seem likely that the suspension of work will continue long. The railways are busy and an unusually large volume of freight is anticipated this summer and fall. Much re-construction is necessary, much is already under way. It is a bad time to have engines dead for lack of fuel. The roads, too, must raise large sums of money for improvements. Mr. James J. Hill estimates that $9,600,000,000 is needed for increasing terminals and sidings alone. In the first quarter of the present year $350,000,000, roughly, has been raised by sale of bonds, advanced by syndicates, or borrowed on notes, for railway improvement in this country. Already it is clear that higher rates than the customary 4 per cent must be paid if these vast improvements are to be made. It is impossible to raise large sums of money except when the country is prosperous, and the astute managers of the big railway systems are not likely to endanger their program to save a few cents on the cost of mining coal.

The United Mine Workers of America is not a new and untried organization. It has a membership of over a quarter of a million men and has capable and experienced officers. It undoubtedly dominates the situation in the central competitive States and in the Southwest. It is weak in the South, in the Southeast, and in the West. In the Middle West and Southwest, however, there is no question as to the ability of the officers to hold the men in line despite the fact that the amount in their treasury is now small. Any thought of breaking the power of the Union by importing non-union men, has long since been abandoned by experienced operators. On the whole, relations between operators and men are cordial. It is only where union come into competition with non-union mines, that the pinch is felt. At first it was thought that the operators of non-union mines in West Virginia would hold out against an increase in wages and the Union officials anticipated an unusually good opportunity to organize the men in these districts. The operators, however, defeated this move by promptly paying the increase asked. As a result the men in non-union collieries, who have contributed nothing to the movement for higher wages, already have the pay for which the Union men are still fighting. It is this sort of a situation, by the way, which not unnaturally, makes Union men vindictive toward the independents.

At present, prospects for settlement on the basis of increased pay to the men seem bright in all districts except western Pennsylvania, Illinois, and Colorado. Even in these areas the advance would probably be promptly conceded if there were no other complications. In western Pennsylvania the trouble arises in connection with the use of safety powder, ordered to be used by the State Mine Inspectors. Both men and companies are willing that the old and dangerous powders should be excluded from the mines, but each wishes the other to assume the extra cost. In Illinois there is a similar difficulty over payment of shot-firers. While according to the State law, these men must be employed and paid by the operators, it has been customary for the men to reimburse the companies. This curious arrangement arose from the fact that the shot-firer's law was passed at the behest of the men at a time when a contract covering mining conditions already existed. As the payment of shot-firers increased the cost of mining and threw the Illinois operators out of line in competition with Indiana and other States, they claimed reimbursement: which the men granted. In both Pennsylvania and Illinois the men say that if the extra cost of safety powder, shot-firers, and other improvements is to be taken from their wages, they will be driven to the unnatural position of fighting every improvement in mining. In Illinois there is a further complication in a threatened advance in freight rates which would still further disadvantage the local operators.

Coal operators can afford to look with some calmness on an advance in the cost of mining which applies to all, but those of each State must necessarily oppose any increase which puts added difficulties in their way and leaves competitors free. In Colorado the trouble is over the fact that only the mines in the northern district are really unionized. The

southern mines accordingly are running as usual, and the northern operators are in danger of losing their trade. Whatever of good will, if any, they may have toward the United Mine Workers it is not in human nature to sit still and see one's business go to pieces. At least it is not in the nature of Colorado operators. Preparations are accordingly being made to open the mines with non-union labor and the customary force of guards has been hired. There is every reason to anticipate trouble since in Colorado the men take their Unionism seriously. In the end it will be a question whether fighting the strike will give the operators cheaper coal than peaceful payment of the increase asked.

Improvement in industrial conditions has ever come slowly and often through conflict. It is the way of evolution. In the future coal is undoubtedly going to cost more to mine and is going to sell for more throughout the United States, and the United Mine Workers is likely to be an important factor in bringing this about. In the Middle West this organization is already dominant. It is certainly growing in the East, and the affiliation already under discussion with the Western Federation of Miners will give it strength in the West. It will take, however, a much stronger organization than now exists to raise the price of coal to the railways and larger industrial companies, the ones who now buy it cheap. The domestic consumer and the small steam-user already pay their share. They can afford to gaze on the situation with equanimity and speculate at ease on the ways of social progress.

The Earthquake Anniversary

Four years ago last Monday San Francisco experienced the most destructive earthquake of which there is local record. The story of April 18, 1906, and the succeeding anxious days has already been told in the columns of the MINING AND SCIENTIFIC PRESS, as has also the fascinating tale of the rebuilding of a modern city after destruction by quake and fire. The work is now nearly complete. Literally acres of the finest office and business buildings have been built in the burned district and San Francisco is transacting business at the old stand, with larger and better equipment than ever. The earthquake of 1906 was not the first which had been felt here. The files of the MINING AND SCIENTIFIC PRESS contain many interesting references to the shocks of 1865, 1868, and other years, and still older records tell of earth tremors in the days before the gringo came to disturb the peaceful padres and their flocks. Mark Twain, in 'Roughing It', has given an entertaining picture of the earthquake of 1868, as he observed it on Third street not far from the site of our present office. Then as now earthquakes were accepted lightly by Californians as being among the phenomena of nature which make life interesting. Certain it is that earthquakes are not to be prevented. Damage by them may, however, be vastly minimized and to that end much has been done in rebuilding San Francisco.

In 1906 the great loss was by fire following the earthquake and in restoring the city extraordinary precautions have been taken to prevent a recurrence of fire loss. Fireproof construction has been widely adopted and while even the best modern structures can not be expected to remain undamaged in case of a veritable conflagration, experience here as elsewhere has proved that proper building is not only the best preventive of the start and spread of a great fire, but is effectual protection from serious damage by any but the greatest.

Water is, after all, the best means of fighting fire, and in the new San Francisco water is amply provided. To prevent breaking of pipes, the mains are laid with tested sleeve-joints instead of the ordinary bell and spigot joints. As a further safe-guard valves are placed at every street intersection in the district subject to damage and at frequent intervals elsewhere. Any broken pipe can be quickly cut out of the circuit and water passed by other mains. Auxiliary stations with powerful pumps are provided so that water can, if needed, be supplied from the Bay. Mains are carried to the ends of numerous piers and in case of destruction of the ordinary reservoirs and the stationary auxiliary pumps, the mains could still be filled by using fire-boats. The Fire Department is large, well drilled, and well equipped. As a final precaution numerous large street-cisterns have been dug and filled with water. These cisterns are constructed of water-proofed reinforced concrete and are so strongly made that a visiting engineer recently expressed the opinion that they would be shaken bodily out of the ground before being broken. Each cistern is marked by a ring of brick in the asphalt so that even in times of greatest confusion it would be easily found and opened.

By these and other means San Francisco has been made one of the safest cities in the world as regards possible damage by fire, and one of the results of the careful studies made after the earthquake is that it is now possible to mark with great accuracy the areas subject to especial damage in any earthquake region. The reason for the strange freaks of destruction has been found in the character of the foundation. As in Biblical times, the house built on rock is safe. In America but little attention has been paid to studies of this sort though interest in them is increasing. While the subject is of especial interest in California at present, this is merely because it is here that there has been recent damage. The Mississippi Valley in 1812, and the Atlantic Coast in 1886, suffered severely and these and other portions of the country are subject to future damage. On another page are given the resolutions passed at the recent meeting of the Seismological Society of America. It is proposed that a National Institute be founded to carry on research as to the occurrence, causes, distribution, and intensity of earthquakes. Observing stations are to be erected and measurements made which, in time, may even permit forecasting. The terror of storms at sea has largely disappeared now that hurricanes are foretold and sailors are warned. The storms still come but they pass by harmless. It is not too much to hope that in time damage by earthquakes may be similarly minimized.

BY THE WAY.

The following address was delivered before the San Francisco Bar Association recently by Courtenay De Kalb:

In asking me to discuss collectivism tonight, Judge Lindley has asked one who is quite likely to take an opposite view from his own, for the Judge has been brought up in the centres of civilization, while I am essentially a frontiersman.

I think that the experience a man acquires on the frontier necessarily causes him to pay a great amount of respect to the rights of the individual—much more so than in the case of one who has been brought up in the centres of civilization. He comes to appreciate individual iniative and individual prowess on the frontier, and he comes to think less of it where he is not called to depend so much upon the unit as upon the mass. There is such a thing as 'mass action' socially, just as there is chemically; there are changes occurring which are proportional to the products of the masses taking part in it. This is part of the cause of the complexity of social problems, and of the difficulty of determining the course of social evolution as a logical process. There are surprises, inexplicable phenomena—the vagaries due to 'mass action,' which here means the shifting balance of preponderating sentiment at different times. Thus we can not predict; we can not be sure that we or any other men, or body of men who take the task upon themselves, are guiding the forces of civilization in any particular direction. We can study what has been done; we can measure the size and strength of the stones that have been set into the social structure. And it has been borne in upon me that the courts have had more to do with this final work as social artificers than any other single agency. It seems that we can not regard anything in our civilization as essentially fixed until it has been fixed by the courts; until it has been winnowed, and tried, and tested by the judicial safeguards of our civic life. There is eternal shifting, tidal ebb and flow, in the great sea of social existence where men are struggling. In this ceaseless effort, which is an effort always for the future, and therefore progressive, something must line up the flood into a definite current, a consciously purposeful stream; and the force that does it is the force we admit as final, before which we all bow at last, namely, the decisions of the judges. We do not know which way we are going until the courts have decided which way we may go.

The decisions of the courts have determined for us, I think, in later years, that the individual is less to be regarded than the mass. I believe that spirit is growing in the West more than it is in the East. That is because the West is feeling the influence of social aggregation after that period of intensely individualistic effort which is needful for pioneer development; but on the other hand it represents relaxation; it means transference of power from the atomic unit to the molecular unit. I am not saying which is better; I am pointing out a fact, and a great fact, fraught with mighty consequences. In proportion as we lose the influence of individual initiative we lose something that has made heroes, brave men, doers of wonders that will remain an inspiration to all times. There is the reverse side of this picture, to wit, the individual brute, trampling on the rights of other men. Are we sure that collectivism will not possess its collective brutality, its collective disregard of your rights and my rights, and those of your children and mine? But these changes are inevitable; the world will go as it listeth, as the wind blows, but the courts are our barrier-walls and wind-breaks to protect our homes, to give us the shelter of peace and security in the divine right to wrest out of the turmoil of life the only thing worth living for—happiness!

I said that the tendency away from individualism was growing in the West. I may illustrate it from events in the mining world, for I must perforce look at this world through the spectacles of an engineer. The West drew its initial strength from the mines, and the balance between the output of the mines and that of the farms is something that it is worth while to maintain for a long time to come if industrial conditions in the West are to remain universally healthy. There has been a tendency to grant that mining corporations may take precedence over the rights of individuals. For my part, I think that we have to admit that the welfare of the community is necessarily to be cared for by the courts, rather than to have our rights looked after by the individual. In a recent decision, which I believe is going to be reviewed soon in this State, it being rendered originally in Montana, the doctrine of the greatest good to the greatest number was set forth in the clearest possible terms. It was a decision by Judge Hunt, in the famous Anaconda smoke-case. There was the question of shutting down a smelter, which involved the cessation of mining operations, and the throwing out of employment of something like twelve thousand men, involving indirectly a population of about forty thousand people. There was no doubt in the world that the surrounding farms were being damaged. At first the injunction was granted, and then the injunction was set aside on the ground that a few could not take away food from so many mouths; and that was done in entire disregard of ample proof that damage was being done and that the continuance of farming was prejudiced throughout a large range around the smelter.

The question of the rights of individuals in Arizona was dealt with in a different way. A decision recently in the Arizona supreme court in connection with the Arizona Copper Company, recognized the right of the farmers; yet that decision has been set aside, pending appeal to the Supreme Court of the United States, so that an effort on the part of the judiciary to protect the individual in Arizona has so far failed.

I have been interested in noting in the court decisions this tendency to exalt the general proposition of the greatest good to the greatest number. My feeling has been that while that must necessarily go on, while we will continue to tenderly regard the mass, at the same time, we must be very careful that we do not lose sight of the units which make the mass.

Housing Conditions at the Garfield Smelter.

Written for the MINING AND SCIENTIFIC PRESS
By L. S. AUSTIN

In settling upon a site for a smelting works regard is had, not only for convenience to railroad lines and to water-supply, but also to convenient places where the men may live. In the Salt Lake valley, Utah, however, the injury to the adjoining country from the emission of sulphurous acid fumes from the works, has compelled the selection of sites for new plants, distant from settled places, where the smoke can do but little damage, and where the smelting company can so control adjacent land that it shall not fear troubles from litigation. At the Washoe plant, Anaconda, Montana, the works are situated two miles from the town, and the company has provided a street-car system for transporting its 2000 employees to and from the works to their dwellings. At the new plant of the International Smelting & Refining Co., in Pine canyon, Utah, four miles from Tooele, trains take the men to their work, and Tooele itself, an old settled place, affords an attractive town in which to live. The works of the American Securities Co., at Garfield are 17 miles from Salt Lake City, the distance being made in 40 minutes. Taking the waiting-time at both ends and for the time spent on the street-cars in Salt Lake City, as much as three hours per day may be consumed by employees in going to and from their work. Part of this difficulty has been overcome by the establishment of a town at Garfield, about one and one half miles from the smelter. It has been planned to operate a street-car line for the employees, but this has not yet materialized. Consequently the advantages of Garfield are nearly nullified.

When the works were started much foreign labor was employed and many of the men built shacks below the works where they lived under temporary, primitive, and unsanitary conditions. They were not well under control, there was an unruly element among them, and disputes occurred, due in part to the free use of beer and liquor. It was found by the superintendent, H. W. Howard, that it was hard to retain proper labor, and he felt that suitable provision should be made to take care of these Greeks, Japanese, and Austrians. At Garfield, however, money had been spent on well built houses, all expenses of a townsite had been incurred, and no sufficient returns had appeared to be coming in on the money thus expended. Of course the reply to this would be, that having met all initial expense of water-supply, grading, stores, and public or semi-public buildings, all houses thereafter built would be constructed at a profit, though, on the other hand, it would be a question whether the new buildings would be fully occupied unless the street-car line were put in.

Smelting Works at Garfield, Utah.

Naturally, with such an experience, the smelter management was slow to accede to the requests for the investment of more money to take care of men at the smelting works. The conditions, however, were adverse, and it was difficult to keep even the foreign laboring population, so Mr. Howard was finally instructed to put in comparatively simple accommodations. The new townsite or settlement now consists of 100 houses or cabins, each capable of accomodating six men, occupied by Greeks and Austrians; one large mess-house and dormitory used by the Japanese; quarters for the repair gang of the works; a store or supply-house, and a butcher shop.

The 100 cabins, 14 by 28 ft. in size, are one-story frame structures divided by a central partition into two rooms. They are unplastered, with the woodwork showing inside, the walls being one board in

thickness. They cost $130 each; one room being used for sleeping, the other for a kitchen and living room for the six men, who are charged $1 each per month—certainly a liberal return on the investment. After the first 75 houses were built the revenue from rentals was employed for the construction of new cabins.

The Japanese quarters consist of a house 120 ft. long, also of lumber, and costing about $2000. It consists of a central part of approximately 33 by 50 ft., used as a dining room and kitchen. The wings on either side are for the sleeping quarters of the men. In these the company has provided two high single iron cots with spring mattresses. At the end of each dormitory is provided a wash sink, and two cement shower-baths. The Japanese are a scrupulously clean people, and hence it is possible to accommodate them in these crowded quarters. This building is under the charge of a committee chosen by the men themselves, who keep up a strict dicipline. Offenders are reprimanded or sent away by the committee chosen by the men, or by the manager to whom the committee is responsible. Meals are served in the dining room except in cases of accident or sickness, and at such hours as are convenient for changing shifts, each man returning his dishes to the kitchen. The food includes a good deal of rice, meat stew, tea, and some bread spread with jelly. Turns are taken by the men in cleaning their quarters, which operation includes a monthly disinfection. The clothes and other little properties belonging to the men are kept in lockers and trunks adjoining the cots. No gambling is allowed, and everyone is in bed by 11 p. m. The men generally go to bed by 7 or 8 o'clock, having a light supper, and rise early.

The high fence of the works adjoins the ground on the south. Openings are made through it to privies set inside, but separated from the plant, and these are used by all the men with some degree of privacy.

In the six-man houses occupied by the Greeks, the usual custom is to cook by some agreement among themselves, provisions being bought by the mess. They have cook-stoves with tile chimnies and depend on these for warmth.

Finally, and this has constituted the success and popularity of the whole settlement, food and supplies are furnished to the men at cost. The company has a store carrying food-stuffs and clothing, and the domestic supplies called for by the men. A storekeeper takes care of this at a salary of $125 per month, and he has the assistance of a clerk. A man cannot overrun his credit at the works, so that collections are assured. The average price for supplies is at least 20% less than elsewhere. Bread costs 4c. per pound. Meat is slaughtered near by and sold from a butcher shop on the ground. A good deal of beer is sold at the rate of $2.10 per case. Of this the Greeks consume about one bottle daily, and the Austrians three.

To maintain order, a mayor is employed, who also acts as sheriff. He enforces excellent dicipline, and the settlement is peaceful. To keep the place clean a garbage cart goes around daily.

The Japanese are noted for their eagerness to learn, and the interest they take in their work. They are able to do considerable mechanical and repair work; though the work of the regular mechanics, bricklayers, carpenters, and machinists, is done by white labor. The Greeks take comparatively little interest in their work, but can be relied upon to carry it on steadily, without objection to furnaces and danger. The Austrians, who are a large and vigorous people, are depended on for the heavier work.

TOPOGRAPHIC SURVEYS IN NORTHERN IDAHO

During the field season of 1909 topographers of the United States Geological Survey mapped parts of the Panhandle of Idaho. Nearly the whole region surveyed, amounting to about 1000 square miles, lies within the Coeur d'Alene and Pend Oreille national forests, and it is expected that the maps will be of great assistance in the future development of the abundant timber, water power, and mineral resources of this part of the State. The party making the survey was in charge of William O. Tufts.

The region is generally rugged, with long ridges covered almost entirely with timber and brush. The highest mountain south of Clark Fork is Packsaddle, 6415 ft. above sea-level. Grizzly mountain, north of Nelson's siding, on the Idaho Northern railroad, is 5977 ft. in height, and a high ridge east of the junction of East Fork with North Fork of Coeur d'Alene river reaches an elevation of 6237 ft. The Cabinet mountains, north of Clark Fork, are much higher and more rugged. Scotchman is 7011 ft. high, and many other peaks in that range reach heights of nearly 7000 ft. Pend Oreille lake lies at an elevation of 2051 ft. The snowfall, from October 15 to June 1, is heavy, amounting in places to a depth of more than 30 ft. Snow remains throughout the year on the northern slopes of the Cabinet range, though not in large quantities. At lower levels, to the south, it disappears about June 15. From June 15 to October 15 there is little rainfall, and forest fires at this period of the year were formerly very destructive, but the fire guards stationed by the Forest Service at strategic points throughout the summer months have greatly reduced the damage.

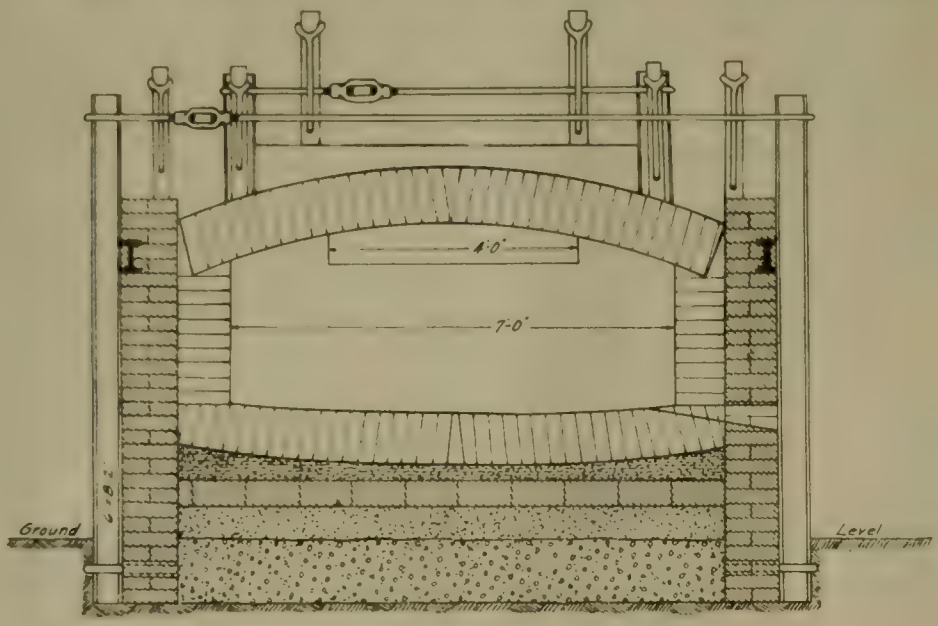
The population of this region is sparse. Only small areas are level and fertile enough for cultivation, and the climate is not favorable to agriculture. Severe frosts occur every month in the year in most parts of this country. The lower valleys of the Coeur d'Alene and Clark Fork, however, are cultivated profitably. The mineral resources of the region are practically unknown. Timber and brush made the work of mapping difficult. Through nearly the whole region, outside of the settled portions, narrow trails afforded the only routes of travel; so that camp outfits were moved by pack horses exclusively. Several varieties of bear and deer, large numbers of grouse, and almost unlimited quantities of trout are found in the more remote parts of the region. Elk, moose, and caribou are practically extinct. The Forest Service is building new trails and the wilderness is becoming more accessible to the prospector and sportsman each year.

Smelting Copper in Small Reverberatory Furnaces

Written for the Mining and Scientific Press
By Lewis M. Clark

About October 1902 the Richardson brothers employed me to go to their mining properties, situated in the rugged mountainous district of Sahuaripa Sonora Mexico, about 150 miles by trail in an easterly direction from Torres a small station on the Sonora railroad, to investigate the possibility of smelting their ores. At that time they were shipping each month, by pack mules and burros over the above trail, something like 45 tons of first class ore and concentrate from their mine at La Bufa, and the same amount of concentrate, with from \$6000 to \$10,000 worth of silver sulphide from the lixiviation plant at Santa Rosa.

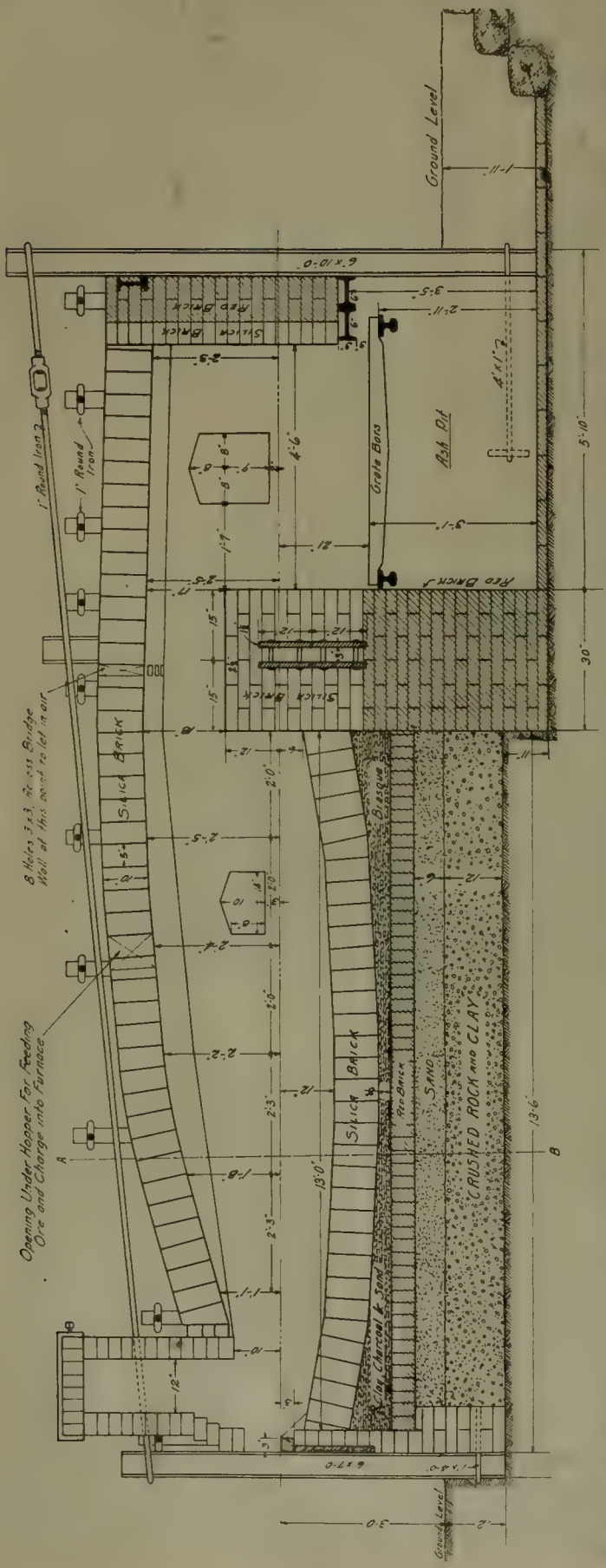
The method of procedure was as follows: The ore as it came from the mine was first hand-sorted to separate the first and second-class ore from the fine which latter was passed over shaking screens so as to classify it. The coarse product was hand-jigged at the mine and the concentrate obtained was added to the first-class ore. The middling from these jigs and all the other fine and the second-class ore, amounting to about 200 tons per month, was sent by mule back, nine miles to Santa Rosa, at a cost of \$8 per ton; where the coarser ore was crushed with rolls and concentrated on jigs and tables, the middling and fine going to stamps to be crushed fine enough to chloridize by roasting with salt in small hand-roasting furnaces. The soluble copper salts were then washed out with water and run to waste. The chloride of silver was leached by hyposulphite of soda and lime, precipated with sulphide of lime, dried, sacked, and shipped to the railroad. This was an expensive operation. The manager saw that if he could smelt the ores at the mine it would reduce this local expense as well as save the copper they were losing. Besides by concentrating the copper-silver into matte or black copper, it would make an enormous saving in the transportation expense to the railroad. I recommended reverberatory smelting, on account of its adaptibility to making copper matte using cord-wood for fuel. It also required less metallurgical skill than a blast furnace. The ores being coarse and fine concentrate would not have to be briquetted after roasting, so the zincy lead-copper concentrate, rich in silver, would be reduced with less loss in fume and flue-dust than in a blast-furnace. I was requested to take charge of the metallurgical department and proceeded to make plans for the mill and furnaces. These consisted primarily of a 24-ton concentrator and a 14 by 50-ft. roasting furnace,



SECTION A-B.

built of stone and red brick at a cost of about \$3000, which was connected to the same flue as the smelting furnaces. The flue consisted of a trench run up the side of a hill to the top of a small butte on which was built a 20-ft. stack. The trench was 300 ft. long. When arched over it had a dimension of 4 by 6 ft. in the clear, and a height above the reverberatory furnace of about 110 feet.

The roasting furnace would desulphurize 12 tons in 24 hours, of a mixture of first-class ore and concentrate, from 23.8 down to 7%; three Mexican cords of wood (96 cu. ft.) were used per day, seven men were employed on a shift of 12 hours, including the foreman, and the *cargador* who brought up the charge and wood. A small 7 by 13-ft. reverberatory furnace, the description of which is the subject of this paper, was also built. Through the courtesy of the La Dura Milling & Mining Co. I obtained their hand brick-press, of German make, which molded a brick 2½ by 5 by 10 in., with which were made all of the common and silica bricks needed at the rate of from 1200 to 1500 per



day. In searching for material to make the refractory bricks, I found an inferior fire-clay at Ocotes, some 15 miles north of the mine, which gave the following analysis:

	Per Cent.
SiO_2	68.77
Fe_2O_3	3.96
Al_2O_3	16.64
CaO	2.23
Loss by ignition	4.12
	95.72

Also a quartzite was found at La Trinidad 17 miles away, which was crushed dry at the mill, fine enough to pass a 30-mesh screen. This gave the following analysis:

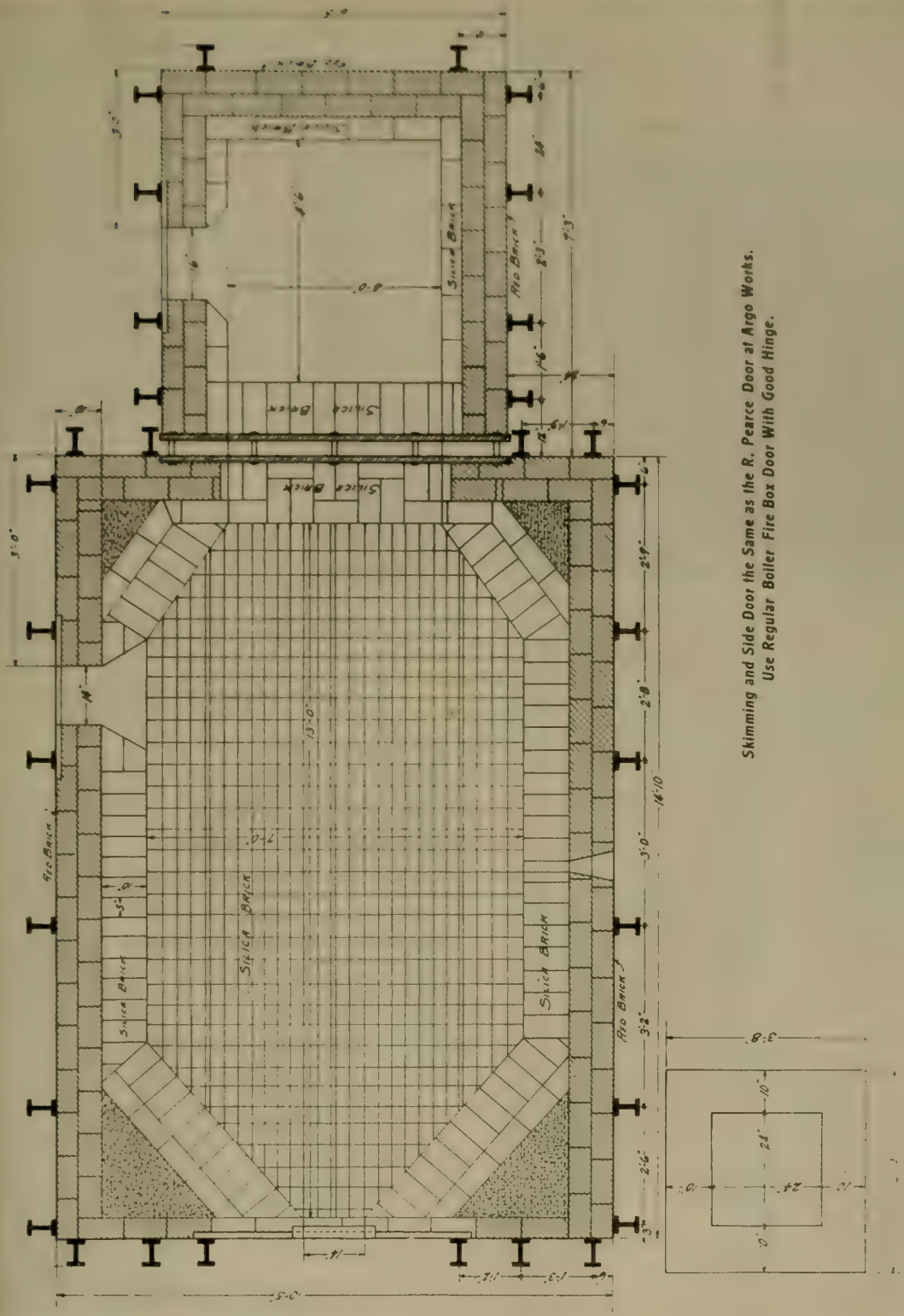
	Per Cent.
SiO_2	95.15
$Al_2O_3 \cdot Fe_2O_3$	4.15
CaO	0.60
	99.90

To make the silica bricks, 2 parts of the crushed clay were mixed dry with 5 parts of pulverized quartz (by measurement) in a mortar box, and enough water was added to make a batter of the material, of the same consistence as ordinary lime-mortar. After thoroughly mixing, it was thrown upon a canvas to dry until stiff enough to press into bricks. In the meantime other batches were made in a similar manner, so that the pressing of the bricks could continue uninterruptedly. The reason for this was to get an intimate mixture of clay and quartz. the bricks when molded were carried by boys upon a small piece of board to a level patio, where they were plaeed to dry, after which they were built into the centre of the kiln. The outside and arches of the kiln were built of common brick so as to protect the more fragile silica-bricks. The common red brick was made from clay and sand found near the mine. The silica-brick when burnt gave the following analysis:

	Per Cent.
SiO_2	90.10
Fe_2O_3	2.67
Al_2O_3	5.33
CaO	1.25
	99.35

These bricks were rather fragile but stood the fire well.

As will be seen by the plan of this 7 by 13-ft. hearth-furnace, it was built without a vault, starting upon a solid foundation of country rock. The outline of the furnace was built of red brick, and when high enough the tie-rods were put in place and the walls continued. A foot of crushed rock and common clay was tamped in the bottom, after being slightly moistened; upon this was placed 6 in. of


Silica Brick
Red Brick
Silica Brick
Red Brick
Silica Brick

pleted the floor must have the shape and conform to that given to the brasque beneath. The ends of the bricks where they join the outer wall of the furnace, are cut sufficiently to allow the 10-in. lining or inner wall of silica-brick to have a firm seat upon them; then the walls are completed to where the skew-backs are placed for the arch. To build the arch, I filled the body of the furnace with sand to within a few inches of the skew-backs, upon which was tamped a mixture of clay and sand a little fuller than was necessary for the forming of the arch; this was scraped to the desired form, and the brick laid upon it by beginning at the chimney end, placing the buckstaves and tie-rods as they were reached and driving the wedges just tight enough to raise the row of bricks a little above the form beneath. There were provided one hole for the feeding of the charge and eight small holes over the bridge-wall to admit air for perfect combustion. When finished the sand is withdrawn, and the hearth swept out, the doors put in place, and about ½ ton of pulverized slag placed upon the hearth around the edges. It is then gradually dried, the doors are closed and brought to the highest heat possible. Leaving the doors sealed the fire is allowed to go down until the hearth is dull red, when the first charge of one ton of sulphide ore is added and quickly smelted in. Then follow the regular charges of 1½ tons. It required about 7 days to fill the hearth with matte and it yielded about 9 tons of matte when tapped.

The calcine smelted had the following analysis:

	Per Cent.	
SiO_2	31.62	
FeO	15.34	
Al_2O_3	12.52	
CaO	tr.	
PbO	9.00	
ZnO	7.40	
S	6.10	
Cu	13.10	
Ag	0.634	(0.634% 185 oz. per ton)
	95.614	

The matte produced had the following composition:

	Per Cent.	
Cu	50.5	
Pb	12.0	
Zn	3.2	
Fe	4.2	
S	25.0	
Insol. residue	2.1	
Ag	2.225	(2.225% =661 oz. per ton)

The slag gave analysis:

	Per Cent.	
SiO_2	44.10	
FeO	20.60	
Al_2O_3	16.64	
CaO	5.28	
PbO	3.40	
ZnO	9.10	
Cu	0.70	
Ag	0.026	(0.026% 7.6 oz. per ton)

The slag shows the silver to be too high for good work, but this was due to the fact that I did a great deal of smelting with green wood, and it was almost impossible to drive the charge as rapidly as it should have been done at a time when the gases were coming off freely. With dry *manta* or pine wood, I was able to smelt at the rate of ¾ cord of wood per ton of charge, and to skim each charge of 1½ tons every 2 hr. and 30 min. The best we attained was 2 hr., 7 min. With this small furnace I smelted over 1000 tons in four months, and the furnace was in as good condition as at starting. It could have been run for a long period with reasonable repairs. It was abandoned for a larger furnace, with a 10 by 20-ft. hearth, built in the same way, which was used intermittently for three years. I say intermittently, because it was closed 7 times one season, and 9 times another, on account of trouble in getting freighters to pack in the wood, due to rains and to the Indian war in progress at that time in the Yaqui district. I employed one American on each shift as skimmer, and two Mexicans to fire the furnace, remove the slag and ashes, and another Mexican to bring up the wood and to help put the charge into the hopper.

In regions remote from transportation, where wood is abundant and inexpensive to obtain, if the management will use nothing but well seasoned dry wood, and have sufficient ore available for a long campaign, the small reverberatory smelting furnace above described, can be made to smelt between 10 and 15 tons per day of 24 hr., with less than ¾ cord of wood per ton where one-half of the charge is hot calcine. Any intelligent person who will be careful of the material used can make a silica-brick which will stand well in such a furnace. I do not, of course, recommend wood where coal can be obtained.

PLATINUM IN THE UNITED STATES

By David T. Day

*While recent high prices have caused active search for platinum, which has brought out the fact that it is widely distributed in many rocks, useful accumulations in the United States are at present limited to the Rambler mine, in southern Wyoming, the Key West group of mines in Bunkerville, in eastern Nevada, and to about seven important groups of accumulations in connection with placer mines of the Pacific slope. Most platinum was produced last year from the neighborhood of Oroville, California, where it occurs about in the proportion of 1 to 500 of gold. The proportion has not been determined for Trinity county, California, and Josephine county, Oregon, the other two inland localities. On the coast, platinum is found in the proportion of 2 to 1 of gold, near Surf, Santa Barbara county, California, but other places in the same region, including San Luis Obispo, show only 1 to 20 or 1 to 50 of gold. The next important group of accumulations is found near Trinidad Head, Humboldt county, California, another at Crescent City, California, at the mouth of Smith river, Oregon, and one on the South Fork of Smith river. The most important group of all extends from the mouth of Rogue river north to Coquille river. At Cape Blanco an accumulation of platinum has been found where that metal is five times as abundant as gold. On the west coast of Washington platinum is comparatively abundant in the proportion of 1 to 10 and 1 to 15 of gold.

*Read before the Washington Geological Society and abstracted from *Science*.

Pasto Gold District, Colombia

The accompanying illustration shows a charming city in southern Colombia, which is perhaps one of the least known towns in South America. It is a clean and rather progressive city of more than 20,000 inhabitants, situated in the Andes near the active volcano also called Pasto, and it is now the administrative head of the Department or State of Narriño. Although only one and a half degrees north of the equator its altitude of 8311 ft. above the sea gives it a pleasant and healthful climate, the average mean temperature being 58 F. It is on the great highway or *camino real* which was opened in Colonial times all the way from Cuzco, Peru, to Cartagena on the Caribbean Sea as a safer route for the shipment of treasure than by galleon to Panama, exposed as Spanish shipping then was to the buccaneers. This route is still open and is regularly traveled. The ride up the Cauca valley from Cali by way of Popayán to Pasto is not

Map of Colombia.

fraught with any difficulties, being through a fairly open country most of the way, but it is long and tedious. The city is more commonly reached by taking the coasting steamers from Panama, stopping at the port of Tumaco, 310 miles distant. Small steamers ascend the river Patia from Tumaco, coming within 125 miles of Pasto. A wagon-road is now being built from the city to this fluvial port. Pasto is only 186 miles from Sofia, the head of navigation on the Putumayo river, which flows into the Amazon, to which point a wagon-road is also being constructed.

Pasto, Colombia.

The commercial importance of Pasto is quite largely due to the widely distributed gold placers in that part of Colombia. Over the doorway of nearly every store in the city runs the announcement 'Compro Oro en Polvo', gold-dust being the universal article of trade with the surrounding country. Veins have also been prospected, and the indications are that mining and milling in the modern way will soon become established on a good scale at many points in the Department. Despite the riches of the Cauca, the Atrato, and the San Juan, the outlook for the development of a great and permanent gold-mining industry in the vicinity of Pasto is perhaps even brighter. For one thing, the veins are more numerous, and the handicap of a climate unfavorable for northern peoples does not exist. The territory on the eastern side of the Andes, in the valley of the Putumayo has been less prospected, but the occurrence of widely extended placers of fair grade is known. It is a region well meriting the attention of prospectors. The photograph from which the accompanying cut was made was kindly furnished by F. Pereira Gamba of Pasto.

Commercially valuable feldspar is now mainly obtained from rocks known as pegmatites, the commonest variety of which is essentially a very coarse granite. Feldspar is mined and ground for use by potters, but a portion of the product is used in the manufacture of emery and other abrasive wheels, to bind the abrading particles together, and small quantities are employed in making opalescent glass, scouring soaps, roofing material, and poultry grit.

Sensitive Test for Explosives

By H. Kast

* The Royal Military Experimental Bureau of Berlin has been occupied for the last 20 years in the examination of explosives for military purposes. Professor Lenz, at the last congress in Rome, reported exhaustively on the accumulated results of these investigations. It need only be remarked that experience has shown that the drophammer must not be allowed to act directly on the explosive, chiefly for the reason that the sensitiveness, as ascertained by means of the drophammer, depends in the greatest degree on the area of the struck-surface, and it is not possible to keep the struck-surface unchanged under the direct action of the drophammer. If the drophammer be allowed to act directly, or indirectly through an interposed piston, on an uneven layer of the explosive spread directly on the anvil, the area of the struck-surface will change in proportion to the varying thickness of the layer in different spots; but then it is impossible to obtain strictly proportional values, because the percussive energy is distributed over surfaces of different area. This drawback can be avoided by interposing a contrivance between the drophammer and the anvil, which is so arranged that only a strictly defined surface is exposed to the blow. This contrivance must comply with the following conditions:

(1.) The surface to be struck must be a definite and invariable area. (2.) The explosive must be so arranged that it cannot spread out sideways. (3.) Any frictional action of the blow must be avoided as carefully as possible, as explosives behave quite differently under friction to what they do under percussion.

Thus the chlorate explosives are more sensitive than dynamite to friction, but less sensitive to percussion. Further the explosives must not be rubbed between hard materials. For this reason it is not permissible to add frictional materials (powdered glass, sand) for the artificial augmentation of the sensitiveness to shock in the comparison of dissimilar explosives, since that would affect the natural ratios of explosives sensitive to friction too seriously. Special methods are used for testing the sensitiveness to friction. As a fourth condition there must be a constant increase of sensitiveness with the height of the fall. (5.) The limits of sensitiveness must be the same whether the tests are made starting with a low fall up to a higher, or the reverse. (6.) The values found at different times must agree with one another within certain narrow limits; and in particular the ratio of the sensitiveness toward that of the explosives with which it is compared must be constant. (7.) The force of the blow developed with different weights for the given limit-values must be about the same; but it must also be recognized that by the use of different weights the ratio of sensitiveness is somewhat changed, on account of the different physical properties of the explosive, the varying velocities of impact, and the different dissipation of the kinetic energy because of the greater rebound of the lighter weights.

Explosives which can easily evade the blow (namely fluids like nitro-glycerin) show themselves more sensitive to a light, swift-acting weight than to a heavier weight. (8.) Sharp differences should be observed with low falls, since experience shows that these differences are less marked as the height of the fall increase. (9.) Proportionally insensitive explosives should also be tested comparatively. (10.) It must be determined, beyond any doubt, whether the explosion is entire or only partial, or whether the explosive has merely burned; from these results conclusions can be drawn as to the danger of unexpected detonation induced by shock.

Care must be taken that the layer of the explosive exposed to the blow is not too thin, as this renders explosion more difficult. In the ordinary way of testing, the air-waves from the drop-weight, and those produced by partial explosion, blow away the explosive, especially when pulverulent, so that the sample appears to have been completely exploded.

These conditions are best fulfilled by an instrument having striking surfaces exactly 0.5 sq.cm. (= 0.0775 sq. in.), with a drop not exceeding 60 cm. (2 ft.) for the more insensitive explosives. The stamp or piston must fit the ring closely, and yet admit of the free motion of the piston. Both striking surfaces should be ground smooth, exactly 8 mm. (0.315 in.) diam. The appartus should be fixed in a cylindrical bed on the anvil to avoid damage from the drop-weight. After measuring the explosive it is pressed by twisting both stamps so that an even layer is spread over the whole surface. The best temperature for the test is from 18 to 20°C.

* Abstract from *Journal* of the Franklin Institute.

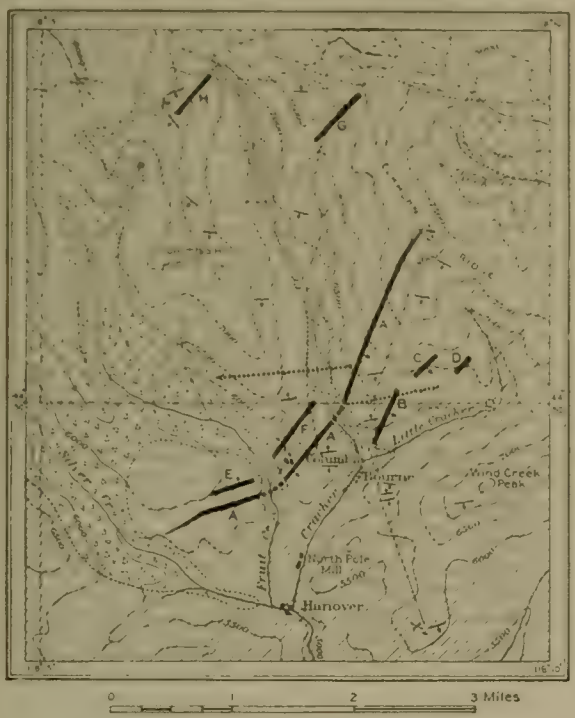
California oil-land withdrawals made prior to March, 1909, aggregating 2,313,482 acres only, prevented the acquisition of the withdrawn lands under the agricultural land laws. All lands covered by these withdrawals could be legally exploited for oil or other minerals. During the year ended March 4 these lands were excepted from acquisition as oil or as mineral lands as well as for agricultural use. New withdrawals were made in the States of California, Colorado, Oregon, Utah, and Wyoming of a total area of 2,130,510 acres. In California there were restored to entry 956,916 acres that field examination had shown to be non-oil land. The area now covered by oil withdrawals is 3,487,076 acres.

Paris stands 226 miles above the mouth of the Seine, measured along its course, and the area drained by the river above the city is only about 17,600 sq. mi. The mean discharge of the Seine at Paris is about 9000 cu. ft. per second; its greatest discharge in the flood of 1876 was 58,600 second-feet; its discharge at the height of the recent flood (January 27, 1910), is reported to have been 83,500 second-feet. This is less than one-eighth the flood flow of the Susquehanna in 1889 (720,000 second-feet) and less than one-fifth the flood flow of the Potomac at Washington in the same year (470,000 second-feet), when boats were paddled along Pennsylvania avenue, in the heart of the city.

Cracker Creek District

By J. T. Pardee

* The Cracker Creek mining district is situated in the northwestern portion of Baker county, Oregon. It is a small integral part of the Blue Mountain gold belt which has been described by Lindgren[1], and as generally understood comprises the drainage basins of Cracker and Fruit creeks. The town of Bourne, six miles north of Sumpter, is the principal settlement within the district. The principal mines are the North Pole, Eureka & Excelsior, Columbia, and Golconda, all situated, from northeast to southwest in the order named, on one persistent fissure, the North Pole-Columbia vein, or 'mother lode,' as it is locally designated. At present the Columbia is the only producing mine in the district, but the suspension of operations in most of the others is believed to be temporary and not caused by exhaustion of the orebodies. In addition to those above mentioned, there are a number of smaller mines and prospects on which annual assessment and considerable development work is being done. Time in which to visit all the mines was not available, but in November 1908, during the progress of field work in the Sumpter quadrangle, in the northern part of which this district lies, advantage was briefly taken of opportunity to visit the underground workings of the Columbia and North Pole mines. The aggregate production of the mines on the mother lode is estimated to be at least $7,000,000.



Geological Sketch Map of Part of Cracker Creek Mining District.

The rocks most extensively developed about the Cracker Creek mines are argillaceous and siliceous sediments, non-fossiliferous so far as known, and very fine grained throughout. The composition of the beds varies from that of chert consisting almost wholly of silica to that of highly aluminous blue-black slate. These types, however, are rarely found in complete purity; they grade one into the other, and are at many places interlaminated, the cherts in particular being divided into thin sheets and lenses by argillaceous partings. Seen in distant views, the weathered outcrops of the sediments everywhere appear rather dark in hue and more or less rusty with oxide of iron. The impression conveyed by a cursory examination is one of monotony and of a lack of sharp lithologic distinctions. Only long continued and careful observation made it possible to recognize lithologic subdivisions of the stratigraphic column. The series appears to be conformable.

The rocks of igneous origin are intrusive granodiorite, surrounding the sedimentary area on the north and northwest; some dikes, observed to cut both the argillite and the granodiorite, varying in thickness from a few inches to 20 ft. or more, that appear to be mainly altered feldspar porphyries; a few aplitic dikes; some small masses of serpentine; and a greenstone, probably an interbedded lava or intrusive sill. This last-named rock is most conveniently considered in connection with the sedimentary rocks, which are probably of Paleozoic age.

The most readily noticeable structural feature of the more siliceous of these beds consists of the contortions and small close folds they everywhere exhibit. The black argillites have a slatey cleavage that as a rule coincides with the bedding. Some of them are closely folded also, but as their bedding is less distinct than that of the siliceous rocks their structure is more obscure. Faulting of an extreme distributive type is developed throughout the district. This faulting is so common that portions of the district, as for instance the northern half of Columbia hill and Elkhorn ridge, from the summit of North Pole hill northward to the intrusive contact, may be said to resemble huge fault breccias. The dimensions of the faults descend to the microscopic, and nearly every joint and cleavage plane shows polishing or striae as evidence of movement. All faults in the district whose attitude has been determined are normal, and steep dips are the rule.

The Cracker Oregon vein is 4 to 8 ft. wide and dips steeply to the southeast. The Cracker Summit vein is 4 to perhaps 12 ft. wide and dips 50 to 70° northwest. Both are said to have produced pay-ore; their vein-filling resembles that of the mother lode

* Abstract from 'Contributions to Economic Geology, 1908,' U. S. Geol. Sur., Bull. 380.

[1] Lindgren, Waldemar, 'The Gold Belt of the Blue Mountains of Oregon': Twenty-second Ann. Rept. U. S. Geol. Surv., pt. 2, 1901, pp. 551-776.

and their walls bear evidence of movement. The Cracker Summit vein has at several points been displaced by faults of the other groups, but the exact details of the faulting have not yet been worked out. The 'mother lode' stands out as a most prominent economic and structural feature. It is a normal fault extending beyond the limits of the district. The portion of it here particularly referred to is that extending from the Columbia shaft to the limit of the North Pole stopes, a distance of 7500 ft. On this portion of the vein are situated the Columbia, Eureka & Excelsior, and North Pole mines, from southwest to northeast in the order named. The displacement along this fracture, which in the North Pole dips 70° southeast and strikes N.34°E., was approximately determined where it crosses Columbia hill to be a vertical displacement of at least 400 ft. But in addition to the vertical throw the fault causes a horizontal displacement of approximately 1800 ft. The vein may be said to divide the district into two fault-blocks. With respect to the northwestern or Columbia Hill block, the southeastern or Bourne block has settled and moved southwest by south, or along a line lying in the plane of the vein and pitching gently to the southwest. The large amount of development work that has been done on the 'mother lode' offers excellent opportunity for investigation of the structure due to complex movements within the vein. The Columbia mine is opened by three adit levels and a 900-ft. vertical shaft with which cross-cuts and drifts connect at each 100 ft. The aggregate of development is stated by F. S. Baillie to be, in drifts and cross-cuts, 19,470 ft.; in shaft, raises, and stopes, 29,274 ft.; total, 48,744 ft. The shaft is sunk in the hanging wall 45 ft. from the vein, which it penetrates at a depth of 800 ft. Northeast of the shaft the vein is well defined and 20 to 100 ft. wide. The ore-shoots, 3 to 8 ft. in width, are found on the foot-wall in all but the upper (adit) levels, where they have crossed to the hanging wall. The pay-ore is usually separated from more barren quartz by walls lined with thinly laminated black gouge. The ore-body itself is separated into overlapping wedges or thick lens-like masses by seams of black, laminated, striated gouge. About 200 ft. south of the shaft the vein loses its identity in a zone characterized by a great number of faults. The gouge linings of these faults nowhere fail to exhibit evidences of movement as above described. Within this zone isolated masses of ore are found.

The North Pole mine is not at present in operation. It is developed by five adit levels and one intermediate level, aggregating 12,500 ft. and a large extent of cross-cuts and stopes. At 1800 ft. from the mouth of tunnel No. 1 a fault displaces the ore-shoot 45 ft. to the southeast. On following this fault for about 500 ft. to the intermediate level, the displacement is noted to be small, and the slip appears to coincide with a flat wall forming the lower boundary of the ore-shoot for a distance of about 1200 ft. farther on. This orebody widens above, attaining a maximum of 25 ft. just under tunnel No. 3. In the main stope the ore lies on either wall or occupies intermediate positions. In some places the ore is observed to cross from one position to another on transverse, southwestward-dipping, obliquely striated fault planes which do not pass without the vein.

The results of structural study in the Cracker Creek district indicate that the 'mother lode' is not notably displaced by transverse faults. Within the vein itself, however, there are faults which affect the orebodies. Some of the smaller veins have been offset by faulting. The fact that the faults of known attitude are normal, and that in the movement upon them the horizontal component is commonly as important as the vertical one, should be taken into account in the development of such of the orebodies as have been displaced.

The zinc ores of Tres Hermanas, New Mexico, according to Waldemar Lindgren, occur as dark-gray cellular masses and consist largely of the unusual mineral willemiate, the pure anhydrous silicate of zinc. Smithsonite, the zinc carbonate, is also present in its usual mammillary form and light-gray or bluish color. Hydrozincite was shown to be present by W. F. Hillebrand as an earthy incrustation. Tabular crystals of calamine, the hydrous silicate of zinc, were noted in crevices of the ore. Willemite appears to make up the bulk of the specimens collected. It is accompanied by a little black pyrolusite, which gives a dark tinge to the ore, and it forms small radial aggregates of slender hexagonal prisms, terminated by flat rhombohedra. It also forms loose crystalline aggregates and crusts of needle-like crystals. This habit is unusual, the more common form being a short, stout, hexagonal prism. The occurrence of these ores seems to be paralleled only by that at Moresnet, in Belgium, where the willemite is also accompanied by galena. The only other occurrences noted in this country are at Franklin Furnace, New Jersey, and as rareties at Clifton, Arizona, and at the Merritt mine, in Socorro county, New Mexico. The zinc minerals of Tres Hermanas are beyond doubt derived from zinc blende by oxidation.

The principal zinc minerals of Tres Hermanas and their tenor are as follows: Willemite (Zn_2SiO_4), zinc silicate, 58.6% Zn; calamine ($H_2Zn_2SiO_5$), hydrous zinc silicate, 54.7% Zn; smithsonite ($ZnCO_3$), zinc carbonate, 52.1% Zn; hydrozincite ($ZnCO_32Zn(OH)_2$), basic zinc carbonate, 59.9% Zn.

The zinc ores shipped from Tres Hermanas probably contained about 30% of zinc. The shipments of lead-zinc ores made from one mine are stated to have contained from 11 to 40% of lead and 2 oz. of silver per ton. They also contained up to 19% of zinc, 4 of lime, 4.2 of iron, and 7.40 of silica.

The Seine at Paris runs between stone walls in a channel that is spanned by many bridges. The width of this channel may be seen by noting that the largest and finest of these bridges—the Pont Alexandre Trois—is but 352 ft. long. During the recent flood constriction of flood water within this relatively narrow channel was impossible, so it overflowed a large area along the banks of the Seine.

Feldspars that are rich in potash are now the subject of experiments made to determine their value as fertilizers.

PROPOSED SEISMOLOGICAL INSTITUTE

The following resolutions were passed at the San Francisco meeting of the Seismological Society of America, March 2.

Whereas earthquakes which are normally recurring phenomena of the earth's crust, have in the past caused considerable loss of property and life, and much of the distress and destruction has been due to lack of knowledge of earthquakes and their peculiar mode of action and of proper precautions against injury and, *whereas* the magnitude of the destruction in the Atlantic Coastal region (Charleston earthquake of 1886), the Mississippi Valley region earthquake of 1812 and the Pacific Coastal region (California earthquakes of 1857, 1868, 1872, and 1906), makes it a matter of great import to all the people, and the fact that with increasing density of population the conditions are becoming more favorable for greater destruction in the future makes it important that action be not longer delayed, *whereas* the problems involved are of national and international character and local authority or private enterprise is insufficient to successfully carry on such work, and this fact has been realized already by many of the great nations including the German, English, Japanese, Austro-Hungarian, Italian, and Spanish which have already established scientific earthquake services for the benefit of their peoples and the world at large.

Resolved that the Seismological Society of America strongly favors the establishment of a National Bureau of Seismology with power (a) to collect seismological data; (b) to establish observing stations; (c) to study and investigate special earthquake regions within the national domain; (d) to co-operate with other scientific bodies and organizations and individual scientists in forwarding the development and dissemination of seismological knowledge. It also favors the organization of this bureau under the Smithsonian Institution with the active co-operation of other scientific departments of the Government.

EARTHQUAKE INVESTIGATIONS

The following report was made by the Committee on Rift Belt Deformation, at the San Francisco meeting of the Seismological Society of America, March 2.

The most important fact brought to light by the investigation of the California earthquake of April 18, 1906, is that a condition of stress existed in the earth's crust antecedent to the rupture which produced the shock. This stress seems to have been effective as a slow tortional creep of the coastal portion of the middle Coast Ranges toward the northwest. It was relieved by a fault rupture along the San Andreas rift at the time of the earthquake, the fault-trace being certainly 190 and probably 270 miles in length. The relief was effected by a forward or northwesterly movement of the portion of the earth's crust lying to the southwest of the fault and a resilience or backward movement to the southeast of the portion lying to the northeast of the fault, the maximum horizontal relative displacement being 21 ft. The fact that similar displacements have repeatedly occurred along the San Andreas rift in time past is warrant for the belief that the stress operative in the earth's crust up to April 18, 1906, was only temporarily relieved by the fault of that date, that the stress is a secular condition of the region, and that the creep of the earth's crust which it induced will be renewed and will accumulate until it is again relieved at some future time by a rupture similar to that which occurred in 1906.

In view of this conclusion it is a matter of the utmost importance to geological science that the phenomena of creep should be most carefully studied. Such a study will doubtless extend through decades and generations owing to the slowness of the movement, and we can scarcely hope in our time to fully understand it. We may, however, attack the problem in the hope and reasonable expectation of arriving at results which will be of service to humanity. The first step toward this end is the determination of the distribution of the stress as manifested by the slow creep of the region and the measurement of its amount. This in the opinion of the committee may be best accomplished by establishing a series of monuments extending out in a direction approximately normal to the San Andreas rift at suitable localities and determining their relative positions by careful survey from time to time. Each line of monuments should extend out where possible for at least 20 miles on either side of the rift and be composed of stable concrete piers spaced not more than two miles apart. In the opinion of the committee there should be at least three lines of monuments, one to be placed near the head of Tomales bay, one near the south end of the Bay of San Francisco, and one crossing the rift where it traverses the south side of the Mojave desert. The cost of installing these monuments and establishing their position in the first instance would be about $5000. The committee recommends that the Society make an effort to secure the money necessary for this purpose.

The Chainman mill at the Chainman property in the Ely district has been remodeled by the lessees, McGill & Willoughby, and is now crushing 30 tons of ore per day with the prospect of having this output doubled in a short time. The ore passes over a grizzly to a 6 by 12-in. crusher, the broken product uniting with the fine which is handled by a 6-ft. Chilean mill. From this the ore passes over a series of 4 by 8-ft. plates on which 15% of the assay value is saved, and through hydraulic classifiers to the settling and agitating tanks. The sand is shoveled from the settling tanks to cars and transferred to leaching tanks where it is treated with a 0.3% solution for five days. The slime is handled in a 100-ton air-agitating tank. Ordinary zinc shaving precipitation is used with an excellent recovery. The ore is taken from the Southern Cross claim of the Chainman group and assays from $6 to $20 per ton. It breaks easily and the cost of mining is placed at $1.30 per ton, with $1.75 additional for treatment at the mill, and $0.65 for transportation.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Electric Drill-Sharpeners

The Editor:

Sir—I note in your Johannesburg letter of March 12 the statement: "We are still hankering after an electric drill-sharpener to enable us to regulate the temperature with exactitude for the different classes of steel, but until this comes the oil furnace will continue to give satisfaction."

I venture to suggest that an electric drill-sharpener is already on the market. The Hoskins Manufacturing Co., of Detroit, makes two types of electric furnaces, each one of which is manufactured in both muffle and tube-chamber styles. These furnaces are heated by electrical resistance, and their temperature may be regulated with absolute accuracy by simply controlling the current through the resistance element. For heat treatment of drills and steel parts they have the fundamental advantage of producing the required temperature with entire freedom from products of combustion, which must necessarily accompany heat production from any other source of energy. The type FB furnaces made by this company are particularly applicable to the treatment of carbon steels; the type FC furnaces are similarily adapted to heating of all classes of high-speed steel. This latter type has the further advantage of having a reducing atmosphere within the chamber while in operation.

I hope that this information may prove of interest in the locality mentioned above.

H. RALPH BADGER.

Detroit, March 20.

Zinc Ore and the Tariff

The Editor:

Sir—The new tariff law which assesses a duty upon zinc has been in operation a sufficient length of time to warrant drawing conclusions as to its effect on zinc ore importations. Eighth months have elapsed since the law went into effect and during that time numerous inquiries have been made as to the result of the change. The duty is assessed upon a sliding scale: some ore is free and some pays up to one cent per pound on the metal content. The tax varies with the percentage of metal in the ore. Ores containing 10% and under are free; those containing from 15 to 20% pay ¼c. per pound of metal; those containing from 20 to 25% pay ½c.; and all ores containing over 25% zinc, are taxed 1c. per pound of metal content. On this basis a ton of 25% would pay $5 duty per short ton; the 20% ore would pay $2 duty per ton. As most of the ore in demand in this country is of higher grade than 25%, the maximum duty of one cent per pound is in fact collected.

Since the law was passed importations have not absolutely ceased as was predicted. Since the predictions were made by the enemies of the law its friends now view the situation as one warranting close inquiry. The following table gives the importations by months for the entire year of 1909. The two periods, before and after the law went into effect, are indicated. Long tons are used but the totals are reduced to short tons.

ZINC ORE IMPORTS FOR 1909

Months.	Long Tons.	Value.
January	9,096	$118,182
February	4,146	41,343
March	5,246	63,754
April	12,973	166,886
May	13,633	150,289
June	9,898	137,621
July	12,073	173,138
Total previous to tariff	67,065	$851,213
August	13,097	$203,740
September	2,438	35,174
October	4,809	65,857
November	7,507	109,182
December	6,819	101,509
Total after tariff was imposed	34,670	$515,462
Total for year	101,735	$1,367,675
Equivalent to short tons	113,010	1,367,675

According to these figures, imports have diminished. Previous to the imposition of the tariff the average monthly imports were 9580 long tons. After the tariff was imposed the average was only 6934 tons. This would indicate a decrease of from 15 to 20%. It will be noted that the heaviest imports were made the first month after the tariff was imposed. This was due to the effort to get the ore into the country before the law went into effect. Following this there was a marked drop in importations. This, in turn, was due to the need of making new contracts with the ore producers, and the necessary arrangements for payment of duties. It will be noted that after only two months the importations jumped to nearly 5000 tons from which they increased to about 7000 at the end of the year. January 1910 showed a reduction again to 5736 tons. This was due entirely to bad weather which interfered with shipments. The February shipments again reached 6925 tons and the March shipments, while not yet available, will presumably be still greater.

If the value of the imports, which ranges from $10 to $12 per ton, be taken into account, it is easy to understand why the importations continue heavy in the face of the duty. The average metal content of the ores is close to 36% zinc. The duty on 36% zinc would be $7.20 per ton. This added to the value of the ore gives $18.20 for 36% ore, or at the rate of $22 per ton for 40% standard zinc ore. This, with the freight rate of $5, makes the total cost of the ore laid down at American smelters $27 per ton; providing that the smelter pays the duty. Since the average price for 40% ore in the Joplin district during the period under consideration was about $27 per ton, it is evident that it is at least as cheap to buy ore in Mexico and pay the duty in addition to the price paid the Mexican ore-producer. It is known that as a matter of fact the duty is deducted usually from the price paid in Mexico. This gives the smelter a profit of from $4 to $5 per ton when he buys Mexican instead of Missouri ore. Had the rate been 1½c. per pound, as asked for by the Jop-

lin operators the duty on the ore now imported would have amounted to $10.80 per ton instead of $7.20, thus making it more expensive to buy in Mexico if the duty were added to the price paid the Mexican ore-producer. If the duty were subtracted from the price paid to the Mexican ore-producer, it would have so reduced his profit as to have excluded him from the American market. The ore-producers of the Joplin district are now beginning to realize that in the compromise they did not secure the protection that they expected.

It is interesting to compare the imports with the production of the Joplin district. The following table gives the imports of zinc ores since 1904 and the production of the Joplin district in parallel columns with the ratio in percentage of imports to Joplin production.

Year.	Zinc imports. Tons.	Joplin production. Tons.	Import. Per cent.
1904	2,264	267,240	0.8
1905	22,137	252,155	8.7
1906	55,114	278,927	19.8
1907	103,117	286,587	35.9
1908	53,757	259,598	20.7
1909	114,850	301,206	38.1
Total	351,539	1,646,993	21.3
1910 (two mo.)	12,761	44,948	28.3

The rapidity with which importations have grown is apparent at a glance. From less than 1% of the Joplin output in 1904, they have grown to 38% in 1909. What is still more significant is the fact that the year 1909 was also one in which the first attempt was made to exclude the imports and the remedial measures were in force five months of the period of that year. The year 1910 has started with the imports practically equalling 28% of the Joplin production. It must be kept in mind that the zinc imports contain only 40% zinc while the Joplin ore assays close to 60%. The evidence seems conclusive that the duties assessed against zinc ore is not sufficiently high to prevent its importation. Moreover American zinc smelters will doubtless find it advantageous to keep up importations even if the cost per ton is slightly higher. In this manner they can depress the American ore market.

In addition to the imports of Mexican zinc ore the American supply has been greatly augmented during the past seven months by development of the zinc-ore deposits of the West. The tariff agitation drew attention to these deposits. It was the contention of all the smelters that the American ore-supply was insufficient to meet the demand. If there was such a demand the Western mine-owner decided he would profit by it, and all through the West there has been an increasing output of zinc ores. American smelters have encouraged this movement and Joplin zinc-ore producers now face the gravest competition they have ever had to meet, since Western zinc ores are produced largely as by-products and are cheaper than the high-grade Joplin ores.

On the other hand there have been inaugurated in Mexico two movements which will help to divert Mexican ore from our market. The Mexican Government has increased the freight rate on zinc ores from the mines to the American border and at the same time reduced rates to sea-ports where shipments are made to European points. This will encourage shipping zinc ores to Europe instead of America. There has been also agitation for the building of a zinc smelter at some suitable point in Mexico. The new oilfields are stated to afford promising conditions for such an enterprise but the promoters are urging its location near Torreon. Since the location of such a plant is largely a matter of suitable fuel in abundant quantities with good transportation, the promoters will doubtless be governed really by the reports of their engineers.

OTTO RUHL.

Joplin, Missouri, April 6.

Ditch and Flume Information

The Editor:

Sir—I am trying to secure data as to the construction of a ditch to carry 2000 inches of water for hydraulic mining. A large portion of this (three miles and 21 rods), will need to be flumed. The main points I am trying to learn are the width and depth necessary to carry this volume of water, 2000 inches being equal to 50 second-feet, the grade as now surveyed being 16 ft. to 320 rods; and as to ditch and flume, the kind of material for fluming, that is, size of sills, posts, caps, and so forth, and how to build this. There are technical works upon almost every phase of mining, such as mine timbering, and the like. Is there not some work covering ditch and flume construction? I expect to install a pipe-line, giants, power-derricks, and other equipment, data as to costs and kinds of which I can figure out from the Hendy, Risdon, and Pelton bulletins, very satisfactorily, but I am 'up against it' on the ditch and flume proposition. Can you suggest ways and means by which I can get the information? I am not a technically educated man, but just one of the common people. As a heavy owner in, and entire manager of, the property, I am anxious to get off on the right foot. Any advice you can and will furnish me I will be thankful to you for, and willing to pay for the advice.

INQUIRER.

Holland, Oregon, April 2.

[The foregoing letter calls attention to a lack of definite information in the literature on hydraulic mining which reveals an opportunity for ambitious authors. It is necessary to add that the MINING AND SCIENTIFIC PRESS does not answer questions privately for pay, but prints its contributions for the benefit of all. Inquirer should consult an engineer for specific professional aid.—EDITOR].

Diaphragm Cones and Tube-Milling

The Editor:

Sir—Allow me to call your attention to a typographical error in my article on Caldecott cones in your issue of April 2. On page 485, top line, left hand column, the word 'sufficient' has been substituted for 'insufficient' resulting in a contrary meaning to that which should be conveyed. There is no warrant either for Fig. 1 being called a 'filter cone'. Diaphragm cone would be more correct, but that is not a matter likely to mislead anyone.

WALTER NEAL.

El Oro, Mexico, April 8.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Dividends by oil companies listed on the San Francisco exchange amounted to $683,679 in March and a total of $29,242,803 has been paid to date.

Feldspars are among the most widely distributed minerals and are constituents of nearly all rocks. The decomposition of feldspar has yielded a large part of the clay of the soil; also the mineral kaolin, an essential material for making fine pottery.

The Seine is the fourth largest river in France, ranking in size below the Loire, the Rhone, and the Garonne. Its drainage basin (30,370 sq. mi.) is larger than that of the Susquehanna (27,400), or of the Sacramento (27,100).

Engineers of the United States Geological Survey estimate the annual damage by floods in the United States at $100,000,000. It is too early, perhaps, to undertake to prevent or to diminish this immense loss, but its very magnitude invites a serious study of means of prevention, and the recent misfortune of France may lead to practical work that will serve as an object lesson to America.

Grounded overhead conductors, relief gaps on insulators, lightning rods supported on the transmission line structures or on separate structures along side, and station-type lightning arresters at points particularly exposed, are some of the principal preventive devices employed to protect high-tension transmission lines from injury by lightning, but none are completely successful.

Insurance on concrete buildings is always low. The report of the committee on insurance to the National Association of Cement Users showed that approximately 30% of the owners of concrete or reinforced concrete buildings carry no insurance, believing them to be practically fireproof. The matter has been taken up by a number of insurance companies and it is probable that more favorable rates will be made for this type of structure.

Molybdenum in lead ore interferes with its assay by the Guess method and it should be removed by treating the ore with nitric and sulphuric acids. This removes the molybdenum and other interfering elements and leaves the lead in the form of sulphate. In the Guess method the ore is treated with nitric acid and the lead is held in solution by the addition of ammonium nitrate. The solution is electrolized in the same beaker and the lead deposited as peroxide on the anode.

The Braden copper mines are located near Rancagua, Chile, about 80 miles from Santiago, and 200 miles from Valparaiso. The company owns 1200 acres of mineralized lands lying around the crater of an extinct volcano. Prospecting work has shown that the mineralization occurs around the entire periphery of the crater, some 14,000 ft. in length. The ores occur in compact masses. It is claimed that over 5,000,000 tons of ore, averaging 2.7% copper, have been developed. The orebodies vary from 80 to 250 ft. in width, and their depth is still undetermined.

The Chino Copper Co. is operating the old Santa Rita mines near Silver City, New Mexico. The property was formerly worked for high-grade ore, but is now being drilled with a view to development of low-grade copper. Some 200 holes have been put down. Of these 169 have found ore and 151 have entered into calculation of 'reserves'. The latter were estimated December 1 at 7,874,000 tons assaying 2.46% copper. The average thickness of the ore as shown by workings and drill holes was given at 82.9 ft., the over-burden at 76.5.

Power-site withdrawals on March 4, 1909, were in force covering public lands on 29 rivers in nine States. These withdrawals have since been reviewed by the Geological Survey, the form of withdrawal has been changed to include all entered as well as all vacant lands and the lands that were found to be not valuable for the purpose for which the withdrawal was made have been restored to entry. New withdrawals have been made along 97 rivers covering land not involved in previous withdrawals and increasing the total number of States affected to eleven. These power site withdrawals now cover about 1,300,000 acres of vacant public land and 200,000 acres of entered land.

Coal-land was sold under the old regulations at a maximum price per acre of $75; under the new regulations the maximum price per acre thus far fixed for any particular area is $465. The maximum valuation of a single township under the old regulations was $949,600; under the new regulations it is $9,206,894. Special efforts have been made to release from existing withdrawals all non-coal areas, and of the total area classified during the year ended March 4, amounting to 17,200,000 acres, much the larger part, or about 14,000,000 acres, has been classed as non-coal land. The sale price of the 3,436,000 acres classed as coal-land has been fixed at $191,490,000. The same land, if sold at the minimum price would have yielded $62,477,000.

In starting a roasting furnace the same precautions should be observed as in starting a reverberatory; it should be gradually warmed to dry it out, and the temperature slowly increased. This process should occupy from 7 to 14 days according to the size of the furnace and particular attention should be given to the tie-rods and buckstays, watching the expansion of the arch and when the maximum has been reached, tightening the tie-rods to bind the whole structure solid. Should a roasting furnace at any time require to be closed down, drop the dampers as low as possible, close all port holes and fire-doors to prevent cold air entering and retain all heat possible. Sudden expansion or contraction in furnace structures has very bad effects and must be prevented if possible.

Special Correspondence

FAIRBANKS, ALASKA

Quartz Prospects and Stamp-Mills — Copper on Dry Creek. — Warm Weather Starts Placer Work. — New Type of Steam-Points.

Indications point here to a good season. Interest in quartz prospects is increasing rapidly since the recent mill run on the 15 tons of rock from the Spaulding & Clough property and since Martin Harrais left for the outside the middle of March to bring in machinery for a 10-stamp mill this season. Mr Harrais has abiding faith in the quartz discoveries and intends to build the mill at Chena, eight miles below Fairbanks, where connections by rail and water give good facilities for custom work. It is possible that Spaulding & Cough, who recently put 15 tons through the Fairbanks test-mill, will put in a plant of their own as their ore needs special treatment. At the recent run, it was found that $5.25 per ton was caught on the plates, $14.50 of free gold remained in the tailing, the concentrate represented $7.70 per ton, and a trifle over $21 was not released by crushing. This makes practically $50 ore. As the sacks were filled by shovel from the broken rock after blasting, there is no doubt but the ore sent in was a fair sample. This vein is from 3 to 4 ft. wide and has perfect walls. As the gold is extremely fine, it would seem that cyanidation after sliming would give a good extraction. A remarkable vein has been opened by the Butler Petree company although work has been discontinued. The vein was struck in an adit and a raise of about 60 ft. driven to the surface. A shaft 170 ft. deep was also sunk. A 40-ft. drift along the vein at the bottom of the shaft shows the vein as strong and rich as above. It is understood that the rock assays about $32 per ton, about evenly divided between free gold and concentrate. The vein varies from 5 to 8 ft. wide. Across Chatham creek from this property, the Pioneer Quartz Mining Co.'s claim is being further prospected by Ringseth & Giske. At the end of a 250-ft. adit a cross-cut is being driven to pick up the vein shown in the shaft farther down the hill. Mr. Rhodes is still driving along the vein on his property on Bedrock creek, being in now about 400 ft. Near the face there is almost 4 ft. of solid quartz. Charles Crawford has a lease on a block of ground on this vein and is sinking at the mouth of the adit. He is down 50 ft. and has a lot of high-grade ore out for shipment. The vein continues strong at the bottom of the shaft. On Willow creek, the Tolovana properties show a bunch of stringers that yield a large percentage of high-grade ore. The gold is practically all free. Some of the richest specimens yet seen in this camp have come from here. Lennon & Liebermann are working this property at present and have a large amount of ore sacked for shipment. Fred Melius is working on the other slope of Willow creek and has found rich ore in a prospect shaft. The vein is from 2 to 3 ft. thick and assays well. Below this slope at the head of Cleary creek, Peter Steil is cross-cutting to pick up a vein found in a surface prospect. He is in 150 ft. Hirschberger, Buhl & Phipps are now sinking on a 3-ft. vein which crosses the saddle between Cleary and Eldorado creeks. Some 9½ grains were amalgamated from 4 lb. of rock, showing that the ore contains approximately $150 per ton in free gold. After sinking 50 ft. an adit will be run from the Eldorado side. This will give about 400 ft. of backs. An immense deposit of copper is reported from the Dry Creek country by the Cook Brothers who have been prospecting in that district for years. The outcrop is from 300 to 600 ft. wide and is traced for over a mile. A sample of croppings taken across a 400-ft. face gave 7.5% of copper after picking out the extra rich pieces. Bunches of chalcopyrite from a few inches to several feet through are found frequently. As the samples taken were croppings only, it is safe to say that below the oxidation zone much richer ore will be found. A mile from this orebody is an immense body of coal and the proposed railroad will pass within a short distance.

Unexpected warm weather has started the placer miners to work in getting ready to sluice. More plants are working on good pay than was expected last fall and the 1910 output should at least equal that of last season. On Chatanika and Cleary creeks alone there are 40 dumps on top waiting for water. Some of the largest and richest dumps are on No. 4 and 5 Below Cleary where eight outfits have been hoisting all winter. Among those are Butland & Aitken, Henry Riley, Max Altman, and Smith & McIntyre. Lower Engineer creek will be a heavy producer this season, the output promising to be even greater than last season. Cascaden & Jameson, Benson Bros & Parker, Enstrom Bros., Lushbaugh & Sandstrom, Sam Hagan, Jorgensen & Co and Porter & Van Winkle will all take out good pay. The famous 17 Goldstream just below will also be in the front rank. It is interesting to note the development of the steam-points which form so vital a part of

A Clean-up on Cleary Creek.

the mining outfit. From the sweater made of half-inch pipe has been developed the reinforced hydraulic pipe with point and head of tool-steel and patent clamps for holding the steam-hose. The most recent development is changing the tapering tool steel-point to a Burleigh bit, thus enabling the driver easily to go through hard bedrock or large rocks. This is just being introduced.

WASHINGTON, D. C.

Conservation Legislation.—Chamberlain's Speech. — New Bills.

That Congress is giving more serious thought to the public land question than ever before is in evidence daily in Washington, but that there will be any new legislation upon this momentous problem at the present session is far from certain. At least fifty bills on this subject have been introduced in both Houses, but practically none has got beyond the initial stage. The session is in its fifth month and is more than two-thirds over. Members of Congress are farther apart in their views than when the session began. The Public Lands Committee of the House is hopelessly split on the proposed law to authorize the President to make withdrawals and classifications of public lands. The Senate Committee on Public Lands has been deprived of its chairman, Knute Nelson, of Minnesota, because of his work investigating the Interior Department and Forestry Bureau. Despite this discouraging situation, Mr. Taft has not given up hope that laws will be enacted at this session along the lines of the nine conservation bills suggested by him. He had a serious talk recently with members of the Public Lands Committees from both

Houses and urged some action on the bills and placed them in the following order of importance: (1) withdrawal and classification of public lands; (2) conservation of coal lands; (3) conservation of water power; (4) conservation of oil lands; (5) conservation of phosphate lands. The meeting simply served to emphasize the difficulty of any attempt to harmonize various ideas on this legislation. There is great misunderstanding of conditions and few of the members are acquainted with the vast detail necessary to consideration of the subject.' Eastern members are unfamiliar with conditions in the West and the representatives from the latter section encounter great difficulty in explaining the actual meaning of conservation as it relates to the people of their district. But one of the conservation bills has been reported from the Senate Committee on Public Lands. As amended, it reads as follows: "That the President may, at any time in his discretion, withdraw from settlement, location, sale, or entry any of the public lands of the United States and reserve the same for forestry, water-power sites, irrigation, classification of lands, or other public purposes, to be specified in the orders of withdrawals, and such withdrawals and regulations shall remain in force until revoked by him or by an act of Congress. The Secretary of the Interior shall report all such withdrawals to Congress at the beginning of its next regular session after the date of the withdrawals." George E. Chamberlain, Senator from Oregon, made a vigorous plea for this bill the other day in which he said he favored it for three reasons. First, the main principle involved, the right of the President to withdraw portions of the public domain from entry, settlement, or sale, had been approved by every department of the Government from the earliest days of the Republic. Second, the exercise of the power is necessary to protect, for the benefit of the whole people, what is left of the public domain from the result of legislative improvidence. Third, it is necessary to conserve the undisposed of and unappropriated natural resources. Relative to existing authority to make withdrawals Mr. Chamberlain said: "I have not been able to find where the authority was questioned until the point was raised by the Secretary of the Interior and possibly later by the President himself. It seems to me that a policy which has proved salutary in the past and has resulted in the prevention of the monopolization of many of the natural resources of the country ought not to have been lightly swept aside by this or any other administration." Mr. Chamberlain said that great frauds had been perpetrated through the preemption law and that the timber and stone act proved even worse. As a result of these measures, millions of acres of valuable public lands had gone into the hands of powerful corporations and syndicates. "There is no question," said Mr. Chamberlain, "but that through the instrumentality of the timber and stone act the most valuable timber in the country has gone into the hands of timber syndicates who are thus enabled to fix extortionate prices upon a product that enters into the everyday life of every man, woman, and child in the country. It may be insisted that their looting of the public domain has been made possible by laxity of administration; but Congress is not the less to blame, for these frauds were known of all men years ago, and nothing has ever been done to make them impossible by repealing the law, although repeal has been more than once recommended as the only panacea." Mr. Chamberlain's speech developed into a strong denunciation of those who oppose conservation of the natural resources. After referring to the inventory of natural resources made by the Commission under President Roosevelt, Mr. Chamberlain said: "Not only did Congress not then see fit to enact any legislation therein recommended, but unfortunately declined to print the report in sufficient numbers for its adequate distribution among the people. More disastrous than this, however, was the Congressional enactment forbidding this or other executive commissions from pursuing their important work in the service of the people. This action, plainly designed to wipe out the national conservation commission, accomplished its purpose. It put an end to the activities of that commission, removing the only national organization which was dealing with the conservation question as a whole. Thus was presented the strange spectacle of a national wide movement, inaugurated by the governors of the States, the presidents of great organizations of our national industries, and other distinguished citizens, and heartily endorsed by the people of the country, by legislative enactment denied not only an appropriation, but even permission to continue its work."

Recent bills dealing with the public lands question have been introduced into Congress as follows: By Reed Smoot, Senator from Utah, to provide for the granting by the Secretary of the Interior of permits to explore and prospect for oil and gas on unappropriated and withdrawn lands; a second authorizing the President to withdraw from all forms of settlement, entry, or other disposition any lands which are or may become chiefly valuable for development of water-power, and providing for the acquisition by any State or Territory, under certain conditions, of any lands so withdrawn, and for other purposes; by Henry Cabot Lodge, Senator from Massachusetts, to amend the mining laws of the Philippines; by George A. Bartlett, representative from Tonopah, Nevada, defining the manner in which deposits of borax, borate of lime, borate of soda, and borate material may be acquired; by Asle J. Gronna, representative from North Dakota, to provide for the classification of the public lands of the United States; a second to authorize the disposal of phosphate, oil, asphaltum, or natural gas; a third to provide for the disposal of coal and coal lands; by James Wickersham, delegate from Alaska, to create, establish, and enforce a miner's labor lien in the territory of Alaska, and for other purposes; by Charles E. Pickett, representative from Iowa, to authorize the President of the United States to make withdrawals of areas of public land for classification and other purposes, pending report and recommendation to Congress.

MEXICO

Teziutlan Copper.—Zimapan, Hidalgo. — Yaqui River Railroad. —Transvaal Copper.—Lucky Tiger.— El Tigre. — Taxco & Guerrero.

The Teziutlán Copper Mining & Smelting Co., owning property in the State of Puebla, which has smelted no ore since the drop in copper prices, will blow in before the end of April. The company is controlled by the Robert S. Towne interests. D. C. Brown, the Towne manager in Mexico, is now at the Teziutlán camp and will remain there until the smelter is in commission. Since the suspension of smelting the Teziutlán smelter has been entirely rebuilt, and it is now one of the most modern plants in the Republic. The building is largely of structural steel, and there are two 500-ton Robertson-type jacket furnaces, with converters and other equipment. All the machinery is electrically operated, power for the smelter and mines being secured from a 3000-hp. hydro-electric plant 3 miles north of the smelting plant. Blister copper will be produced, and the product shipped to Perth Amboy for refining. Shipments will be made through the port of Vera Cruz until such time as the projected Teziutlán-Nautla railroad is built, when the company will have a direct outlet through the Gulf port of Nautla. Development has been continued steadily since smelting was suspended, and there is now an immense tonnage in sight in the mines, and supplies for several months in the ore-bins at the smelter. It is said that stoping can be done at a rate of at least 10,000 metric tons per month. The company owns the big Ocotes copper mine in the State of Oaxaca, and development is now in progress there. Some Ocotes ore will be shipped to the Teziutlán smelter. A 1400-hp. hydro-electric plant will be installed on the Sola river in Oaxaca to furnish power for operations at the Ocotes mine. Within the next few months the Teziutlán company will again take rank as one of the principal copper producers of Mexico.

The Towne interests are extensively developing the Flojonales copper mines in the Zimapán district in the State of Hidalgo, and there is promise of heavy copper production there. The mines were taken over last year at the expiration of an option. The completion of the Pachuca-Zima-

pan railroad now under construction by the Honey interests, will greatly reduce the distance to modern transportation, and a branch may be built by the Fowne interests. The installation of a copper furnace at the Fowne custom smelter in San Luis Potosi, to handle Flojonales ores principally, is now under consideration, although shipments may be made to the Tezluttlan plant.

The roadbed of the Southern Pacific's Yaqui river line has been completed through the canyons south of Nacozari, and south of Cumpas the work will be comparatively easy. The concession requires the completion of the line from Nacozari to Cumpas in July, but if necessary it is probable that an extension can be secured. The Transvaal Copper Co., which has money of Cincinnati brewing interests behind it, plans to build a railroad from Cumpas, where it has a smelter, to the mines, a distance of about 40 miles west. The mines are now connected with Cumpas by an excellent wagon road that is said to have cost ₱100,000. Just beyond the Transvaal properties are the mines of the Minneapolis Copper Co., said to promise heavy production, and beyond them the Washington mine, purchased last year by James Douglas, L. D. Ricketts, and others for ₱400,000. The Washington is a big low grade copper property. The Duluth-Moctezuma Co., operating in the Moctezuma district, has realized $22,000 from 5 carloads of silver ore shipped to Douglas. The value of the ore was $56,000. The Lucky Tiger Gold Mining Co. has declined to double the

Travel in the Yaqui Country.

capacity of its concentrating plant at the rich El Tigre mine, and plans for securing additional and cheaper power are being studied. An oil-burning plant at either Izábal or Douglas, with electric transmission to the properties, and a hydro-electric plant on the Bavispe river, are under consideration. Work on a cyanide plant at El Tigre was commenced a short time ago. It is reported that the Ryall exploration concession, covering about 1,500,000 acres of mineral land in the Yaqui river region of Sonora, will expire on April 24. The new mining law of Mexico provides against the renewal of such blanket concessions, and the granting of new ones. The concession is now held by the Pacific Smelting & Milling Co., the $8,000,000 concern that last year succeeded the Douglas Copper Co. and allied corporations. Recently suit to recover an interest in the Ryall concession and all mineral land taken up under it was filed in New York by Mrs. Metta F. Merchant, a daughter of the late James McCallum, who was one of the men originally concerned in the big exploration grant.

The Sultepec Electric Light & Power Co. has agreed to transmit power into the old Taxco district of Guerrero under a guarantee of 600 hp. A guarantee for a greater amount is said to be certain, and the comparatively cheap power will play an important part in reviving mining and milling in that mining region. The Atlixtaca Mining Co., in which Italian capital is interested, is preparing a site for a cyanide annex. Cyanide tests have shown satisfactory results. Frank Olendorf, who has been making zinc shipments from the Taxco district for some time, has interested American capital in plans for the erection of a zinc separating plant.

TORONTO, CANADA

Lignite near Cochrane —Cobalt News.—Peterson Lake. — Porcupine.—Government Testing Plant. — Chibougamou Exploration.

Considerable excitement was caused in mining circles about the end of March by the announcement that coal in large quantities had been discovered in northern Ontario, west of Cochrane and about 60 miles north of the Grand Trunk Pacific Railway route. The deposits are situated along the banks of the Metagama river, the high bluffs of which are thickly seamed with coal. About 20 square miles has been staked, each claim comprising a square mile, but not including a right to other mineral which may be found. Numerous prospecting parties have left for the region and syndicates are being organized to develop the deposits. The officials of the Ontario Department of Mines were not at first disposed to attach much importance to the discovery. A sample of the mineral sent to the Department proved on analysis to be lignite, and there is no authentic statement as to the existence of bituminous or anthracite coal in that region. The occurrence of lignite in that part of the country has been known for many years, Robert Bell having reported deposits on Coal brook and the Missanable river, in the report of the Canadian Geological Survey 1875-77. The subject is dealt with more exhaustively in a paper by James Mackintosh Bell, published in the annual report of the Ontario Bureau of Mines for 1904, on the economic resources of the Moose River basin. The coal is declared to be of excellent quality, analyses showing that it will make good steam fuel. The present discoveries therefore simply indicate an extension of the field and a wider distribution of the lignite than was previously known. While the cost of transportation will operate as a bar to an extended market, the lignite will be available for local domestic use, and probably will find some market as a steam coal when the region becomes settled. In the meantime there appears to be little opportunity for its successful exploitation commercially.

The Cobalt shipments for the first three months of the year amounted to 7069 tons. As the total shipments for 1909 were 30,098 tons, this indicates a slight falling off in the output, which will doubtless be more than made up when the cheap power now obtainable is in full operation. The shipments for the week ending April 1 were 844 tons. There were two new shippers on the list, the Harrgraves with 20 tons, and the Lucky Godfrey of Elk Lake, 27 tons. The latter sent out the first full car of ore shipped from the Elk Lake district proper. Another Elk Lake mine which bids fair shortly to rank as a producer is the Moosehorn. The shaft is down 125 ft. and 480 ft. of driving and cross-cutting has been done. Rich ore was struck some weeks ago about 385 ft. from the shaft and a winze will be sunk from this point to a depth of 250 ft. The company has installed a new 6-drill compressor.

The lawsuit between the Peterson Lake and Nova Scotia mining companies of Cobalt has been decided in favor of the latter. The dispute was over a strip of land which the Nova Scotia company, which leases a portion of the Peterson Lake location under a royalty, claims should have been included in its holding. The judge ruled that though the land was not covered by the description in the lease it was intended to be granted, and ordered a rectification of the case. On the Little Nipissing property a 3-in. smaltite vein carrying native silver, has been found at the bottom of the winze at a depth of 239 ft. The Bailey mine has been started again with power from the Montreal river. Stoping has been commenced on No. 2 vein, which is about 2 ft. wide, with ore carrying 1000 oz. silver per ton. At the Ophir good ore is being taken out at the 200-ft. level where the vein runs from 6 to 8 in. wide assaying about 2000 oz. silver per ton. The City of Cobalt, A. S. Stevens, manager, has closed a contract with the Northern Customs concentrator for the milling of a large tonnage of low-grade ore.

Large shipments of machinery are going forward to Porcupine. The syndicate that has acquired the Wilson property, on which 70 men are employed, is geting in 17 carloads. The Scottish Ontario is putting in a steam-hoist and boilers, camp buildings are completed, and the

rock removed in development is being sacked for shipment to Scotland for testing in the company's laboratory. A stamp-mill will not be put in until the company has 5000 tons ready for treating on hand. The Canadian Department of Mines announces that an experimental ore concentrating plant will be established at Ottawa to demonstrate methods of treating ores of all kinds. It will be operated in connection with the new experimental peat-plant. The Quebec Government has undertaken an examination into the mineral resources of the Chibougamou district, and an advance party carrying supplies and equipment for the expedition has set out. It will be followed in a few days by A. E. Barlow of Montreal and Mr. Quillin of Queen's University, Kingston, Ontario. The additional 1000 hp. turned over the wires of the Cobalt Power Co. permits the mill at the Temiskaming to keep the complete battery of 30 stamps dropping continuously.

JOHANNESBURG, TRANSVAAL

Big Mines to the Fore.—State Mines Flotation.—Cinderella Consolidated Amalgamation.—Crown Mines Annual Meeting. — Premier Diamonds.

Your correspondent is in the proud position this mail of being able to discuss several matters of topical interest without descending to trivialities. There is nothing petty in recent events. On the contrary, there have been so many 'big things' in evidence, that one has almost yearned for the reappearance of the controversy on 'fracture planes' in stopes, to relieve the solemnity of current history. There has been a gigantic flotation, with a huge name—the Government Gold Mining Areas (Modderfontein) Consolidated, Ltd. There has been a great amalgamation, resulting in the creation of the Cinderella Consolidated Gold Mines—a potential 'Crown Mines', in the opinion of the promoters, a distinctly latent one in mine. The Crown Mines, Ltd. has held its annual meeting, where some interesting points were announced as to the progress of the world's greatest gold mine. The Premier Diamond Mining Co. has also held its annual meeting, where details were given of the unparalleled scale of operations attained and where A. Wagner made a stupendous speech. The flotation referred to followed disposal of the mining rights of the great area in the Far East Rand held by the Government. The area consists of 2633 claims* on Modderfontein No. 167—the magnitude of which may be well expressed by the fact that it was often considered best to equip or mine on the basis roughly of one stamp per claim in the days of 5-ton stamp-duties. Tenders were invited to work this ground. The Government puts up no money for capital expenditure and takes no risks. It demanded minimum renumeration in a tax based on a sliding scale, ranging from 10 to 50%. The percentage is determined by the ratio between profit and yield. For example, if the yield is 30s. and the profit 10s., the tax will be 33.3% of the profit (including the regular 10% tax due by all mines). The successful tenderers, Barnato Brothers, offered an additional surtax, also on a sliding scale. It was stipulated by the Government that a certain proportion of the shares should be offered for public subscription at par and as a result of this provision, the prospectus has already been issued. The company's capital is £1,400,000—all working capital; 1,225,000 shares at £1, in full or partly paid up, have been subscribed by the promoters, leaving 175,000 shares that are offered at par to bona fide residents of the Transvaal. Applications are to be received for not less than 10 shares and not more than 400. The area being one of good promise, where the yield should range from 24 to 28s. per ton and profits from 7 to 10s., there will undoubtedly be a big rush for these shares and the allotment proportion is not likely to be big, in the case of applications for the maximum. The small applications will probably be satisfied in full, in order to popularize this scheme of State mining by proxy. The Government is also busy upon some other of its holdings in the Far East Rand and is diamond drilling to determine reef contours to the east of the Modderfontein 'B' gold mines. Possibly this area will be worked by the State more directly and utilized as a training school for miners. The General Mining & Finance Corporation is trying its hand at something 'huge', and has fallen an easy victim to the combined fascinations of a big claim area and a calculating machine. The amalgamation emerges from the Cinderella Deep, Ltd., which is a 100-stamp deep-deep mine with a single shaft. Because the Cinderella Consolidated is to have over 2000 claims and because a central mill ultimately of 200,000 tons per month is virtually promised, the error may be made in regarding it as another East Rand Proprietary or Crown Mines. Unfortunately, the producing nucleus is very small in the case of the new amalgamation, and we are dealing with ultra-optimistic estimates, instead of merely an improvement in conditions to be effected by joint operation. The Cinderella Consolidated is to be equipped with two new vertical shafts (over 3000 ft.), and a central mill of 100,000 tons per month. The cash provided is £681,000, which is inadequate for the completion of the scheme outlined. The Crown Mines, Ltd., a vast concern—one of actualities, as opposed to the foregoing acreage of 'potentialities'—held its first annual meeting on March 8. The group was only run under single control after July 1, so that the first half of the year is represented by the results of the constituent companies. Comparing these with the figures for the united concern for the latter half, we get the following summary:

	Constituent Companies Jan. to June	Crown Mines, Ltd. July to Dec.
Tons milled	829,473	740,924
Yield per ton	32s.7d.	33s.9d.
Cost per ton	15s.1½d.	16s.10d.
Total profit	£723,027	£627,135
Development per month (average)	2839 ft.	3205 ft.

Apart from the natural difficulties involved in reorganization and centralization, labor troubles are almost entirely responsible for the poorer showing of the amalgamated company. There is no reason to question the beneficial influence of the amalgamation because there have been temporary troubles. Single-mill properties have suffered severely enough during the same period. G. E. Webber, in his report as consulting engineer, gives the ore reserve estimate at 3,916,583 tons at 7.7 dwt., and notes that the additions to reduction works in hand will bring the crushing capacity to about 157,000 tons per month. The reserve thus forms practically a two-years' supply.

The chairman of the Premier Diamond Mining Co. had another year of huge production and comparatively poor financial results to discuss before shareholders at the recent annual meeting. The annual report contains some well tabulated statistics which demonstrate the tendencies of progress more convincingly than any general statement in words. The principal features may be summarized as below:

Year to Oct. 31.	Loads of 16 cu. ft. washed.	Yield per load, carats.	Value per carat.	Value per load.	Cost per load.
1903	76,931	1.29	27s.8d.	35s.7d.	4s.7.2d.
1904	939,265	0.798	23s.1d.	18s.5d.	2s.7.6d.
1905	1,388,071	0.609	23s.6d.	14s.4d.	3s.3.4d.
1906	2,988,471	0.301	28s.5d.	8s.7d.	3s.5.7d.
1907	6,538,669	0.290	18s.0d.	5s.2¼d.	2s.4.1d.
1908	8,058,844	0.258	14s.9d.	3s.9.7d.	1s.10.2d.
1909	7,517,793	0.249	12s.6d.	3s.1.4d.	1s.11.4d.

The relation between the last two columns is particularly noteworthy, it being apparent that it is not long since the cost per load washed exceeded the present value recovered per load. The speed of washing will increase rather than diminish. Providing it gets the labor, the company will be treating 850,000 loads per month shortly, and 1,000,000 loads before the end of the year. A. Wagner again delivered his customary onslaught upon De Beers and the New Jagersfontein, from which we must conclude that the world's diamond market, from the producers' standpoint, is influenced by the same little feelings of personal antagonism that bear on the sale of peas or pumpkins in a country town.

*A Transvaal reef claim equals 64,025 English square feet, or 1.47 acres.

NEW YORK

Porcupine and Cobalt News —Copper Boom Deflated. — General Development Co Option Pacific Smelting & Mining

The keenest interest in mining circles at the present moment is in Porcupine. The one feature perhaps most deserving of comment is the public attitude and the comparisons constantly drawn between the intense interest shown in any news from this most recent gold discovery and the apathy displayed toward Cobalt. There was never a better illustration of the old adage that mankind takes more pleasure in pursuit than in possession. Cobalt is just getting the power turned on literally and figuratively, electric current and air are just available, both are to be used in increasing the production of the mines already shipping and in prospecting. The coming summer will, beyond question, be the busiest, best, and most profitable season Cobalt has yet seen, but it is equally beyond question that no new discoveries, no widening of the producing territory could revive or create any enthusiastic interest in Cobalt. On the other hand prospectors and miners are ablaze with excitement over the possibility of gold discoveries. A find was reported to have been made at Cariboo Lake some 12 miles from milepost 170 on the Temiskaming & Northern Ontario railroad about 30 miles southeast of Porcupine. The trails are almost impossible owing to an early spring. Yet 500 men took chances over an almost unbroken trail 'through the bush' as the Canuck puts it, in the hope that a real strike had been made. It proved a false alarm. In the Porcupine district some progress has been made. Five outfits were fortunate enough to get in before the snow and ice roads broke up. On the Timmins property two 60 hp. engines and a 6-drill compressor are being set up. The shaft on this property is down 70 ft.; one shipment of 30 tons of ore has been sent out, part of it went to the Kingston School of Mines, and the balance to the Perth Amboy refinery. The assays returned from the first shipment showed from $750 to $2000 per ton. The returns from the refinery are not yet available. The syndicate headed by Ambrose Monell, of the International Nickel Co., has about 75 men at work on its property which is known as the Wilson ground and boilers and compressors are being set up. The Crown Chartered Co., operated by New York men, is also installing a power-plant and a sawmill. A flood of promotions may be expected during the summer should any of the development now under way result in making a real gold mine.

For the present at least the copper boom is deflated, if not collapsed. There are several important factors in the copper situation at the moment. First, and of overwhelming importance, is the growing stock of metal. The report of the Copper Producers' Association covering the month of March was exceedingly disappointing. It was expected that some increase in production would be shown, the demand during the month being good, but the worst that was looked for was a parity between producer and consumer. The increase in the surplus, therefore, of 16,636,882 lb. was a distinct setback. While tobacco, oil, and copper may, off hand, be supposed to have little in common, the action of the Supreme Court of the United States in calling for a reargument of the Standard Oil and American Tobacco Co. cases had a distinctly adverse effect upon the copper stocks while affecting almost all other securities in an opposite manner. The greater part of the public enthusiasm for 'coppers' has been founded on the belief that an all important merger was to be made, and opportunities for profits might and probably would be created in gathering up various properties. Now it is admitted on all hands that there will be no copper merger until the law relating to combinations or trusts is determined, which it will probably not be for at least a year. In the meantime the Granby episode, which is as yet without any satisfactory explanation, has helped to cool the public ardor. It is said that the real reason for the decline in Granby is high copper costs, and inability to show any profit on a 13c. copper market. It must be added also that the general public has not the patience required to wait during the four to seven years needed for the making of a big low-grade copper mine and a shrinkage accreating a staggering total of nearly $200,000,000 on only 24 of the leading issues in the copper list means that the smaller investor is not to be lured in line. Conditions must be radically improved either by curtailment or by the forced shutting down of the higher cost producers before the public can be brought back into coppers. An increased production from the Phelps Dodge Co. so large as to indicate a total for the coming year of more than 140,000,000 lb., together with a recent announcement of the Calumet & Hecla to the effect that the present market is very satisfactory so far as it is concerned as the company can make a reasonable profit on 13c copper, holds out little hope for any agreement to curtail production. The General Development Co. has taken an option for examination of the properties controlled by the Pacific Smelting & Mining Co., a reorganization of the Douglas Copper Co. The properties, which are controlled through complicated reorganizations, consist of some 491 acres of mineral ground in the Alamos district, Sonora, Mexico, and the Pacific Smelting & Refining Co. smelter at Fundicion. The option is said to be on a basis of $600,000 for control of the Pacific Smelting & Mining Co. The various organizations as they stand appear to be involved past comprehension, but presumably the Pacific Smelting & Mining Co. holds the control. Theodore Douglas and Russell T. Connell, who is acting for the Lewisohn interests, are on their way for Mexico to make a thorough examination of the property and equipment.

BUTTE, MONTANA

Washoe Copper Co.—Butte-Ballaklava.—Tuolumne-North Butte.

The Washoe Copper Co. and the Big Blackfoot Lumber Co., Amalgamated subsidiaries, have accepted the Anaconda proposals. The Blackfoot was recently reorganized and its capitalization increased to $25,000,000. The Washoe company will receive 380,000 shares of the new Anaconda stock. The company owns the large smelting plant at Anaconda, and some good mines at Butte. Its producing mines include the Moonlight, Clear Grit, Cambers, and Poulin. It also owns coal lands at Bear Creek and Red Lodge, and a controlling interest in the Cokedale Coal Co. The Washoe company produced last year about 80,000,000 lb. of copper. The smelter is leased to the Anaconda company, but the Amalgamated furnished the funds for building it and holds a claim against the Washoe company for nearly $8,000,000. The Butte-Ballaklava Copper Co. will shortly be prepared to resume mining and shipping ore. A few days ago the west drift on the 800-ft. level opened a fine body of copper glace. The vein itself is about 9 ft. wide and 2 ft. of it consists of copper glace. The whole face of the drift is glance mixed with ore of a lower grade. In the east drift on the same vein the orebody is 11 ft. wide, and averages 10% copper and 20 oz. silver per ton. The same vein is being opened on the 900, 1000, and 1200-ft. levels. Owing to the limited capacity of the old hoisting engine only the ore that is taken out in the course of development is being brought to the surface, but from that the company is making occasional shipments. The new hoist, with double drum and capacity to work to 2000 ft., will be in commission as soon as the 300-hp. electric motor can be installed. It is said that the Tuolumne company has been assured that whatever claim the North Butte company may have on the strip of ground secured some time ago, no effort will be made to interfere. The ore being taken from the 2000 and 2200-ft. levels of the North Butte is averaging between 5 and 6% copper, and is being mined at a small profit. The company at the present time is taking out about 1200 tons of ore per day, which is between 200 and 300 tons per day less than before the engineers' strike. The Boston & Montana properties are being worked to practically their full capacity and the company's smelter at Great Falls is receiving about all the ore it can handle from these mines. On the lower levels of the Leonard some very valuable covellite has been encountered. Samples have been placed on exhibition in this city and they are attracting great attention from mining men.

General Mining News

ALASKA

(Special Correspondence).—The steamship *Northland* has just arrived at Ketchikan with a compressor plant for the Goodroe mine in this district and the Rogers property at Hollis. The latter is one of the new producers of the district and is stoping a good grade of gold ore on the 100-ft. level while the shaft has reached the 200 opening milling ore the entire distance.——Several new prospects are being opened with good results though the unusually heavy snows have hindered the work. The report of the Alaskan

The Alaska Perseverance Mill, Juneau.

United Gold Mining Co. for the month ended March 15, states that the Ready Bullion mill ran 26 days and the 700 Ft. Claim mill ran 21 days 9 hours. The mills crushed 28,085 tons of ore, recovered $35,659 worth of free gold, 520 tons of concentrate valued at $26,822, and $1805 worth of base bullion. The yield per ton milled averaged $2.30.

Ketchikan, April 11.

ARIZONA

COCHISE COUNTY

The El Tigre Mining Co. is contemplating the erection of a central power plant at Douglas which will furnish power for the proposed cyanide plant and electric line between Douglas and the mine. The line will not only handle the concentrate from the high-grade ore at the mine but would also serve the North Tigre, Antigua, Fortuna, South Tigre and Cinco de Mayo mines.——At the Bisbee Extension property the shaft has been stopped at the 800-ft. level and drifts started on the 700 as the water was coming into the shaft too fast for the pumps to handle. A new boiler has been ordered and oil burners will be installed in the old ones the oil being hauled from Lewis Springs by wagon. ——Myers & Bland netted $22 per ton on a shipment of 14 tons to the El Paso smelter from the Scott & Crawford mine at Paradise which they are operating under lease.—— The Royal Guard Mining Co. has been organized to take over the properties of the Old Guard Mining Co. in the Tombstone district. New machinery will be installed and the mine reopened under the management of Frank L. Fowler.

GILA COUNTY

(Special Correspondence).—The Inspiration orebody as indicated by the underground and churn-drill work so far is 3000 ft. long, the maximum width being about 800 ft.—— J. Parke Channing, consulting engineer and vice president of the Miami Copper Co., has just given an interview in Globe in which he said that the orebody of the New Keystone Copper Co. is undulating, following the topography of the schist underlying the porphyry and that while the results of the underground work and of the churn drilling have been very satisfactory, the work has not yet been sufficiently correlated to make estimates of tonnage advisable. Mr. Channing estimates that in two months the various connections necessary for accurate figures will be made. Regarding the churn-drill work, he said that two holes just put down on the Philadelphia group have given negative results. Mr. Channing stated that undoubtedly a large body of ore assaying over 2% will be developed.—— Three drifts are being driven in the Live Oak orebody on the 300-ft. level. The vertical shaft has been sunk 65 ft. below the third level and is bottomed in chalcocite ore of good grade. The churn-drill recently purchased has just begun work at the junctions of drifts No. 308 and 311, 450 ft. west of the shaft.

Globe, April 15.

GRAHAM COUNTY

The churn-drill on the Celtic group of the Arizona-Morenci Copper Co. is down over 700 ft., and new cable has been shipped to the property to continue the hole to 1000 ft. Results have been extremely favorable and the company has ordered several other drills to facilitate the work. J. O. Baylor is manager.——The mill recently erected at the Gold Belt mine is running 12 hours per day with satisfactory results.——The New York-Arizona Copper & Gold Co. is preparing to erect a mill on its group in the Morenci district.

YAVAPAI COUNTY

(Special Correspondence).—M. S. Masson, chief engineer for the Electric Operating Construction Co., of New York, has just completed a transaction whereby the Arizona Power Co. acquires the holdings of the Prescott Electric Co. and the Prescott Gas Co., of this city. The resident manager of these companies will be M. V. Watson.——The Humboldt Smelter was blown in at 1 o'clock April 16. The entire plant has been remodeled and new steel buildings erected.

Prescott, April 18.

The Alturus group between Walker and Poland has been sold to Charles B. Foley of Mercur. An adit has been driven to the vein cutting it at a depth of 315 ft. and development carried on from this that blocks out about 40,000 tons of ore. The ore is 12 ft. wide at its maximum and is all suitable for cyanide treatment.——No definite figures have been given out by the management of the United Verde Extention as to the extent of the recent discovery but assays of the ore have run about 15% copper with $10 gold per ton and a small amount of silver.——In the Silver Mountain district 30 miles north of Wickenburg a rich vein has been opened in the Monte Carlo property at a depth of 65 ft. A small stampede has been started and a number of claims staked as the result of the assays.

YUMA COUNTY

The Carbonate Hill shaft of the Tank Pass Consolidated Mines Co. near Salome is down 125 ft. and is being sunk to the 250-ft. level. At the 100-ft. level a cross-cut was driven to the ore and a drift started toward the centre of the hill while two drifts are being driven on the vein from its outcrop.

CALIFORNIA

AMADOR COUNTY

The work of reopening the Ross mine near Sutter Creek has been started under the direction of L. R. Poundstone. ——Since the recent discovery in the foot-wall of the South Eureka local interests are planning to resume work at the Lincoln mine. This was diamond-drilled some time ago with unsatisfactory results but the finding of the ore mentioned has led to a belief that similar ore might be found in the Lincoln.——At the Central Eureka work is continued in the shaft. The cross-cut connecting the Central and South Eureka shafts has been completed and much better ventilation obtained.

CALAVERAS COUNTY

The Swiss Gold Mining Co. has been organized to reopen the old Swiss and Fine Gold mines at Rail Road Flat which have been idle since 1907. The vein is 4 ft. wide and assays from $6 to $10 per ton. The property is equipped with a 10-stamp mill and has built excellent accommodations for the men.——Owing to the shortage of power the mill at the Sheep Ranch mine is only running 16 hours per day. The stamps are dropping on ore from the dumps.

NEVADA COUNTY

The Central Consolidated, on Banner mountain, in the

Nevada City district has completed the installation of 1000 ft of cable and a new skip. The company at present is confining its work to blocking out ore on the levels already opened.—The installation of the new machinery at the Mountaineer has been completed and the big hoist started. The ore is now raised in 3 ton self dumping skips which empty into cars at the landing.

PLACER COUNTY

W. F. Morris is opening the old workings of the Pioneer mine below Damascus. This is one of the old mines with a good production record though it is thought that considerable fair ore was left in the old stopes by the early day workers.—W. W. Bissell has cross cut the bedrock at the Excelsior group and is now working in the channel. The group embraces the Iowa Hill townsite.—The ore recently opened at the Jupiter mine is said to run as high as $20 per car.

PLUMAS COUNTY

Work at the Eagle copper mine, in Light's canyon, is being carried ahead rapidly. A small force of men is employed at the saw mill which will soon be cutting lumber for the mine buildings, and the castings for the smelter are being hauled to the mine. The company is blocking out a large amount of ore in the mine, and will be in a position to keep the smelter busy as soon as it is ready for operation.

SHASTA COUNTY

(Special Correspondence).—It is announced that the Mammoth Copper Co. will have its bag house installed by July 1. The annex will be erected by the American Bridge Co.—Developments are progressing steadily at the Milkmaid with the 10 stamp mill yielding $15,000 to $20,000 per month. Clifford Wiegel, former owner of the Central mine, has been appointed superintendent.—A small force of men is employed at the Mad Ox property near Stella. Al Egerton is superintendent.——A call for an assessment of $1.25 per share has been issued by the First National Copper Co., controlling the Balaklala Copper Co. It is payable on or before May 10. Stockholders of record April 12 are subject to this call upon the unpaid balance of par value of their shares.——The Heroult electric iron smelter is ready for an extended run. A carload of graphite electrodes is on the way from the East which will enable operations to be conducted steadily. The management states that an excellent demand prevails for the product.

Redding, April 18.

The Balaklala Copper Co. recently requested an extention of time from the Shasta County Farmers' Protective Association in which to complete the installation of the Cottrell process for destroying smelter fume at the company's plant at Coram. This was refused by the association on the grounds that if the extention, from July 1 to October 1, were granted the crops for the year would receive no benefit from the installation.——The Pittsburg & Mount Shasta Gold Mining Co. is shipping ore from the Little Nellie mine on the Iron Mountain railroad to the Mammoth smelter.

SIERRA COUNTY

Homer Gould and Edward Pegg, of Downieville, have secured a bond on the Oakes mine in Sailor ravine.——F. A. Gowing, of Oakland, has taken the Standard mine three miles from Downieville under bond. Considerable high-grade ore has been taken from the property and a number of shipments of rich concentrate made. Twelve tons of ore which is expected to run about $12,000 per ton has been taken to the York mill to be treated.——A contract has been let to drive a 100-ft. adit on the Slattery group near Forest.——The shaft of the Poker Flat Mining Co. is now down 238 ft., and is still in lava.——At the property of Elmer Mott, on Rock creek, a raise is to be started to open the gravel.——Work is to be resumed on the Runyan claims in Hungry Mouth ravine.

TRINITY COUNTY

The new machinery at the Lappin has been started and the machine-drills are doing excellent work in the mine. Frank Hollingsworth is superintendent.——Six men have been started at the Yellow Jacket mine and two adits will be driven to open the ore.—Operations are to be resumed this month at the Overslight mine on Yellow Jacket creek.—It is reported that Fred Bandy has purchased the Poverty Slide hydraulic mine at Trinity Center and the water resources will be increased.

TUOLUMNE COUNTY

(Special Correspondence).—A rich pocket was opened last week in the Mohrman mine south of Big Oak Flat, over $2000 being taken out in a few days. The property adjoins the Eureka mine on the east and the Red Jacket on the west and is worked under lease by N. W. Hilliard.—The work of cleaning and retimbering the shaft and adit at the Sunnyside mine and the repairing of the mill and other machinery has been completed and development commenced.—Development work will be commenced at the Laguira mine, in the Groveland district, within a week, when repairing the shaft, 125 ft. deep, will be completed.—It is reported that the Jumper mine will soon again be actively worked and that a new shaft will probably be sunk.—The Central Mother Lode Mining Co. is installing a 50 hp. boiler at the Mangante mine, near Jamestown.—It is reported that the Santa Ysabel mine near Jamestown will be reopened and worked again by the Santa Ysabel Mining Co. R. C. Hayward is president of the company.

Tuolumne, April 16.

COLORADO.

CLEAR CREEK COUNTY

(Special Correspondence).—The Homestake adit in the Georgetown district intersected the Golden Jack vein this week opening a body of smelting ore three feet wide. Work is to be put under way in the construction of a 50 ton mill at the Centennial mine during the present month.—A body of ore 14 in. wide was cut last week on the sixth level of the Dunderberg mine.——The Lucania tunnel on lower Fall river, is to be driven an additional 500 ft. The bore is now in a distance of 4500 ft. John McCall is manager.——The Lombard mill at Alice is to be remodeled and the capacity increased at once as the output from the mine promises to be double what it has been in the past. H. I. Seemann is manager.——A body of lead ore two feet wide has been uncovered in the bottom of the 135-ft. shaft sunk on the Park vein of the Highlander Mining & Milling Co. Ira Pollard is manager.

Idaho Springs, April 16.

GILPIN COUNTY.

(Special Correspondence).—Work is to be resumed upon the property of the Euclid Gold Mining Co. in the Pine Creek district.——A local pool of business men has secured a lease upon the Star of the West mine in Russell district. A drift is to be run to cut under the upper workings from which a production of $60,000 was made a few years ago.——The Foot & Semmons property adjoining the Next President group of claims has been taken over by the Great Bonanza Gold Mining Co. Ltd. of London. Cecil C. Morgan is manager.——Work in the construction of the new mill for the Gilpin-Eureka Mining Co. has been put under way. Two carloads of lumber arrived at the Black Hawk depot last week.——A gold retort weighing 79 oz. was sold last week by the operators of the Egyptian mine on Quartz hill. This represented a clean-up from the Fifty mill and the sum of $1200 was realized.

Central City, April 15.

LAKE COUNTY

After two years of constant work ore has been opened in the Huston adit in the Leadville district. At one portion of the vein the ore is a sulphide of lead and silver with considerable gold, while deeper the ore is oxidized with its main value in gold. The shoot is narrow, but assays from $40 to $100 per ton. Harry Mamlock has resumed operations on the Doris claim adjoining the Huston.——Operations are to be resumed at the Helena mine about May 1.——A lease has been obtained on the First National claim in Iowa gulch by local operators and development work started.——Two shifts per day are now being worked at the Lanphier lease on the Penn property, and 200 tons of

ore per day shipped to the smelter.——Supplies have been hauled to the Theodolite group in Half Moon gulch, and work started for the season.——The Dinero shipped 350 tons of ore during March, and at the present rate of production, the April output will exceed this.

SAN MIGUEL COUNTY

Last year the washout on the railroad prevented the Junta Mining Co. from completing its plant in the Placerville district before the snow became too deep to run the mill. It has now been finished and the test runs have been so successful that the management is now considering increasing the capacity to handle 100 tons of ore per day. ——At Ophir the Crown Point has been taken over by lessees and is being operated after an idleness of eight years. The vein is about 8 in. wide, and averaged 180 oz. per ton where it was stoped. In the same camp the stamps at the Fairview are dropping on good ore from the mine, the Carbonero is shipping, while the Alta and Butterfly are both opening fair ore.

SUMMIT COUNTY

The machinery for the O'Reilly property, in the Breckenridge district, is being forwarded to the mine and the management expects to have the machine-drill at work in the adit within the next two weeks.——The dredge, operating in French gulch, was cleaned up for the first time this season a few days ago and the amount of bullion reported as satisfactory.——Dredge No. 2 on the Swan river has been thoroughly overhauled and is running steadily.——A station is being cut in the adit on the mill-level at the Wellington, and a shaft will be sunk and the lower portion of the vein opened.——At Moctezuma the Ohio-Toledo adit is now in over 2200 ft., and a new vein has been opened. The vein appears to contain good ore and drifts have been started to cut the shoot. The mill is to be equipped with new machinery the coming summer.——There are 38 men now working in the King Solomon mine, at Frisco, where a shoot was recently opened on the No. 11 vein. A drift has been driven 60 ft. along the vein which now contains a fair amount of gold in addition to its lead.

TELLER COUNTY

Sub-lessees operating on the first level on block No. 7 in the Jennie Sample mine, in the Cripple Creek district, opened a body of high-grade ore assaying about $100 per ton. The ore is considerably oxidized and with a small amount of sorting will be shipped directly to the smelter. ——A prospecting permit with an option of a lease on the Ocean Wave property on Battle mountain has been secured by S. W. Vidler who represents Denver capitalists.——The Work Mining & Milling Co. has issued a report for the year ended April 1 stating that there were seven sets of lessees and sub-lessees working in the mine and that $43,127 worth of bullion was taken from the ore produced by these operators. Of this $22,651 was paid to the lessees, $13,280 for milling and transportation, salaries of officers and taxes, $7400, and $11,717 spent in litigation. The surplus on hand at the beginning of the month amounted to $53,641.—— Twelve sets of lessees operating on the property of the Free Coinage Gold Mining Co. are shipping about 40 cars of ore per month. The Altman Leasing Co. is cross-cutting on the 800-ft. level and expects to open the Wilson vein within the next few days.——The Uintah Leasing Co., operating a lease on the Necessity fraction through the main shaft of the Ajax property, is opening a rich orebody and shipping high-grade ore. The company paid its first dividend the first of this month.——The holdings of the Midget Gold Mining Co. have been sold to the Midget-Bonanza Mines Co. for $150,000 which will be distributed as a final dividend to the stockholders.

IDAHO

BOISE COUNTY

The Gold Hill & Iowa Mines Co. is sinking the Pioneer shaft from the 400 to the 500-ft. level. The new 100-ton mill is practically completed and will be in operation in a few days. The method of treatment is a departure from the ordinary practice of the district, so results are being watched with interest. The ore is coarse crushed in the batteries, classified, re-crushed in a 10-ft. Lane mill, the entire product being amalgamated here, and sized with a Richards classifier. It is then concentrated on Bartlett tables and Frue vanners, the sand allowed to go to waste and the concentrate treated in Pachuca tanks. E. E. Carter is manager, and W. L. Bowron, superintendent.

IDAHO COUNTY

The citizens of Elk City have subscribed to a fund to construct a trail from Elk City to the new townsite of Golden where rich ore on the Harmon & Morrow claims started a stampede to the district. There are now several hundred prospectors near the camp, and good showings are reported on a number of claims. J. T. Omo, who holds a bond on a three-quarters interest in the South Fork mine for $112,500, is to incorporate the South Fork Mining Co. to more completely develop the group.

OWYHEE COUNTY

The final payment of $19,250 on the group in the Silver City district which the Silver City Mining & Milling Co. has been operating under bond from Abel A. Berg has been made. The company has been re-financed and the name changed to the Silver City Mining & Milling Co. London 1910.——The Wennersten group has been taken over by an English company and will be more actively worked in the near future.

NEVADA

ELKO COUNTY

(Special Correspondence).—Contact district, situated in the northern part of this county, is about 40 miles east from Jarbidge and 70 miles south of Twin Falls, Idaho; a stage runs three times a week from Rogerson, Idaho, to Contact. Travelers go in, also, from Wells, Nevada. The veins of copper ore in that district, which are claimed to be on the contact of limestone and granite, are being opened on one property by the United States Smelting, Refining & Mining Co. Other properties have been partly developed. Specimens of ore from the camp run high in copper, accompanied by some gold and silver.

Twin Falls, April 16.

ESMERALDA COUNTY

The Goldfield Consolidated has laid a temporary track over the ore-bins and now has 80 of the stamps in the mill dropping. The consulting engineer, J. H. Mackenzie, is at the mine and is devoting all his time to the reconstruction of the plant. Underground a large force of men that has been working in the stopes has been started on development so that the company will have a greater supply of ore blocked out ahead of the stamps than anticipated. The debris has been cleared away from the refinery and three shifts are at work repairing the refinery and building a new conveyor. Officials of the company have given out the statement that the regular quarterly dividend will be declared. ——The shaft of the Grizzly Bear lease is now down 1175 ft. which makes it the deepest in the district. A number of rich stringers have been cut since the shaft passed the 1000-ft. mark but it is not expected to open the main orebody till below the 1200-ft. level.——At the Goldfield Annex lease on the Polverde claim of the Jumbo Extension a stope 70 ft. in length with a 6-ft. face has been started on the intermediate level 40 ft. above the 800 and a carload averaging 25 tons of ore per day is being shipped from this portion of the workings.——Ore is being saved for shipment on the Booth and it is understood that the property will enter the ranks of the regular shippers. On the Webber-McLaughlin lease ore that assays between $30 and $40 per ton is being broken from a 5-ft. face.

LANDER COUNTY

Kimberly still maintains its place among the recent booms and is rapidly developing into a large camp. M. C. Scully has taken up his options on the Hilltop and Independence claims and incorporated the Kimberly Consolidated Mining Co. to develop the groups which total 17 claims. A double-compartment shaft will be sunk to a depth of 500 ft. and 60 stamps added to the mill where 20 heads are now in operation.

LINCOLN COUNTY

W. D. Shoenwerd, manager of the Bristol, Jellyroll and Campbell companies operating in the Chief district between Pioche and Caliente, is to erect such a boost at the shaft on the Bristol and further develop the vein that was opened at a depth of 100 ft. In the bottom of the shaft the vein was four feet wide and assayed about $40 per ton in lead silver and gold. Plans are being drawn for a 100-ton mill and cyanide plant to be erected at the Gold Prince property. The company has been developing the property for some time and now has a large amount of ore blocked out. New machinery is to be added to the equipment at the Pioche X Ray and operations resumed on a larger scale as soon as the repairs to the railroad are completed. George T. Banovich and Robert Corkish who are operating a lease on the Delamar April Fool mine at Delamar have opened a shoot assaying as high as $1200 per ton and are figuring on building a small mill. A number of local men have tried to obtain leases on the Jumbo Extension claim of the Delamar company as a 28 ft. vein assaying $8 per ton was opened by former operators of the property. It is reported that the company is to be reorganized in June when the term of the receiver who has been handling the affairs of the company is ended.

LYON COUNTY

(Special Correspondence). The Nevada Douglas Copper Co. has entered into a contract with the Mason Valley Co., which is to erect a smelting plant at Wabuska, whereby the former is to ship to the latter's smelter 250,000 tons of ore, at the rate of 10,000 tons per month, beginning with the blowing in of the furnaces, which will be about January 1911. A. J. Orem & Co., who control the Nevada-Douglas, estimate that there are 600,000 tons of ore blocked out in the Ludwig and other mines of the group. In the meantime the railroad now in operation from Wabuska to Yerington and Mason, is to be completed to the Nevada Douglas mine, in Smith valley, by the time the smelting plant is ready.

Mason, April 18.

The Nevada Mining, Reduction & Power Co. operating at Dayton and Silver City is making good progress in the development of its properties and will soon be ready to start operations on a large scale. The new 40-stamp mill constructed by the Risdon Iron Works of San Francisco will be one of the most complete in the State. The company contemplates building a spur-track from the property to the Southern Pacific near Dayton.

NYE COUNTY

(Special Correspondence).—The District Court at Tonopah has decided the boundary dispute affecting the Indiana holdings and Gold Hills estate of the Pioneer Consolidated company. The terms of the decision are generally favorable to the latter.——The Black Warrior group near Oak Springs has been taken over by W. D. Bobin, A. E. Keables, and George R. Raymond of Salt Lake City. The property has been developed to a vertical depth of 260 ft. by means of an adit and cross-cuts. The ore assays 7% copper and $2 gold, with some silver.——It is officially announced that operations will be immediately resumed at the Grand Central group, in the Horn Silver district. The 135-ft. shaft will be carried to the 400-ft. point and a gasoline hoist installed. Two shoots of ore are exposed near the bottom of the shaft. ——The Nevada Crane recently made a 10-ton shipment to the Western Ore Purchasing Co.——The Great Western has been arranging for the shipping of ore, but has been restrained by an order from Judge Stevens from extracting or milling ore. S. H. Brady recently brought a suit against the company, hence the injunction.

Tonopah, April 15.

STOREY COUNTY

The hoist for the Monte Cristo operated by the Butters company has been taken to the mine and will be in operation by May 1. The company will soon begin shipping ore over the tram from the Chollar and Potosi leases to the mill.——Joseph Deitrich operating a lease on the Best & Belcher croppings has opened good ore and is now shipping material that assays from $... to $... gold and $12 to $60 silver per ton. [illegible] has never been prospected before as it has been considered a part of the line of the Comstock. ——The south cross-cut on the 2500-ft. level of the Ophir has broken into a 3-ft. shoot of milling ore. Twenty-one cars averaging $23 per ton have been taken out. ——In the Consolidated Virginia the raise in the 1750-ft. level is now up 51 ft. in ore assaying a little over $6 per ton.

WHITE PINE COUNTY

New pumps have been installed at the Clipper shaft of the Ely Central mine in the Ely district and sinking resumed. The company was forced to stop operations in the shaft about a month ago on account of striking a heavy flow of water. The Eureka three-compartment shaft has been retimbered and operations resumed. - The adit at the Ely Centennial is now in 580 ft. and is cutting a dolomite formation with considerable native copper and malachite. One shift per day is being worked in the adit, but as soon as a new blower can be installed another shift will be started. ——A preliminary survey for a railroad from the properties of the Nevada United Mines Co. at Ward to connect with the Nevada Northern railroad at Ely has been completed. The road will be 14 miles long, standard gauge, and have an average grade of one per cent. When completed the mines at Ward will be in a position to ship 300 tons of ore per day and the saving will amount approximately to $3 per ton.——Charles Minnoletti who has been working the Cornell mine at Hamilton is preparing to ship the ore to the Salt Lake smelters by way of Ely. Considerable ore has been taken from the upper workings though the mine has been idle for some time.——The Steptoe Valley Mining & Smelting Co. has installed an elaborate sampling plant in the concentrator and in the future all tailing from the mill will be sampled and re-treated if it contains too high a value.

NEW MEXICO

OTERO COUNTY

The machinery for the 100-ton concentrating mill of the Tularosa Copper Co. has arrived and is being installed. The properties of this company are near Bent, 12 miles north of Tularosa, on the El Paso & Southwestern railroad. The property is well explored by drill-holes and shafts proving the deposits to be 45 ft. thick, in blanket form, and within 10 to 30 ft. of the surface. The average is 2.6% copper occurring as chalcocite disseminated through the mass. The property consists of 307 acres of patented ground, 15 mining claims, a farm, ranch, and mill-site, and water rights capable of developing 200 hp. H. Vincent Wallace is the consulting engineer. The company has run 7000 tons of ore through its 30-ton experimental mill, producing in concentrate and sorted ore, net smelter returns of $37,381.

PHILIPPINE ISLANDS

J. C. McCoy, of New York, who controls the Colorado mine in the Masbate district has ordered a 20-stamp mill for the property, and the preparatory work is now under way. In the mine development work is being advanced rapidly and a large amount of ore blocked out.——The Benguet Consolidated is considering replacing its 10-stamp mill with a 20 or 30-stamp plant and treating the custom ore of the district. Such a mill or consolidation of the claims would be a great advantage to that portion of the country, and bring a number of claims to the productive stage that are now lying idle.——A new Huntington mill has been forwarded to the Paracale company from Manila.

SOUTH DAKOTA

LAWRENCE COUNTY

The nailing down of the bell-rope in the shaft at the Homestake mine at Lead and the filling of one of the Little Jap drills with dynamite is blamed on the Western Federation of Miners by the officers of the company. Both were discovered before any serious accident resulted.

UTAH

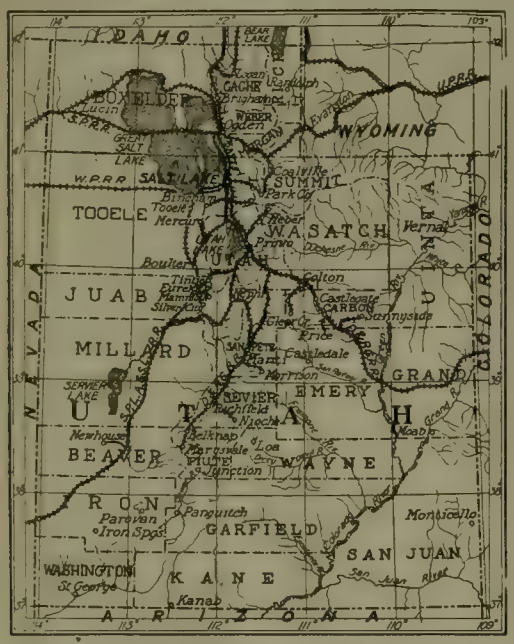
BEAVER COUNTY

The shaft at the Red Warrior mine near Milford is now

being sunk to the 500-ft. level and the management expects to complete the work about June 1. Between the 300 and 400-ft. levels the ore was 50 ft. wide and a winze sunk 25 ft. from the 400 was in ore the entire distance. W. J. Merritt is manager.——The cross-cut on the 100-ft. level of the Moscow mine opened a body of silver-lead carbonate ore.——The drift on the 500-ft. level of the Cedar-Talisman opened the shoot 180 ft. north of the shaft. The ore is the same silver-lead type that the company has been working on the 400 and a raise will be started from the 500 to connect with that level.

JUAB COUNTY

The drift on the 500-ft. level of the Iron Blossom mine in the Tintic district recently broke into a shoot of gold-



Map of Utah.

silver ore and a shipment of several cars assayed $30 per ton. On the 600-ft. level the company has opened three feet of ore that contains 30 oz. silver per ton and from 10 to 15% copper.

WASHINGTON

FERRY COUNTY

(Special Correspondence).—The Republic Mines Corporation has paid the second installment of $12,250 on its lease and option on the Pearl Consolidated group near Republic, which, with royalty added, has put over $25,000 in the Pearl Consolidated Mining Co.'s treasury. The latter has paid its second dividend, amounting to 1c. per share. ——The lessees of the Insurgent mine are employing eight men and have shipped 70 tons of ore which assayed $42 per ton.——A carload of machinery for the concentrator at the Kettle River mine, near Rockcut, has been received. ——The sub-lessees of the Tom Thumb mine, in Republic camp, have shipped ten carloads of ore, valued at $18 per ton.

Republic, April 16.

OKANOGAN COUNTY

(Special Correspondence).—The Alaska River Red Mining Co. has commenced the season's run on its placers, on the Similkameen river. Several cofferdams will be installed in addition to the one successfully operated last summer.——The Golden Sands company, operating several claims on the Similkameen river, near Oroville, installed a 100-hp. motor and pump last summer and is now getting ready for this season's run.

Oroville, April 16.

STEVENS COUNTY

(Special Correspondence).—The Copper Butte mine in the Orient district has been drained of water, preparatory to resuming work in the shaft. The property is equipped with a gasoline hoist, compressor, and machine-drills.—— A new sinking contract has been let at the Summit mine. ——The Mars Hill Mining Co. has ordered a steam-hoist, compressor, and machine-drills. The winze is down 45 ft. below the adit and has a total depth of 145 ft. It is on a good quality of ore, containing gold, silver, copper, and lead. Sinking will be continued for 100 ft. when a station pump will be installed, and the winze will probably be sunk to the 500-ft. level.——The Mogul Mining Co. has been organized to operate a group of claims situated five miles north of Orient. The incorporators are Chas. H. and E. W. Scothorn and D. E. Twitchel, of Spokane, and William Brandenberg of Orient.——The Scotia mine has been sold and will be operated on a larger scale.——The Utopia Mining Co. has been organized by the Spencer brothers of Orient, and Seattle capitalists to operate the Jumbo mine, seven miles east of Kettle river.——Work has been resumed on the Blue Grass mine.——A contract has been let for the construction of a 3100-ft. aerial tram from the Globe mine to a railway siding to be put in at the mouth of Boulder creek, 2½ miles south of Orient.

Orient, April 18.

CANADA

BRITISH COLUMBIA

A body ore assaying 55% lead and 200 oz. silver per ton has been opened in the No. 6 adit of the Slocan Star Mining Co. at Sandon. A small seam of gray copper assaying 600 oz. silver per ton has also been opened.——Ten men are working at the Stewart mine on Portland canal and the main adit is now in 275 ft. with drifts started on veins No. 1, 2, and 4.——On the Portland-Wonder property a shaft is down 40 ft. to the vein and drifts started on the ore.—— A contract has been let to drive a 75-ft. adit on the Silver Queen property at Copper City. It is thought that this will open the ore at a depth of 100 ft.

MEXICO

CHIHUAHUA.

The steel work of the main building of the Palmilla Mining Co.'s mill at Parral is nearly all up and in about a week the steel frame will be finished when the installation of the machinery will be started. The machine shop, a steel frame building, is all done but the roof and the assay office will be finished in a few days.

JALISCO

The Cinco Minas Co. has been organized to operate the Cinco Minas property in the Hostotipaquillo district and will expend ₱500,000 in the erection of a new plant which will have a capacity of 250 tons per day.——A body of ore assaying 800 oz. silver and $10 gold per ton has been opened by the Boquitas adit at the Tajo mine in the San Sebastian district. A clean-up of $35,000 was made recently from a run on 3000 tons of ore.

SINALOA

Work has been resumed on the extention of the West Coast line of the Southern Pacific to Guadalajara from the point below Mazatlan where building ceased some time ago and contractors with supplies are being hurried to the end of the line.

SONORA

The report of the El Tigre Mining Co. for the year of 1909 states that the company broke 47,130 tons of ore during the year. Of this 37,721 tons were milled producing 2235 tons of concentrate which with 1911 tons of ore that the mill could not handle was shipped to the smelter of the Copper Queen company at Douglas and the American Smelting & Refining plant at El Paso. The milling ore averaged $24.65 and the gross return from the sale of ore and concentrate amounted to $1,087,273. A net profit of $586,597 was reported for the year, a record surpassing any of the previous work by over $200,000. During the year $409,500 was paid in dividends.——Work is to be started at once on the railroad from Port Lobos on the Gulf of California by way of Vaborca to Tucson. It will open a large copper region near the Gulf, and pass through the gold district of Altar.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

JOHN B. FARISH was in San Francisco

M. B. COOKE of Chicago is in San Francisco.

CHARLES JANIN is at Grass Valley, California.

ERNEST A. HAGGOTT is in Nevada on professional work

J. HENRY RICKARD has gone from Lake George, Canada, to Katanga, Central Africa

F. LANWOOD GARRISON has returned to Philadelphia by way of Kingman, Arizona

ELTON W. WALKER is superintendent for the Mass Con Mining Co., at Mass City, Michigan

L. A. WOMBLE is general manager for the Princess Estate & G. M. Co. Ltd., at Roodepoort, Transvaal.

P. R. WHITMAN has left Pachuca on account of illness and is temporarily at Long Beach, California.

MASUTOMO MAYEKAWA of Tokyo, Japan, is in San Francisco and has been visiting the dredging fields.

PAUL L. PAINE has resigned the position of special agent in the Land Office to engage in private practice.

J. B. FLEMING has gone to Goldfield, Nevada, to superintend repairs on the mill of the Goldfield Con. M. Company.

C. M. EYE has resigned as manager for the Benguet Con. M. Co. to take charge of the Colorado mine at Masbate, Philippine Islands.

HORACE F. EVANS, who has been ill at Portland, Oregon, has recovered and gone to Oroville, Washington, to supervise drilling for the Detroit-Oroville Exploration Company.

JESSE J. MACDONALD has returned to California after two years' residence in Europe and is preparing to re-enter the professional field with headquarters at Los Angeles, California.

R. H. BURROWS, of Guanajuato, has accepted the position of manager for the mining companies subsidiary to the K. C. M. & O. railway and will make headquarters at Chihuahua.

H. B. BARLING, formerly with the Cia. Metalurgica y Refinadores del Pacifico, has been appointed assistant superintendent and chief engineer for the San Antonio Copper Co., one of the Cole-Ryan organizations operating at San Antonio de la Huerta, Sonora.

PUBLICATIONS RECEIVED.

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

THE COPPER HANDBOOK. A Manual of the Copper Industry of the World. Compiled and published by Horace J. Stevens, Houghton, Michigan. Vol. IX, 1909. Pp. 1628, index. Price $5.

The Handbook for 1909, as frankly stated in the preface, is a reprint of Vol. VIII with appended chapters which cover the operations of companies that have become active since the previous issue, adding some 128 pages and bringing the total of companies described to over 7551. It also contains chapters on the history, chemistry and mineralogy, mining, and metallurgy of copper, together with a glossary of mining terms. It maintains the high standard previously set by the author who, as usual, is absolutely fearless in cataloguing the 'wild cat' companies. It is well printed on thin paper to keep the size reduced to one convenient volume and excellently edited. As a guide to one interested in copper mining, securities, and statistics it is without a peer.

ELEMENTS OF MACHINE DESIGN. By Dexter S. Kimball and John H. Barr. 8vo.; pp. 452; ill.; index. John Wiley & Sons, New York, 1909. Price $3.

This work embodies the best recent American practice, and is excellently adapted for use in the shop and the school. The energy and force-problem are well treated, with diagrams, and the straining action in machine elements is discussed at great length, and with aid of ample illustration. Commendable also is the statement of the general theory of friction. The book is essentially a guide to correct method in design, suitable for those technically trained. It is a distinct addition to the literature on the subject.

MINERAL RESOURCES OF THE UNITED STATES FOR THE CALENDAR YEAR 1908. Parts I and II. 2 Vol. 816 and 899 pages respectively. Washington, D. C., 1909.

The scope of the Mineral Resources has been considerably enlarged through facilities granted in accordance with a change in the sundry civil appropriation act of May 27, 1908. The figures are obtained mostly direct from the producers, and the work of collecting statistics of mineral production has been greatly aided by co-operation with a number of the State Geological Surveys. The Surveys of Alabama, George, Illinois, Iowa, Kentucky, Maryland, North Carolina, and Virginia have lent their support in this manner. The high value and importance of these volumes is so well understood that we need only say the work is better done than ever.

PROCEEDINGS OF THE ILLINOIS FUEL CONFERENCE. State Geol. Surv., (Illinois), Bull 14. Pp. 89. Urbana, 1910.

The full proceedings of this interesting meeting, held at the inauguration of the branch Mine-Rescue Station of the U. S. Geological Survey, are now available. The occasion was unique in that geologists, mine inspectors, coal operators, Federal officials, coal miners, railway presidents, steam users, and retail coal dealers all came together for serious consideration of the problems of the local fuel industry. The good effects of the conference have been many and similar friendly gatherings might well be more general.

DAVIS HANDBOOK OF THE COBALT SILVER DISTRICT. By H. P. Davis. Pp. 108, ill. Canadian Mining Journal, 1910.

This is a directory of the mines and companies operating in Canada's great silver camp. It has in addition interesting chapter, on the geology of the district, on methods of estimating ore reserves, on concentration, smelting, and related topics. The work seems to have been done with unusual care and the book is a valuable addition to existing technical literature.

GEOLOGY AND ORE DEPOSITS OF THE BULLFROG DISTRICT, NEVADA. By F. L. Ransome, W. H. Emmons, and G. H. Garrey, U. S. Geol. Surv., Bull. 407. Pp. 130., ill., index, maps. Washington, 1910.

An excellent description of an important district. The discussion of faulting especially constitute a distinct contribution to science in general.

GEOLOGICAL RECONNAISSANCE OF THE REGION TRAVERSED BY THE NATIONAL TRANSCONTINENTAL RAILWAY BETWEEN LAKE NIPIGON AND CLAY LAKE, ONTARIO. By W. H. Collins. Canada, Department of Mines, Geological Survey Branch, No. 1059. Pp. 67, ill., map. Ottawa, 1909.

PALEONTOLOGY OF THE COALINGA DISTRICT. By Ralph Arnold. U. S. Geol. Surv., Bull. 396. Pp. 125, 30 plates. Washington, 1909.

A technical discussion of the fossils by which are discriminated the formations in a great oilfield.

UNIT COAL AND THE COMPOSITION OF COAL ASH. By S. W. Parr and W. F. Wheeler. Eng. Ex. Station, Univ. Illinois, Bull. 37, Pp. 68. Urbana, 1909.

This is a scholarly contribution to a subject of great scientific and practical importance.

REPORT ON THE COALS OF THE THREE FORKS OF KENTUCKY RIVER. By James M. Hodge. Kentucky Geol. Surv., Advance Sheets. Pp. 286. Submitted, November 1907.

ANNUAL REPORT OF THE INSPECTOR OF MINES OF THE STATE OF KENTUCKY, 1908. By C. J. Norwood. Pp. 164. Lexington, 1910.

The Prospector

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

M. K. R., Seattle, Washington: Bitumen.

A. M. S., Flourine, New Mexico: Jasper; the color due to ferrous iron.

C. H., Hackberry, Arizona: Coarse pegmatite consisting of orthoclase and black tourmaline.

E. D., Winnemucca, Nevada: No. 1, diorite; No. 2, labradorite porphyry; No. 3, feldspar; No. 4, porphyrite; No. 5, quartz porphyry; No. 6, epidote and black tourmaline.

DRILL CONTEST

The drilling contest between the Waugh and a drill of another make was held recently at the Vindicator shaft, at Cripple Creek, for a $400 purse, and the speed attained by each was something remarkable; a few years ago it would have been considered impossible. The ground picked out for the contest was what is known on the Vindicator as the black syenite. The drills were in operation within a few minutes of an hour and a half, the Waugh drilling 49 ft. 10½ in., and the other 35 ft. 9½ in. The air-line from which the machine operated was an inch and a half line to within 100 ft. of the drills, then reduced to one inch, and the hoses fed from that, the Waugh running off 75 ft. of ¾-in. hose, and the other off 50 ft. of same sized hose. The Waugh used was the regular 8-C. The Waugh weighed 62 lb., and the other 78 lb. Notwithstanding the weight and the small air connections of the Waugh it has never been beaten in a drilling contest in the district.

CATALOGUES RECEIVED

The Jeffrey Mfg. Co., Columbus, Ohio. Bulletin No. 39 Roll Crushers. Illustrated. 6 by 9 inches. 16 pages.

Denver Fire Clay Co., Denver, Colorado. 1910 catalogue of assayers' and chemists' supplies, and scientific apparatus.

Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colorado. 'Vulcan Steel Frame Electric Hoists'. Illustrated. 9 by 6 inches. 16 pages.

Power & Mining Machinery Co., Milwaukee, Wisconsin. Catalogue No. 4. 'Rock Crushing Machinery'. Illustrated. 6 by 9 inches. 68 pages.

Morris Machine Works, Baldwinsville, New York. 1910 Catalogue. 'Centrifugal Pumping Machinery'. Illustrated. 9 by 6 inches. 96 pages.

The Economic Machinery Co., Denver, Colorado. 'The Deitz Airolectric Rock Drill'. A concise description of this electrically operated air-drill. Illustrated in colors. 6¾ by 9 inches. 20 pages.

COMMERCIAL PARAGRAPHS

T. H. Proske, of Denver, Colorado, recently shipped a 15-ft. D 24 Ajax drill sharpener to the Degnon Contracting Co., at Forest Glen, New York.

The Wisconsin Engine Co., Corliss, Wisconsin, advises that Benjamin K. Hugh has been appointed as its sales manager in the New England States. He will have offices in the Oliver building, Boston, Massachusetts.

The Abendroth & Root Mfg. Co. announces that the B. M. Osbun Co., with offices in the Commercial Bank building, Chicago, has been appointed its representatives for the sale of Root spiral riveted pipe and Root water-tube boilers.

The Robins Conveying Belt Co. reports extraordinary progress in the way of new business within the last few months. Thomas Robins, president, states that the company has done as much business in the last three months as it did during the entire year of 1909. The Robins Conveying Belt Co. makes the well known conveyor, bearing its name.

Market Reports

LOCAL METAL PRICES.

San Francisco, April 21.

Antimony	12–12¾c	Quicksilver (flask)	49–49½
Electrolytic Copper	15¼–16½c	Spelter	7–7¼c
Pig Lead	4.75–5.70c	Tin	36–37½c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Apr. 14	12 69	4.38	5.45	53¼
" 15	12.81	4.38	5.44	53⅛
" 16	12.81	4.38	5.48	53⅛
" 17	Sunday.	No market.		
" 18	12.75	4.38	5.48	53⅜
" 19	12.69	4.38	5.48	53⅜
" 20	12.69	4.38	5.48	53¼

ANGLO-AMERICAN SHARES.

Cabled from London.

	Apr. 14. £ s. d.	Apr. 21. £ s. d.	
Camp Bird	1 8 6	1 11 6	
El Oro	1 8 3	1 8 0	
Esperanza	2 15 0	2 8 9	
Dolores	1 8 9	1 8 9	
Oroville Dredging	0 10 6	0 10 0	
Mexico Mines	9 0 0	8 13 6	ex div.
Tomboy	0 18 9	0 18 9	

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, April 21.		Closing prices, April 21.
Adventure	6½	Mohawk	53
Allouez	47	North Butte	35½
Atlantic	7½	Old Dominion	38½
Calumet & Arizona	64	Osceola	141
Calumet & Hecla	602	Parrot	15
Centennial	18¼	Santa Fe	2
Copper Range	69½	Shannon	12½
Daly West	8¼	Superior & Pittsburg	13⅛
Franklin	13¾	Tamarack	60
Granby	48	Trinity	6
Greene-Cananea, ctf	9¼	Utah Con	24
Isle Royale	17	Victoria	3½
La Salle	14	Winona	7¾
Mass Copper	7	Wolverine	126

(By courtesy of J. C. Wilson, Mills Building.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, April 20.		Closing prices, April 20.
Amalgamated Copper	75⅛	Miami Copper	23⅝
A. S. & R. Co.	82½	Mines Co. of America	⅛
Boston Copper	19⅜	Montgomery-Shoshone	⅝
B. C. Copper Co.	6¼	Nevada Con.	20⅝
Butte Coalition	21⅞	Nevada Utah	⅞
Chino	12⅞	Nipissing	10
Davis-Daly	2⅛	Ohio Copper	3½
Dolores	6½	Ray Central	3
El Rayo	2⅞	Ray Con	18⅝
Ely Central	1	South Utah	2⅛
First National	2⅝	Superior & Pittsburg	13⅛
Giroux	8⅛	Tenn. Copper	30⅞
Guanajuato Con	1	Trinity	7
Inspiration	7⅝	Tuolumne Copper	3½
Kerr Lake	8⅝	United Copper	6⅝
La Rose	3⅝	Utah Copper	46⅛
Mason Valley	8¾	Yukon Gold	4⅜

SOUTHERN NEVADA STOCKS.

San Francisco, April 21.

Atlanta	$ 16	Mayflower	$ 3
Belmont	2.45	Midway	27
Booth	15	Montana Tonopah	85
Columbia Mtn	6	Nevada Hills	60
Combination Fraction	46	Pittsburg Silver Peak	72
Daisy	■	Rawhide Coalition	36
Fairview Eagle	15	Rawhide Queen	36
Florence	2.10	Round Mountain	46
Goldfield Con	8.07	Silver Pick	10
Gold Kewenas	6	St. Ives	17
Great Bend	2	Tonopah Extension	85
Jim Butler	17	Tonopah of Nevada	7.15
Jumbo Extension	33	West End	37

(By courtesy of the San Francisco Stock & Exchange Board.)

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EDITORIAL.

CARD-TABLES were among the things ordered to equip a mine recently. The purchasing agent thought the company had opened a social betterment department till he noticed the capital C had been used.

NAVIGATION to Nome will soon be open. The Post Office department plans to begin forwarding mail by the all-sea route tomorrow, May 1. The season promises to be a busy one on Seward Peninsula.

RECLAMATION of land which has been dredged for gold seems to be making substantial progress. Mr. J. H. Leggett has grown a remarkable crop of hay on the rock piles around Oroville and is now experimenting with tokay grapes and apricot trees.

PAYMENT of $1,780,000 in dividends at one time is not common. All the more notable is it when such a sum is paid following a disastrous fire and while reconstruction is still under way. As announced in the newspapers, the Goldfield Consolidated Mines Company will today distribute this large sum among its stockholders.

RAILWAY improvement continues despite still reverberating talk of hard times. The Santa Fe directors have appropriated $31,000,000 for improvements and new equipment this year. Of this sum nearly two-thirds is for new work. The company is engaged in laying second track from Chicago to the Coast and will spend $4,000,000 toward that end this year, west of Albuquerque. With such work under way, with two new lines to the Coast just entering the field, and with Mr. James J. Hill predicting next fall the greatest freight congestion the railways have ever faced, it would seem that railway managers at least see plenty of work ahead.

JARBIDGE, Nevada, has been heralded by its friends as a 'second Goldfield', while others have maintained that the riches of the district were a figment of the imagination of those interested in transportation and outfitting. As usual when such wide differences of opinion exist, the truth seems to lie between. On another page we present an account of the district written by Mr. W. A. Scott of our staff, and including the results of sampling by Mr. F. V. Bodfish. Apparently the work so far done amply warrants further expenditure and there is at least a reasonable prospect of developing good bodies of mill-ore. The development of a mining

district, however, requires work; and if Jarbidge is to fulfill the expectations of its friends a good deal of work needs to be done by individuals and partnerships before company promotion is warranted.

THE LEITER coal mine in southern Illinois has been sold to Bell & Zoller of Chicago and is to be re-opened. The mine is best known because of the long contest waged there by Mr. Joseph Leiter, against the United Mine Workers. There were several conflicts and finally the property was enclosed in a stockade and defended by means of searchlights and Gatling guns. It has been worked for some years with non-union men, the most important commercial mine in Illinois which was outside the trade agreements. The coal is of good grade and thickness, but a series of disastrous accidents has resulted in much loss of life and prevented any substantial profit being realized from its operation. It has been a disturbing factor both to the men and other operators, and the change of ownership will make for peace. Mr. Leiter stood for his legal pound of flesh; but in doing so brought hardship on himself and others. A man of great intellectual strength and marked ability, he is dominating to a degree that brooks no opposition. He took advice from no one and naturally made many mistakes. He is a striking example of a powerful human machine failing of high accomplishment by reason of lack of discipline.

Smelter Fume Troubles

Shasta county smelters, as well as the Anaconda, are again in trouble. Complaint is made that large quantities of Nevada ore are now treated and that the resulting smoke is much more injurious. It is understood that the Government is making trouble for the Bully Hill Copper Mining & Smelting Company and that injunction proceedings are threatened. This seems to us entirely unnecessary. The principle of relative worth recognized in the earlier decisions is, we believe, essentially just. The smelters are much more valuable to the community and to the State than the small amount of land that is being injured. Real damage should, of course, be compensated and is as legitimate an expense in smelting as in any other industry, but the greatest good to the greatest number requires that the smelters be not put out of business unless the owners wilfully refuse or neglect to take all practicable steps to minimize damage to the property of others. There has been little allegation, and no satisfactory proof that this has happened. Indeed smelter men have everywhere shown the utmost willingness to adopt any practicable means of relief. At the Mammoth smelter a bag-house is now being built and at Coram the Cottrell process is being installed. The Mountain Copper Company is making sulphuric acid, but this relieves the situation to only a limited extent, since the market for acid is small, and even granting that it would be economically feasible to make acid and waste it, the damage through the streams would doubtless be greater than that resulting from diffusing the gases through the air. The case is one for patience and mutual forbearance rather than for arbitrary closing of works by means of injunction.

Mark Twain

Samuel Langhorne Clemens, who died at Redding, Connecticut, April 21, once, as he himself has told, walked the streets of San Francisco, footsore and weary, lived in cheap lodging-houses, and earned his meals as best he could reporting for local papers. He came here from Virginia City, where he had worked as reporter and later city editor of the *Enterprise*. In his writings he has given one of the most accurate and graphic pictures of the West of fifty years ago. At Virginia City his salary was forty dollars a week, but, as he relates, he seldom drew it, for "New claims were taken up daily, and it was the friendly custom to run straight to newspaper offices, give the reporter forty or fifty 'feet' and get him to go and examine the mine and publish a notice of it. They did not care a fig what you said about the property so you said something. Consequently we generally said a word or two to the effect that the 'indications' were good, or that the ledge was 'six feet wide', or that the rock 'resembled the Comstock' (and so it did—but as a general thing the resemblance was not startling enough to knock you down). Occasionally we patched up and varnished our reputation for discrimination and stern undeviating accuracy, by giving some old abandoned claim a blast that ought to have made its dry bones rattle—and then somebody would seize it and sell it on the fleeting notoriety thus conferred upon it. There was nothing in the shape of a mining claim that was not salable. These were 'flush times' indeed! I thought they were going to last always, but somehow I never was much of a prophet." His account of the million dollars which was just within the grasp of himself and his two partners, of the night spent planning the 'trip to Europe', and the 'brown stone house' to be built in New York, the unusual and yet natural chain of accidents that led to the neglect of the necessary assessment work until too late and so lost him his early fortune—all this is a true picture of the old West and helps to link his name and fame with the great basal industry of the Rocky Mountains and Pacific Coast. We are glad to know that another and more substantial million came to him before he died, for while the public never learned to think of Mark Twain as 'one of the plutes,' he died a wealthy man. It was clean, honest money that he left; a willing tribute paid by a wide circle of readers as part return for the pleasure he gave them. At his death his books were more popular than those of any other author living or dead. Not America alone, but the whole world mourns his death. He was a many sided man; an undoubted genius and a philosopher. His insight was keen and unerring, but it was his gentleness and simplicity that gave him his wide following. Mark Twain wrote for the average man and was widely loved because, like Lincoln, however high Fate carried him, however much wealth, position, and learning came to be his, he remained always in his heart, one of the common people and was unashamed.

BY THE WAY

Apropos of the testimonial dinner to be given to night in New York to Dr R W Raymond, *The Mining Magazine* says, editorially: The career of Dr. Raymond synchronizes with the growth of mining engineering across the Atlantic and is identified with the development of the mineral wealth of a continent. When he was born in 1840, the mining industry of the United States had made a feeble beginning, when he went to Freiberg in 1860 there was no School of Mines in America, when he served in the Union Army during the four years of the Civil War the discoveries of gold in California and silver in Nevada had created highly productive industries, and when he filled the post of Commissioner of Mining Statistics, from 1868 to 1876, he assumed a leading part in the application of technical science to mineral exploitation. As a lecturer on economic geology and as the editor successively of two mining periodicals he developed the ability as a journalist inherited from his father and used to splendid effect when in 1884 he became Secretary of the American Institute of Mining Engineers. This post he has held uninterruptedly for 26 years, so efficiently, so completely, and so vividly, that the Institute has become identified with his name and personality. He practised as a consulting engineer after he resigned his Federal appointment, and in later years he has acted in an advisory capacity, especially in mining litigation, a department in which he early achieved a unique position as a skillful advocate. Since 1903 he has been lecturer on mining law in Columbia University. Of his other multifarious activities it is not necessary to speak at this time, save to emphasize an exceptional versatility.

It is an open question whether he plays chess better than he plays whist, or writes hymns better than he composes stories for children, whether he is stronger as superintendent of a Sunday school or as leader in the intellectual jiu-jitsu of a mining lawsuit, whether he preaches in Beecher's pulpit better than he lectures at Columbia, whether he talks more convincingly than he writes, and finally whether he is a great mining engineer or only a great man. Undoubtedly Raymond's work as editor of the *Transactions* of the American Institute is his greatest service to the mining industry. Here he has proved himself incomparably able and stimulating. Many of the best writings on technical science have been prepared on his initiative and at his suggestion. For more than twenty years the *Transactions* have been enriched and concentrated by the labor of his pen until the successive volumes constitute a magnificent reference library of well digested technical information. If he had done nothing more, the *Transactions* would be achievement enough. And he has done so much more. As a friend of R. P. Rothwell he collaborated on *The Engineering and Mining Journal* for many years, and there is hardly a technical periodical of the first class that has not been enriched with the products of his pen.

Of course, he is, and has always been, the life and soul of the Institute meetings. Presidents can come and go, but the Secretary remains. It would be invidious to compare the easy grace and confident skill of the Secretary, as a speaker with the clumsy but well meant efforts of those who have filled the honorable office of the presidency, but such comparisons have been inevitable. At times the revolution of the Institute around its Secretary has proved embarrassing even to the Doctor. From such embarrassment he extricates himself readily. The present writer remembers how at Aspen, in 1896, it was suggested that someone should tender the thanks of the visiting members to the local committee and to local citizens for facilities and hospitalities provided. As the president and other members were successively invited to discharge the graceful task, each said: "Oh! No, better ask Raymond to do it." Finally the Doctor rose, prefacing his remarks with an apology for seeming reluctant to perform an obvious courtesy, and explaining his position by reference to the story of a boy whose father had served in the Civil War and had talked so much about his own doings in the campaign that the small boy finally put the question: "Pop, was there anyone else in that war?" Most of us thought that if there were 'others', they failed to make themselves numerous. And at Chicago, in 1893, on the occasion of an International Science Congress, the leaders of thought on various subjects had spoken, in French, in German, in broken English, without igniting a spark of sympathy or illuminating a line of thought. Then rose our Secretary. He did not begin with the conventional "Ladies and Gentlemen"; he startled his audience by addressing them in his Plymouth Church style as "Brethren." Then, referring to the purpose of such an international gathering, he said that we had come there in the hope perhaps of lighting on something new, some invention or theory, or of discovering a fresh technical method, but we had done better: we had "discovered one another." There he expressed the one salient feature of such a meeting of scientific men from every part of the world. It was the one great fact made evident amid a multiplicity of speech-making, and it was stated by Raymond in words that I have only feebly outlined. This happy faculty for expressing clearly the inchoate ideas of a large meeting is the mark of the born orator. His is "the brightness of carved speech."

Another less cheerful characteristic is a fondness for writing obituaries. The obituaries that Raymond writes are more inspiring than the presidential addresses of most men; like the burial service of the Church of England, they are meant not so much to honor the dead as to inspire the living. They do. We confess to having read all of them, as they have appeared, and finding in them sound philosophy, deep religious feeling, and highly stimulating thought.

But this is no panegyric; it is simply a greeting from those of us who would like to be at the 70th birthday dinner and are prevented from participating in that delightful celebration. For ourselves, for the members of the Institute in distant lands, for the profession in general, we venture to express to Rossiter W. Raymond an affectionate regard that is and always will be

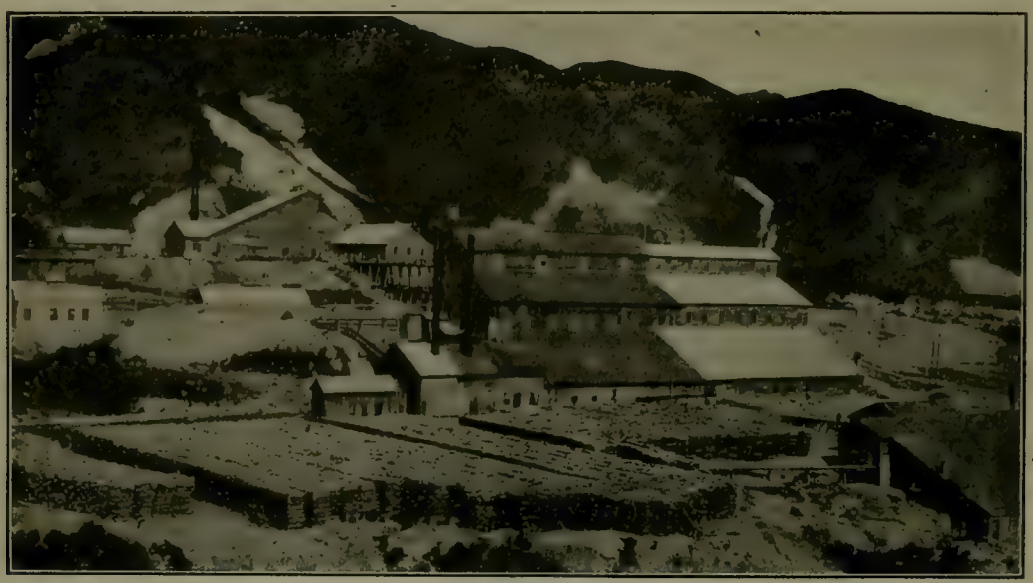
"Above the mere fortuities of place
And cold interposition of the sea."

Costs at Unsan, Korea

Written for the MINING AND SCIENTIFIC PRESS
By A. E. DRUCKER

Year by year the Oriental Consolidated Mining Co. has been gradually reducing its costs so that at present any ore that assays more than $2.75 per ton can be handled at a profit. Great credit is due H. F. Meserve, who, for the past twelve years or more, has been general manager. In a country far from technical assistance and skilled labor he has developed a property and an organization that has produced excellent economic results for the shareholders, and at the same time has instructed and greatly benefited the Korean people.

Up to June 30, 1909, the company has produced 1,934,008 tons of ore containing $12,417,260. The last annual report, for 1909, gives the total ore treated at 293,417 tons valued at $1,716,104 ($5.79 per ton). The net total yield in bullion equaled $1,421,213 or an extraction of 82.8% of which 51.8% was saved by plate amalgamation and 31 by cyanidation of concentrate. The net profit for fiscal year 1909 was $556,369. Detailed costs are given in the following tables:



Tarboie Mill, Oriental Consolidated Mining Company.

MINING AND DEVELOPMENT COSTS *

	Quantity.	Cost.	Cost per ton.
Mining timbers		$74,806.480	$0.254
Firewood (cords)	10,486	39,100.925	0.133
Lumber		31,061.330	0.105
Dynamite (lb.)	126,856	28,508.535	0.097
Candles (lb.)	175,613	27,628.375	0.094
Fuse (ft.)	1,430,230	7,868.300	0.026
Detonators (pieces)	328,105	3,454.575	0.011
Charcoal		3,994.035	0.013
Lubricants		3,015.240	0.010
Drill steel (lb.)	34,899	3,244.250	0.011
Bar, sheet, track iron		3,171.150	0.010
Picks, shovels, hammers		2,670.910	0.009
Miscellaneous (rope, pipe, cars, etc.)		13,589.110	0.046
Supplies		$242,105.460	$0.823
Assays		1,878.920	0.006
Salaries (White)		34,563.590	0.117
Payroll (Koreans)		179,826.470	0.612
Outside expenses (shops, stables, etc.)		8,981.890	0.030
Total		$467,356.330	$1.590

* 293,828 tons for 1909.

MILLING COSTS *

	Quantity.	Cost.	Cost per ton.
Firewood (cords)	16,175	$54,301.80	$0.1831
Battery shoes	675	6,298.50	0.0212
" dies	490	3,935.00	0.0132
" bosses	23	245.00	0.0008
" tappets	15	325.00	0.0011
" cams	5	85.00	0.0002
" stems	3	70.00	0.0002
" cam shafts	21	1,087.50	0.0036
" pulley flanges	2	105.00	0.0003
" extras		602.08	0.0020
Feeder extras		226.25	0.0007
Screens		1,293.05	0.0043
Crusher shoes	17	562.50	
" dies	12	400.92	
" toggle-plates	4	8.00	0.0036
" jaws	1	37.50	
" extras		65.00	
Concentrator belts	31	4,870.00	
" extras		2,658.37	0.0254
Lubricants		2,537.06	0.0085
Quicksilver (oz.)	33,798	1,689.90	0.0057
Belting, pipe, valves		3,178.80	0.0106
Pumps and fittings		336.21	0.0011
Iron-bar and sheet (lb.)	25,526	1,623.66	0.0054
Silver plating		1,196.89	0.0043
Mill repairs		8,500.00	0.0289
Miscellaneous		10,419.05	0.0351
Supplies		106,648.24	0.3597
Assays		3,189.92	0.0107
Electric power		8,317.46	0.0280
Outside (shops, etc.)		9,419.12	0.0317
Salaries (Whites)		22,493.03	0.0758
Payroll (Koreans)		21,473.90	0.0724
Total		171,541.68	$0.5787

* 230 stamps—296,417 tons.

CYANIDING COSTS *

	Quantity.	Cost.	Cost per ton.
Cyanide (lb.)	102,592	$18,510.31	$0.5420
Zinc (lb.)	39,776	3,161.89	0.0925
Lime		1,403.70	0.0411
Fire wood (cords)	1,114	3,220.50	0.0943
Borax		511.40	0.0149
Soda and litharge		31.37	0.0009
Crucibles		599.25	0.0175
Charcoal		370 62	0.0196
Candles		99.42	0.0126
Lubricants (gal.)	820	332.74	

Shovels	72.40	0.0021
Pipe, fittings, and valves	81.48	0.0023
Filter cloth and mats	79.41	0.0023
Belting and lacing	70.70	0.0020
Pumps and fittings	87.87	0.0025
Miscellaneous	1,576.20	0.0452
Supplies	$1,967.70	$0.0566
Assays	1,460.00	0.0419
Outside shops, etc.	711.10	0.0217
Electric power	868.33	0.0250
Concentrate transport	791.80	0.0242
Salaries, White	7,498.16	0.2167
Payroll, Koreans	6,659.61	0.1944
Total	$47,648.80	$1.3951
Cost per ton concentrate treated		$1.3951
" " " ore milled		1.1650

Concentrate treated 34,152 tons.

SUMMARY OF COSTS

	Cost.	Cost per ton.
Mining and development	$167,356.33	$1.590
Milling	171,911.68	0.580
Ore transportation	4,707.49	0.015
Cyaniding concentrate	47,648.80	0.165
General expenses	108,952.13	0.370
Total	$800,206.43	$2.720

The total cost of $2.72 per ton compares favorably with Treadwell and Homestake, and is considerably lower than the cost at Kolar, Waihi, Kalgoorlie, or on the Rand. While labor in Korea is efficient and cheap, on the other hand the cost of power is comparatively high. Supplies are more expensive than in most places on account of the mines being some 7000 to 10,000 miles from the base of supply. Recently there has been a change in management at the mines, Alfred Welhaven having succeeded H. F. Meserve who becomes managing director with headquarters in New York. Mr. Welhaven is well equipped with a long mining experience in Korea, and under his able direction the good work will no doubt continue.

Old Mexican land measures are confusing. Therefore the following notes by F. W. Johnson, published originally in the *Galveston News* for 1859, and re-published recently in *Engineering-Contracting*, are helpful. From 1821-2 to 1830 there was no uniform measure in laying out lands. Chains used were from 29 ft. to 28 ft. 6 in. and 27 ft. 9⅔ in. Each surveyor regulated his chain by what he believed the colonization laws required; hence the difference in old surveys. In 1830 the two-pole chain of 50 links, reduced to 10 varas of 33⅓ in., making the length 27 ft. 9⅓ in., was established in Austin's colony, every 5 links of which equals 1 vara and every link equals $^{2}/_{10}$ of a vara. The long and land measure established by the Government of Mexico, compared with that of the United States, is found to be less by a discount of 8%. Hence 1 yd. equals 1.08 varas and 100 yd. 108 varas. Hence, also, yards by 1.08 equals varas, and 1.08 times 1.08 equals square varas in terms of yards. There is no measure less simple than the Mexican. The vara is the unit: 5000 varas the side of the league, 1000 varas the side of a labor. The labor being the least subdivision of the league, may be regarded as the unit in quantity, and is the $^{1}/_{25}$ part. An area 25,000,000 square varas equals 1 league or 4428.4 acres. An area of 1,000,000 square varas equals 1 labor or 177.136 acres; 5654.3797 square varas equals 1 acre.

MINING DEBRIS IN CALIFORNIA

In reclaiming the Great Valley of California, the removal and control of mining débris in the rivers play an important part. It is estimated that the bed of the Yuba river alone contains 300,000,000 cu yd. of debris. By these deposits the low water stage of this stream was raised 15 ft. at Marysville between 1849 and 1881, and the stream bed near this place is now 13 ft. above the level of the surrounding farm land, so that it has been necessary to build large dikes or levees along the river. For four years the United States Geological Survey has been studying this débris problem, as it has been called, and in connection with the study a hydraulic laboratory was built at the University of California, at Berkeley, for the experimental investigation of the laws of transportation of sand and gravel by water. This investigation has outgrown the narrow limits of the laboratory, and it is proposed to continue this work on a much larger scale in connection with one of the projects of the United States Reclamation Service.

In a preliminary report now in preparation the apparatus and methods employed will be described and the results obtained will be expressed by formulas and curves. Relations connecting the discharge, slope, and load will be given for eight sizes of sand and gravel and for artificial and natural mixtures. The experiments included stream transportation, in which the stream bed is sand or gravel—a self-made bed—and flume transportation, in which the bed is wood or metal, as in sluicing.

The accuracy and the applicability of the results to practical problems will be discussed and the data that have only an indirect bearing on the débris problem will be presented in three appendixes. If means are provided for the use of the larger apparatus and the much larger water-supply that will be available in connection with the reclamation project, some of the data thus far obtained will be tested and the relations connecting the factors of transportation will be extended so as to make them more directly applicable to problems of stream control and economic sluicing.

Coal is bought by the United States Government to the value of about $7,000,000 every year for use in the navy, in public buildings in Washington, and other cities, and for other purposes. About one-third of it—mainly coal used in public buildings—is bought on specifications under which prices are fixed according to the value or quality of the coal delivered by the successful bidder. A definite standard of quality for the coal thus purchased is specified by each bidder and this standard is considered in awarding the contract. If the value of the coal furnished is below the standard fixed, a discount is made from the contract price; if its value is above the standard an allowance is made for the excess of value and a proper sum is paid in addition to the contract price. The value is determined by tests and analyses made by the Geological Survey on samples taken from the coal furnished by the contractor.

Pebble-Mill Amalgamation

Written for the MINING AND SCIENTIFIC PRESS
By W. H. HARDINGE

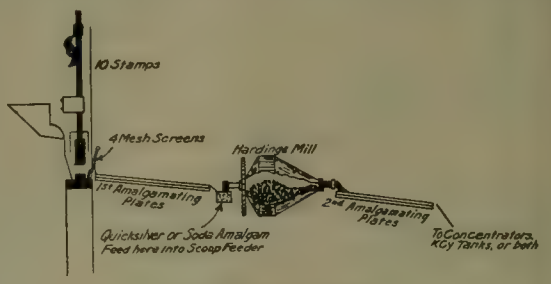
To those who have had trouble in the 'flouring' of quicksilver in their metallurgical work the bare suggestion of putting it in a pebble-mill will be apt to bring forth comments more positive than elegant. Such at least was my mental attitude when the suggestion was made to me of the possibilities of amalgamating in the pebble-mill. We of the older line of metallurgical workers are, perhaps, too prone to 'let well enough alone', and in the letting alone are forced into the background by the more daring younger investigators. This was the case when J. M. Elmer, of Tuolumne, California, tried quicksilver in tube-mills. The experiment was successful and he advanced his recovery from 65 to 85 and even 90%. Mr. Elmer credits A. D. Foote, of the North Star mine, at Grass Valley, California, with the first actual success with this method. Mr. Foote, it appears, met with considerable success in this direction.

From Mr. Elmer's statements it would seem his first work was a success only in so far as heads and tailing showed an appreciable difference. The difference in assay between the tailing before and after the addition of the quicksilver to the feed of his two 8-ft. Hardinge pebble-mills was very marked. After the difference due to mechanical 'saturation', which made itself apparent for two or three days, had been overcome, there was not only an actual recovery in bullion of the difference between heads and tailing, but for a time an additional but fluctuating recovery in some instances of more than the normal amount. This excess recovery can only be accounted for on the supposition that some of the gold previously lost had been retained within the mill. The saturation necessary before recovery begins is naturally proportional to the area of shell of mill and charge of pebbles, and might be prohibitive, if quick results are desired, especially in the old style of cylindrical mill.

At Tuolumne Mr. Elmer is crushing through a four-mesh battery-screen. A short copper plate is interposed between the screen and the pebble-mill and the total product, amounting to upward of about 100 tons in 24 hours from 10 stamps, is then passed directly to an 8-ft. Hardinge mill into which is fed at regular intervals of half an hour, a spoonful of quicksilver; the regulation wooden mustard spoon being used. From the pebble-mill the pulp is run through a box distributer over a second set of amalgamating plates where additional free gold or amalgam produced within the mill is caught. A plan or flow-sheet of the method is shown below.

After passing the second set of plates the pulp is concentrated, about 10% additional being recovered. The concentrate has heretofore been shipped to the smelter for treatment. It is Mr. Elmer's intention to try a still further advance in the treatment of his concentrate by converting one of his two mills into a re-grinder for concentrate and for further inside amalgamation. When this is done, the grinding will be carried to a point of converting the mass into a slime. Under these conditions flouring might be anticipated, but if Mr. Elmer's opinion is correct, the quicksilver is no longer free when it issues from the pebble-mill, having been converted into a gold amalgam. This, owing to its weight and cleanness through scouring in the mill, is easily caught on the outside amalgamating plates.

Considering the high percentage of saving and the simplicity of operation it would seem as though this


10 Stamps
4 Mesh Screens
Hardinge Mill
1st Amalgamating Plates
2nd Amalgamating Plates
Quicksilver or Soda Amalgam Feed here into Scoop Feeder
To Concentrators, KCy Tanks, or both

Plan of Work at Tuolumne.

method of internal amalgamation might become a strong competitor of the cyanide process; especially in the case of a combination mill where amalgamation and concentration is followed by cyanidation. Mr. Elmer has used native quicksilver fed direct to the pebble-mill. He has also used a soda-amalgam made by mixing a small amount of metallic sodium with his quicksilver. In the case of the soda-amalgam I question whether flouring occurs. The final result would be minute particles of gold-soda-quicksilver-amalgam readily caught on the plates.

At my suggestion the experiment has been made of attaching to the outlet trunnion of the pebble-mill an amalgamated copper cylinder revolving with the mill forming a peripheral plate or cylinder with a speed of about 100 ft. per minute. The pulp flowing through the revolving cylinder is carried with a gentle motion up its side. The gold particles having constantly changing surface exposed, readily amalgamate with the quicksilver on the copper surface just as on an ordinary inclined plate. The experiment showed that the greater portion of the gold was accumulated within a few inches of the outlet of the mill and a very short cylinder, about 18 in. long, did good work. Since, however, in this case outside plates already had been provided, no particular advantage was gained. One advantage of this style of plate would be in the fact that the cylinders can be attached and detached without stopping the mill and are easily removed to a safe place for making the final 'clean-up'.

In the Baltic provinces of Russia peat has been used for some considerable time in the breweries and distilleries, but all attempts to introduce it as a fuel for domestic use have been unsuccessful. This is attributed to the low price of wood, which is cheaper and better adapted to the national stove. Since the year 1906, however, there has been a marked rise in the price of wood, it having reached at one time last year a price more than 50% above that of 1906, and more than double that of 1892. The need of cheaper fuel has now become urgently felt, and attention has been drawn to peat.

Hydraulic Excavation on the Panama Canal

In connection with changes made at the Pacific entrance of the canal, it has become necessary to remove a large amount of alluvial material in the section from La Boca to Miraflores. The *Engineering Record* in its issue of April 2 has presented a full account of the plans for this work. From this the following abstract is published by permission.

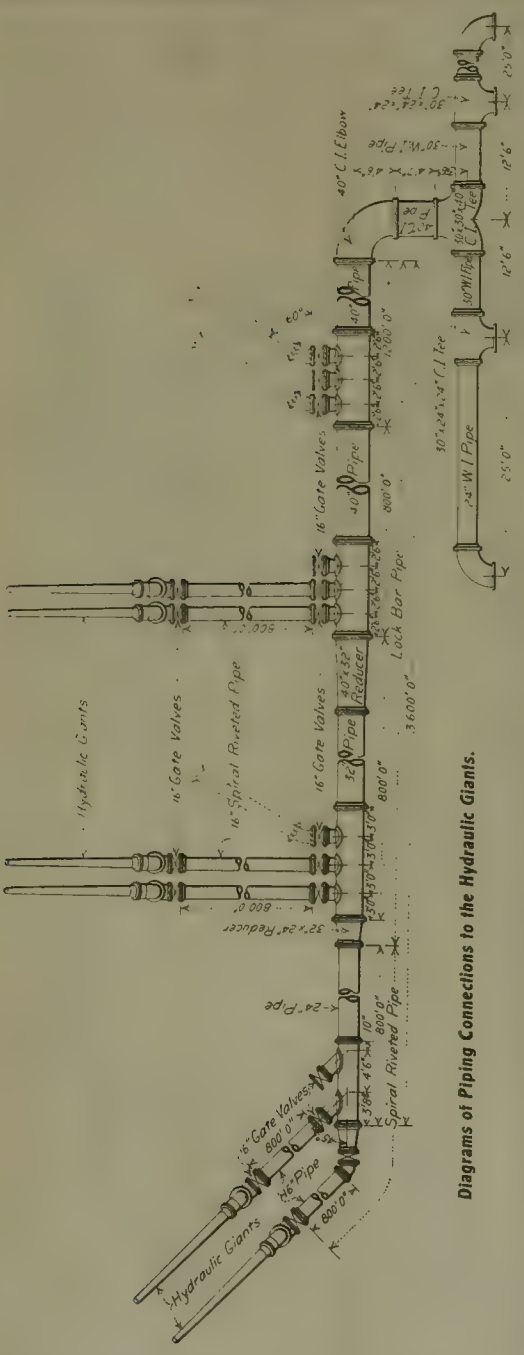
There is estimated to be over 7,800,000 cu. yd. of dark loam, containing about 15% of sand and some gravel, and in order to leave time enough for the excavation of rock below, this alluvial matter would have to be handled in less than 18 months. It is evident that a steam-shovel is too small a unit for this work, as it would take 10 shovels, 25 locomotives, 400 cars, and miles of track, all within an area 9000 ft. long and 500 ft. wide. The use of ladder or dipper dredges, with attending tugs and barges, would do away, to a certain extent, with this crowded condition, as five units would be sufficient. The long haul, the large cost and length of time required to put the plant upon the ground, however, prevented the adoption of this method. Suction dredges would seem, at first glance, to be the proper machinery. They could be used in large units, would eliminate the long haul, as well as the numerous barges and tugs for spoil transportation. In addition, they would give (at $400,000) a lower plant cost than any of the other layouts before mentioned. However, one year's experience has demonstrated the inability of the 20-in. suction dredge 'Sandpiper' to handle to advantage the stiff clay, mixed with sand and coarse gravel, which covers the rock. This method of removal was, therefore, out of the question; and after a thorough investigation of the material to be moved, and the effect of a jet on it, the hydraulic system of excavation was finally adopted.

This system involves two main operations, first the breaking and disintegrating of the material by a water jet under high pressure, so that it will flow readily to the sump, second, the lifting and conveying of the dirt laden water by a dredge pump, through a pipe line to the dumps. To perform these two operations the following plant is provided, central pumping station, discharge main with branch lines and hydraulic giants, and dredging pumps.

The central pumping station is situated west of the canal, near the bank of the Rio Grande, and near the middle of the section to be excavated hydraulically. The house, a light frame building, covered with tarred paper, is divided by a partition

Area on the Pacific Division of the Panama Canal to be Excavated by Hydraulic Monitors.

into an engine room of 50 by 100 ft. on the east side, and a boiler-room 40 by 100 ft. on the west; the floor being at El. + 12. The purpose of this station is to furnish water at a pressure of 150 lb. and this will be done by four horizontal direct-acting triple expansion pumping engines, built by Henry R. Worthington, with 19, 30, and 50-in. steam and 24½-in. water cylinders, and a 24-in. stroke. The four units are lined up parallel to each other at a distance of 25 ft. from centre to centre, the steam ends facing the boiler-room. Along the east side of the building, and extending to the river, is a trench 20 ft. wide at the bottom, which will serve as a sump. A concrete wall will be carried up to the floor of the engine room, to separate the pump foundation from the sump.



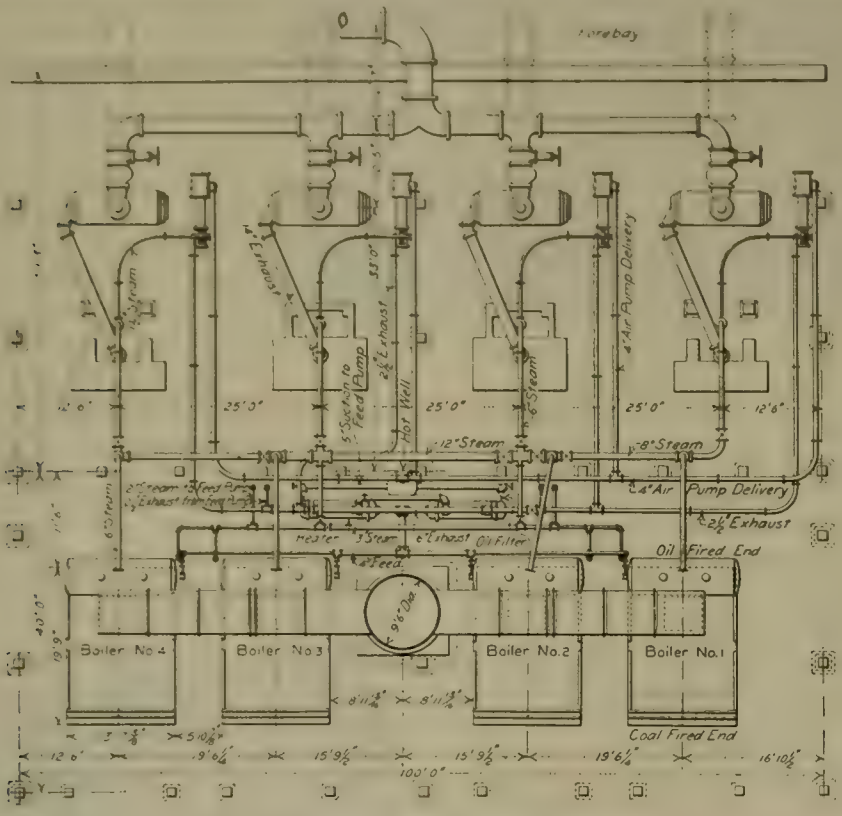
Diagrams of Piping Connections to the Hydraulic Giants.

The 36-in. suction pipes, one for each pump, are made of cast iron, and reach, with their foot valves, 24 in. below the waterline, which is at El. – 10, and connect by a quarter-bend to the pumps. Each engine has its own surface condenser built into the discharge pipe, and an independent direct-acting single cylinder 12 by 20 by 24-in. vacuum pump. At El. + 20, the pumps discharge toward the sump into a common delivery pipe, from which they are separated by a 24-in. check valve and a 24-in. gate valve. The delivery pipe has two branches which begin at the outside with a diameter of 24 in. and increase in size toward the centre line of the building, where they unite in a Y and connect with the 40-in. main. Each unit is guaranteed to furnish 7500 gal. per minute at 150-lb. pressure, with an efficiency of 95 ft.-lb. per British thermal units, corresponding to a coal consumption of about 1500 lb. per hour. In the boiler-room are four Babcock & Wilcox water-tube boilers arranged in two batteries of two each. The boilers are standard, have 4500 sq. ft. of heating surface each, and are designed for a working pressure of 150 lb. per square inch, without superheat. On the side toward the engine room the boilers have oil furnaces; on the other side, fire doors, grates, and ash pits are provided, so that coal can be fired in case of emergency. The boilers have steel casings, arranged with magnesia and tile insulation. The smokestack is steel and situated between the batteries, to which it is connected by a steel breeching. The stack is 9 ft. 6 in. inside diameter, 150 ft. high, and is guyed by three sets of four wire ropes. An automatic stop and check valve and a stop valve are provided in the 6-in. lead from each boiler to the 12-in. steam header, and a stop valve at the 6-in. outlet of this header to each pumping engine. Two 10 by 6 by 10-in. brass-fitted boiler feed pumps of the centre packed plunger pattern, two 1000-hp. Goubert feed-water heaters, with Ross oilfilter and a hotwell, are situated in front of the boilers, where they can be controlled.

Fuel oil is stored in two steel tanks having a capacity of 2000 bbl. each. These tanks are situated on the hill-side behind the station, and are connected with the main line of the Union Oil Co. of California, which supplies the Canal Commission with fuel oil. The oil is fed by gravity to the boilers, through a 4-in. pipe and reaches the burner at 50-lb. pressure. Steam for atomizing the oil is supplied at full boiler pressure.

The discharge main has a total length of 3600 ft., and is made up of 2000 ft. of 40-in. lock-bar pipe; 800 ft. of 32-in. lock-bar pipe, and 800 ft. of 24-in. spiral riveted steel pipe. The plates used for the different sections are No. 6, 8, and 10 U. S. standard gauge, respectively. The lock-bar pipe is made by the East Jersey Pipe Co., in lengths of 30 ft., which are to be connected by forged steel flanges ¾ in. thick. Five air-valves are mounted at equal distances to prevent rupture of the pipe in case of sudden discharge and to allow the escape of air while the pipe is being filled. Twelve openings, in groups of three, fitted with 16-in. gate-valves, are so situated in the main as to permit the connection of branch lines, as the progress of the work demands.

At first the main will be in the position shown by heavy lines on the map; but after the portion north of the central station has been excavated, it will be taken up and relaid in the position indicated by broken lines. The main will be in each of these positions over six months. There will be but two slight curves, and the pipe will be at an average down grade of 0.3%, beginning at El. + 20. The greater portion of its length will rest upon a berm in the slope of the approach track leading to the central station, thus giving a well graded and drained foundation. Close to the central station, the pipe will rest upon a trestle. Cables fastened to dead men will oppose the side thrust at the curves and at the points of connection with the side lines.



Plan of Pumping Station Furnishing Water for the Jets.

An asphalt compound will be applied hot, internally and externally, to the pipe to prevent corrosion. From the discharge main to the six hydraulic giants, the pressure water is carried through branch lines formed of 16-in. spiral riveted steel pipes, in lengths of 30 ft., and connected by forged steel flanges. A total of 4800 ft. will be furnished by Abendroth & Root Mfg. Co. of Newburgh, New York.

Two giants, working to supply one dredge-pump, constitute, with that pump, one working unit. To each unit belong three branch pipe-lines. While one of these lines is being shifted, the other two will supply the two giants, thus avoiding loss of time. A number of 30 and 45° elbows are kept in stock, to be used whenever necessary to give flexibility and cause the pipe-line to conform to the ground surface.

The hydraulic giants or monitors are manufactured by the Joshua Hendy Iron Works of San Francisco and represent the latest type operated successfully in the La Grange mine, Trinity county, California. Each giant weighs 1500 lb. and consists of a base for attachment to a 16-in. gate valve at the terminus of the pipe-line, a horizontal and a vertical joint, and a long conical reducing piece. To decrease the frictional resistance of the horizontal movement, a ball-bearing has been introduced, and a weighted lever is attached to control the direction of the jet. A deflecting nozzle fitted to the discharge butt of the giant permits deflections through a small angle, without changing the position of the main body of the monitor. The taper piece of the giant is fitted on the inner side with two sets of guide vanes, which prevent a scattering or rotary motion of the water after it has issued from the nozzle, and a solid efficient stream is thus insured. Different sizes of nozzles will be used, varying from 4 to 6 in. diameter, according to the nature of the material being worked. Owing to the frequent shifting, the monitor cannot have a heavy or permanent foundation. The base will merely be bolted to a 10 by 10-in. timber 10 ft. long, placed at right angles to the terminal length of the feed-pipe. This timber will be laid in a trench and weighted down in soft material, or secured with dowel pins on bedrock.

Three units of dredging pumps will be in use, each consisting of an 18-in. single-suction dredge-pump, direct connected to a 655-hp. induction motor, resting on a common cast-iron base plate. This unit, with the necessary auxiliaries, will be set up on a barge. The pump, built by Henry R. Worthington,

has a cast-iron steel-lined casing of split pattern. The runner shaft is supported by a single bearing, which, owing to the great overhang, is made especially long. This bearing is designed also to take the horizontal thrust, is supplied with ring oilers, and is entirely separated from the casing, thus eliminating the possibility of foreign matter working into it. The manganese steel impeller is shrouded, has five blades, and is designed to lift, per minute, 10,000 gal. of salt water containing 10% of solid material, against a varying actual head up to 70 ft., while running at 480 r.p.m. The pump, with base plate elbow and valve, weighs 29,600 lb. The cast-iron suction pipe is 12 ft. long and 20 in. diameter. The discharge pipe, a 20-in. spiral riveted pipe, manufactured by the Abendroth & Root Mfg. Co., is 1200 ft. long, and connects with the pump at an angle of 30° above the horizontal. The 30-ft. lengths are flange-connected, and will be supported wherever necessary by light wooden bents that are adjustable to different heights, and easily set up and taken down.

The motor, furnished by the Westinghouse Electric & Manufacturing Co. is of standard design, for three-phase alternating current at 2080 volts and 25 cycles. It weighs 12,800 lb. and is operated at a speed of 480 r.p.m. The machine may be started by pressing a push button. The starter will consist of seven oil immersed switches, which at first connect the motor to reduced starting voltage; then increase the voltage gradually until, with the controller at the last notch, the motor is connected across the line and the auto transformers are disconnected. The acceleration of the motor will be automatic, and controlled by a power-driven master-switch with series relays. The switch-board consists of a single slab of finished slate 22 in. wide, 48 in. high, and 1½ in. thick. On this panel will be mounted an indicating and an integrating watt-meter, a 300-ampere oil circuit breaker, and a pair of time limit relays of the fused type. The electrical apparatus, switchboard, and auto-starter weigh 5000 lb. The priming of the dredge-pump is done by a horizontal 10 by 10-in. single cylinder vacuum pump, of the piston pattern, geared 5 in 1, and driven by belt from a 5-hp. induction motor. This priming outfit weighs 1300 lb. and is built by the Dean Steam Pump Co. For the transmission line connecting the dredge motors with the Miraflores power-house, 2400 ft. of wire-armored three-conductor cable, manufactured by the Kerite Insulated Wire & Cable Co., is used. Each conductor is No. 00 B & S gauge, stranded.

The barges for the dredging units will be built of reinforced concrete, on temporary ways situated near station 2060-50 on the bank of the cut now being dredged. After allowing sufficient time for the setting of the concrete they will be launched, the dredge pump with its motor and accessories erected, and the finished unit towed into position. After the dikes are closed, the discharge-pipes laid, and the motors connected to the power station, the pumps will be started and the water lowered until the pontoon settles almost to the bottom of the cut. Then the barges will be anchored in the lowest places, which will form the sump for the suction-pipe.

The giants will now attack the bank, washing down the material into sluices, which carry the earth-laden water to the sump of the dredging units. From the sump the mixture will be pumped through the discharge-pipe and spread over the low ground selected for that purpose, on both sides of the canal. At first the giants have to be operated so as to lower the dredge-pump until it reaches bedrock. In doing this, the banks will be given the steepest slope that will stand without endangering the dredge. After this preparatory work is finished and the greatest possible head for sluicing obtained, the regular operation of the monitors can begin. The cut will be made in two benches, and the jet, with a pressure of 130 lb. per sq. in. at the nozzle, will be used to under-cut the bank, thus causing much of the material to fall by gravity. The monitors will be placed as low as possible, at a distance of 50 to 150 ft. from the bank, and the jet will be played on the bank at an angle, rather than striking the face of earth squarely. Whenever the dredging units will have to be moved, the monitor will cut a new sump and a channel leading to it, and the water will be allowed to rise high enough to float the barge to its new position.

With the supply main in the first position, the work will begin at the upper end of the cut (at the lower end of the locks) and will gradually progress southward, each unit having assigned a section about 1000 ft. long. The dredged material will be discharged behind dikes and distributed evenly by gradually shifting and lengthening the discharge-pipes. In this way a large tract of land near Corozal will be reclaimed, which is now under water during spring tides, or is so low that the tide-water keeps it saturated. It is the intention to cover these low-lands to El. + 15. As the surface of rock is at – 30, the pumps will have to work against a maximum head of 45 ft., not including friction and velocity heads. About 1,000,000 cu. yd. of the hydraulically excavated material will be deposited by two of the dredge-pumps in the core of the Miraflores dam, whose crest is at El. + 70. To overcome the additional lift, each of these pumps will be assisted by a motor-driven 18-in. relay pump, which is identical with the dredging units. The suction end of the relay pump will be connected to the end of the dredge-pump discharge pipe; the discharge end to a 20-in. spiral riveted steel pipe, of which 1200 ft. is on hand. When used as relay pumps, these units will rest on solid concrete foundations; afterward they can be erected on barges and used as additional dredging pumps.

Phosphate-land withdrawals in force March 4, 1909, covered all vacant public lands in an area comprising 4,493,551 acres in Wyoming, Utah, and Idaho. During the year areas covering 2,389,141 acres were restored to entry, for the field work showed that they contained no phosphate. Additional withdrawals including 399,693 acres have been made and the form of withdrawal has been changed so as to cover entered as well as vacant lands. All unpatented lands in an area of 2,504,103 acres are now affected by phosphate withdrawals.

Jarbidge, Nevada

Written for the Mining and Scientific Press
By W. A. Scott

The new mining camp of Jarbidge is situated in the northern part of Elko county, Nevada, seven miles south of the Idaho-Nevada State line. It is about 95 miles southwest from Twin Falls, and the same distance from Buhl, in Idaho, these being the nearest railroad supply points on the Idaho side. The distances to the camp from Elko and Deeth, Nevada, are 80 and 65 miles, respectively, the former on the Southern Pacific and the latter on the Western Pacific. The travel to Jarbidge is divided among the railroad points named, though at present most of the passenger and freight traffic appears to be from Twin Falls, which has excellent hotel accommodations. A branch railroad of the Oregon Short Line runs 28 miles southerly from Twin Falls to Rogerson, and the stage trip begins at the latter place, making the distance into Jarbidge 67 miles from the railroad. The stages leave Rogerson at 9 a.m., and arrive at Rim Rock, on Bruneau river, at 6 p.m. Passengers stop here over night, and meals and tent lodgings are provided. The following day the traveler reaches Jack Hole, 12 miles farther, at noon. This is the local name of the canyon formed by the east fork of the Jarbidge river, and which is four miles from the town of Jarbidge. At the time of my trip, Jack Hole was the end of the stage line; the remaining four miles had to be traveled either on foot or horseback, as the route led across the canyon and over a ridge having precipitous slopes. However, a wagon road was being graded over this part of the route and by the time this is in print stages and wagons will be going into camp, resulting in greatly reducing the freight rate on merchandise.

Rim Rock on Bruneau River, on the Way to Jarbidge, Nevada, From Twin Falls.

Jarbidge is a typical camp of tents with a few log cabins. It is strung along Jarbidge river for a mile, and up Bear creek, which comes into the Jarbidge from the west. The Jarbidge and its tributaries drain the northern slopes of the range of mountains of that name which culminate in Jarbidge peak, reaching an altitude of about 12,000 ft. There are four other conspicuous peaks in this cluster, and travelers approaching from the Idaho side have designated them as the Five Peaks. Their southern slopes drain into the tributaries of the Humboldt river. The Jarbidge river, which flows northerly into the Bruneau and thence into the Snake, is one of the few streams in Nevada whose waters find their way out of the State. The Jarbidge is a swift-flowing stream, having nearly the same volume as Clear creek, in Colorado. The canyon in which it flows is 400 to 600 ft. wide, and has a bed of gravel and sand, the bedrock of which has not been explored. The sides of the canyon rise to a height of 1500 to 2000 ft. above the stream, but the slopes are not too precipitous to be readily climbed in most places. In the river-bed and on the mountain sides are growths of mountain mahogany, cedar, pine, and some cottonwood trees. The entire section, embracing both slopes of the Jarbidge range, is within a National Forest, and persons wishing to cut trees for tent poles, cabins, and mine timbers are required to secure permits from the local Forestry official.

Jarbidge, Nevada, March 10.

The country is covered principally by rhyolite, in which are, apparently, some dikes of andesite and dacite. Cutting through this formation are numerous dikes of silicified rhyolite and quartz which carry the gold and silver of the camp. The croppings of the latter dikes, or lodes, are very prominent, in some instances protruding from 5 to 30 ft. above the adjacent surface. On the east side of the Jarbidge are three of these outcropping veins, more conspicuous than the others, which strike northwest; they are cut obliquely by the stream. The

one farthest north is now known as the Bourne lode, the 11 claims on and contiguous thereto having been located by D. A. Bourne in August, 1909. The next lode, or zone, paralleling the Bourne, is the Pavlak, five claims along which were staked in September, 1909, by Mike Pavlak and Peter Thourot. Still farther south, on the east side of the canyon, is the Pick and Shovel group, which was located at about the same time by John Escalon. The vein on the last named may or may not be the same as that of the Pavlak. Bourne, after making his locations, secured the co-operation of some Boise men and the North Star Mining Co. was organized to develop the property. J. E. Clinton, of Boise, is president of the company, and D. A. Bourne, manager. Mr. Clinton is a banker, and Charles Reynolds, a banker of Bruneau, is a stockholder and director. The only work thus far performed by the company consists of an adit 100 ft. long on what is considered the principal lode, some 30 ft. of cross-cutting from the adit, and a 15-ft. shaft on the same lode. F. V. Bodfish, of Victor, Colorado, who spent 12 days in the camp and thoroughly sampled this lode and had assays made, favored me with data showing the results of his investigations. In sampling what he considered as mill-dirt, not including picked specimens, he found that 13½ ft. of the surface outcrop averaged $8.54 per ton; that 11 ft. of cross-cutting from the main adit, neither wall exposed, averaged $8.50 per ton; that samples across one side of the shaft, that was sunk on the east wall, ran an average of $12.32 per ton. Assays of 23 samples from this lode gave results as low as 40c. and as high as $19.15 per ton. As showing exact results for gold and silver, 8 ft. of the outcrop gave 0.28 oz. gold, 1.88 oz. silver; 3 ft. more of outcrop gave 0.34 oz. gold, 0.9 oz. silver; the first 2½ ft. across the south side of shaft gave 0.92 oz. gold, 1.5 oz. silver; the next 2½ ft. showed 0.32 oz. gold, 2.40 oz. silver; the next 1 ft., 0.32 oz. gold, 0.5 oz. silver. Mr. Bodfish also made assays of picked specimens from the Bourne lode, six of which assayed as follows: $64.50, $88, $211.-93, $305.90, $151.60, $414. He believes the Bourne orebody is a lode in the rhyolite, with defined walls, that its strike is south 40° east, dip 80° east, and its probable width 30 ft. Free gold is visible in some of the ore, and may usually be obtained by crushing and panning. The highest-grade ore occurs in dark streaks in the quartz, in which the gold is associated with sulphide of silver. There are those in the camp who assert that they find petzite in the ore, though experienced assayers here have failed to find it. Three supposed high-grade specimens from the Pavlak gave $13.44, $35.60, $12.90; two from the Pick and Shovel ran $42.24 and $46.70 per ton. Mr. Bodfish is of the opinion that there is a mineralized zone, in which is embraced the principal lodes, which has a length of 12,000 ft. The Bourne company is undertaking the development of one part of the group, and has let a number of leases on other parts. The first lease was let to Frank W. Riddle, of Twin Falls, and he is starting systematic work. The second lease was let to Roberts & Lamb, who have begun work. Ten or twelve other leases have been given, and most of these lessees were to make their selections April 10. Among these are Wyman & Wyman, of Boise; P. L. Williams, of Salt Lake; and others from Goldfield. Some of the leased ground covers what appears to be cross-veins or spurs from the principal lode. The small amount of work performed, however, makes the system of veining uncertain.

The Pavlak group has been bonded to the Pavlak Mining Co., in which Coburn & DeWitte, and Brunn, Kinney & Co. are principals, the price named being $100,000, a payment of $10,000 to be made in May. The outcropping vein on this group is a strong one and seems well defined, but the development is very limited. A cross-cut has been started from the base of the mountain, on the river, which is expected to intersect the vein by driving 400 ft.; this will give about 600 ft. of backs. The Twin Falls Jarbidge Development Co. holds a bond from John Escalon on the Pick and Shovel group at $100,000, a payment of $2000 having been made. A shaft is being sunk on the foot-wall of the vein, with the idea of driving cross-cuts from it to the hanging wall of the vein at various depths. This plan assumes that the vein dips east. This vein runs nearly parallel with the canyon at this point, and ample opportunity is offered to obtain great depth by driving cross-cuts to the vein from the side of the canyon. The characteristics of the ore at the Pick and Shovel and Pavlak are similar to those at the Bourne, and so far as can be ascertained the value of the ores is much the same. There is a large area here that is attractive to prospectors. The streams head in snowy basins near the summit of the range, each cutting deeply into the formation. Bear creek is one of those streams. It runs almost parallel to the Jarbidge for some distance before making a turn to the east and into the latter. The high ridge between the two canyons is marked by east and west andesite dikes, which also extend westerly from Bear Creek canyon. A part of this area is covered by the group of the Belmont Mining Co., in control of W. A. Stevens and associates, of San Francisco. Some work is in progress here; one adit is being driven easterly and another westerly from the bed of Bear creek. Assays obtained here make it seem worth while to continue development. Mr. Stevens spent two months in camp last fall and has done a great deal of prospecting and testing. Information obtained at the district recorder's office was to the effect that over 500 claims have been staked and filed for record in the district. Aside from the ore obtained on the three most prominent veins in the camp—Bourne, Pavlak, and Pick and Shovel—there seems to be gold-bearing ore distributed over a wide area where quartz croppings occur. At the time of my visit there were hardly 20 men at work on all the claims of the camp. It is but fair to say, however, that work has been held back till the wagon-road from Jack Hole was finished and until finances were arranged. Many claims were staked by men who will do little in the way of actual mining, as they not only lack the means but are without experience. Probably the proportion of this class is not greater here than it has been in other new camps. Mine operators of Colorado, Utah, Ne-

vada and California have sent representatives to examine the district but before much capital takes hold it will have to be developed to some extent by those now in control. Present development amounts to but little as practically no depth has been attained. The preliminary showing made thus far would seem to make development worth while. Claim holders have exaggerated ideas of the value of their ground, which causes hesitancy on the part of those whose business is mining. There are those who would take a bond and agree to expend a certain sum in development, but in most cases the claimant wants a good payment down. Among those in the camp looking it over at the time of my visit were P. L. Williams, Salt Lake; C. Tillery, Charles Howbert, F. V. Bodfish, Cripple Creek; Dr. Bowes, Marshall Bond, and Ben Luce, of Goldfield; W. A. Stevens, of San Francisco.

The properties and ores above described are considered typical of the district and for this reason the data given may be of interest. There are five assay offices in the camp, established by Price & Beadles, W. D. Greene, George H. Wyman, Dr. Brownfield, and A. D. Sly. Mr. Beadles spent the winter in camp. Among the surveyors and engineers are William Neilson, W. W. Fisk, H. W. Horn. There are eight or ten stores, as many restaurants and sleeping tents, and a dozen saloons, whose sales of liquors are confined to bottled goods, the Government restricting them thus because the town is in a Forest. It is astonishing to see how many bottles the saloon men have of the right size to hold each a drink. The name 'Jarbidge' is a 'metamorphosed' Indian name; the red man called it 'Ja-ha-bich'. The population of the camp is about 800 to 900, and while some are leaving, about 20 to 30 per day are coming in. For the man seeking employment Jarbidge is a poor place at present. Predictions concerning a new mining camp are often hazardous, but it looks now as though Jarbidge might yield good quantities of milling ore.

Coal-land withdrawals were made during the year ended March 4 covering 7,675,000 acres not previously withdrawn and the form of withdrawal affecting an additional 9,000,000 acres was changed to cover all forms of entry instead of coal entry alone. The new regulations of April 10, 1909, for the classification and valuation of coal lands, materially increased the sale price of these lands and fixed more definitely the standards of coal classification. Thus, for example, under the old regulations, in eight widely separated townships the total area classed as coal land was 66,320 acres and the sale price was fixed at $2,088,600, whereas, under the new regulations, the area in the same eight townships classed as coal land is 126,663 acres and the sale price is $15,777,668—an increase in area of over 100 per cent, and in price of over 600 per cent.

Transvaal gold mines in the fiscal year, 1908-09, paid £9,338,691 for supplies and £11,039,106 for labor. The latter included European salaries and wages, £6,556,658; wages to colored persons, £4,181,894; wages to Chinese, £290,554.

Taylor Peak Iron Deposits

By E. C. Harder

* The Taylor Peak district lies in the eastern part of the Elk mountains on the boundary between Pitkin and Gunnison counties, Colorado. The nearest railway station to the north is Aspen, about 18 miles distant, on the Denver & Rio Grande and Colorado Midland railways, which may be reached by way of Ashcroft. To the south are St. Elmo, Quartz, and Pitkin, about 45 miles distant, on the Colorado & Southern railway, which may be reached by way of Dorchester and Tincup. The ore deposits are situated on the north, east, and south sides of Taylor peak, about ten miles west of the junction of the Elk and Sawatch ranges. They are all above timber line, ranging in elevation between 12,000 and 13,000 feet.

Geologically the district is composed of Cambrian, Silurian, and Carboniferous sediments resting on pre-Cambrian granite and irregularly intruded by a fine-grained diorite of Tertiary age.

The sediments have the following succession:

Carboniferous: *Maroon conglomerate*, 4500 ft. Conglomerate and sandstone, with local limestone layers. *Weber formation*, 100 to 550 ft. Dark shale, with limestone layers. *Leadville limestone*, 400 to 525 ft. Blue limestone.

Silurian: *Yule limestone*, 350 to 450 ft. Limestone with upper shale bed.

Cambrian: *Sawatch quartzite*, 50 ft. Quartzite with thin conglomerate at base.

Pre-Cambrian: Granite, gneiss, and schist.

In general the distribution of formations is as shown in Fig. 1.

The pre-Cambrian granite occupies the eastern part of the district and the intrusive diorite the western part; between them is the belt of Paleozoic sediments, the oldest on the east, narrowing to a thin strip on Taylor Peak. The sediments have a general westward dip of 25 to 45°. To the west of the district the diorite is in contact with the Maroon conglomerate, the uppermost Carboniferous formation of this region, but near Taylor peak it comes into contact with the underlying Weber formation and is very near the Leadville limestone. On account of the proximity of the intrusive rock, the Leadville limestone and the limestone layers in the Weber formation are locally recrystallized and replaced by iron ore. The Leadville limestone is very coarsely crystalline in places near the diorite contact. Where not so coarsely crystalline it shows numerous needle-like crystals of tremolite. Except for the formation of ore deposits the shales of the Weber formation show but slightly the effect of the intrusion. The limestone layers in the Weber, however, have been recrystallized, though not so coarsely as the Leadville limestone. Near the ore deposits both formations are deeply stained by iron.

The ore deposits are situated at or near the contact of the sediments with the intrusive diorite, the actual location being determined by the kind of rock and probably by fracturing and faulting. The

* Abstract from 'Contributions to Economic Geology, 1908,' U. S. Geol. Surv., Bull. 380.

largest single deposit (Fig. 2) lies near the head of Cooper creek, on the northwest slope of Taylor peak, about 3½ miles south of Ashcroft. It is situated near the contact of the Weber formation and the Leadville limestone, being a replacement of both, and is 500 ft. from the diorite contact. This deposit is irregular, containing horses of quartzite, shale, and limestone and having stringers that extend into the surrounding limestone area. It is situated on a slope of 35 to 45° and is opened by several horizontal tunnels, three of which, having a length of 70, 110, and 120 feet, end in limestone. Whether this limestone is merely a horse or whether it is wall-rock is not known, but if it is wall-rock a large part of the present body of ore is merely a surface covering. In the limestone area surrounding the deposit there are numerous veins of iron ore and bodies of limestone and shale partly replaced by iron. The ore is mainly a dark blue, glossy magnetite with calcite, quartz, pyrite, kaolin, siderite, barite, and chlorite as gangue minerals situated in cavities or disseminated. The gangue minerals are most abundant near the limestone contact. Locally pyrite is present in such quantities as to become injurious. In places the ore is soft and friable, but mainly it is dense and hard. Near the surface it becomes more porous, owing to the leaching of gangue minerals, and is stained by limonite. The limonite originates partly from the oxidation and hydration of magnetite, but mainly from the oxidation and hydration of pyrite; indeed, considerable partly altered pyrite is present near the surface.

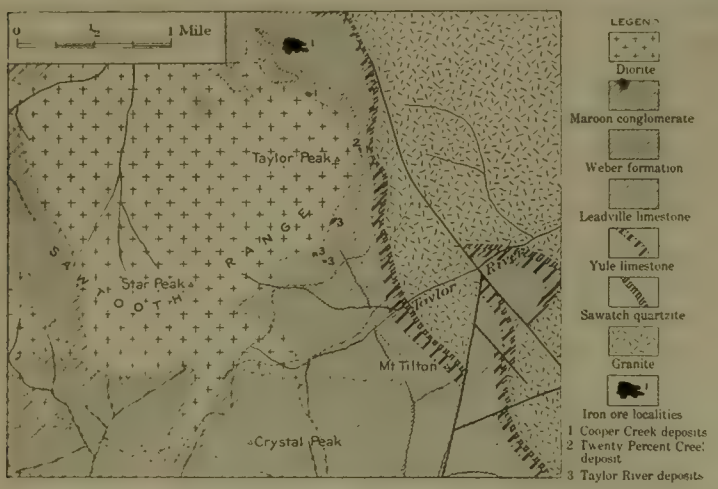


Fig. 1. General Geological Map of the Taylor Peak District, Showing Iron-Ore Deposits.
From Anthracite-Crested Butte Folio With Additions and Revisions.

The contact of iron ore and limestone has commonly a very steep dip—from 70 to 80° toward the iron—but in places the dip is as low as 35°. The limestone is hard and crystalline within a few feet from the contact, and much of it contains veins of calcite. At the contact it is soft and friable and is mixed with gangue minerals and seams of magnetite and limonite. On the iron-ore side of the contact the gangue minerals gradually become less abundant and within a short distance give place to solid magnetite. Near the contact the ore is generally soft, but the main part of the ore-body is dense and hard. The sediments surrounding the ore deposits contain veins and stringers of iron for a distance of several hundred yards, and close to the deposit they are deeply stained and here and there partly replaced by iron. Halfway between the main deposit and the summit of Taylor peak is a small deposit at the contact of the diorite and the Weber formation. (See Fig. 2.) This deposit contains two kinds of ore—a dense blue magnetite and a mixture of magnetite and limonite with partly replaced sedimentary material. Both kinds are present at the surface; the former probably represents the replacement of a pure limestone, and the latter shows the less thorough replacement of a shaly limestone. The surrounding sediments are stained and partly replaced by iron, but the

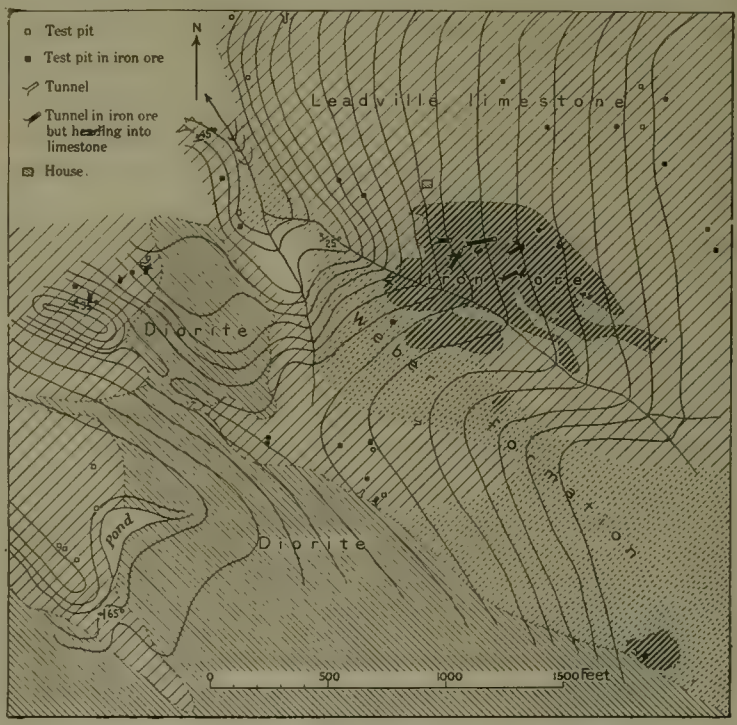


Fig 2. Detailed Map of the Cooper Creek Iron-Ore Deposits.

diorite shows little or no change near the contact. The gangue minerals here are mainly calcite and quartz. Another small deposit lies at the contact of the diorite and Weber formation on the east side of Taylor peak, near the head of Twenty Percent creek. (See Fig. 3, *a*.) This deposit is similar in every respect to the one just described, being the replacement of a local limestone area in the shale-limestone formation. On the southeast slope of Taylor peak, above Taylor river, there is a series of small deposits in the Weber formation at or near the diorite contact. (See Fig. 3, *b*.) The character of the ore here is the same as in deposits previously described, but the association of gangue minerals differs in some of them. In the deposit farthest to the north, a short distance southeast of the summit of Taylor peak, the ore is heavily impregnated with chlorite and contains some calcite, and directly at the contact there is an association of pyroxene, amphibole, garnet, epidote, and pyrite in a cherty matrix. The diorite at the contact is finer grained than usual and contains seams and specks of pyrite.

The iron ore is intimately associated with sedimentary material, occurring as local replacements, stains, and small veins. Where the original rock was sandstone or shale the ore is very sandy, some of it being so lean as hardly to be called an iron ore. Most of the deposits, especially the replacement deposits, are very near the diorite contact, but veins of magnetite, limonite, and locally pyrite occur in the sediments at some distance from the igneous rock. Near Star peak in the Sawtooth range the diorite contains included masses of silicious shales from the Weber formation which have been deeply stained and contain little seams of magnetite a few inches in thickness and one or two local areas of ore a few feet in diameter at the contact with the diorite. On account of the color the whole mass has been considered iron ore.

The Taylor river deposits are several miles beyond Cooper creek, on the other side of the Elk Mountain divide, and would have to be transported by way of Taylor river to the Colorado & Southern railway. It is practically impossible to construct a railroad nearer than two miles from either of these deposits, as they are well up on the slope of the mountains and can hardly be reached by wagon. Unless the price of ore rises so as to make a 15 or 20 mile haul by pack animals and wagon profitable or a cheap method of transportation is installed these deposits will probably not be utilized. The Cooper creek deposit is by

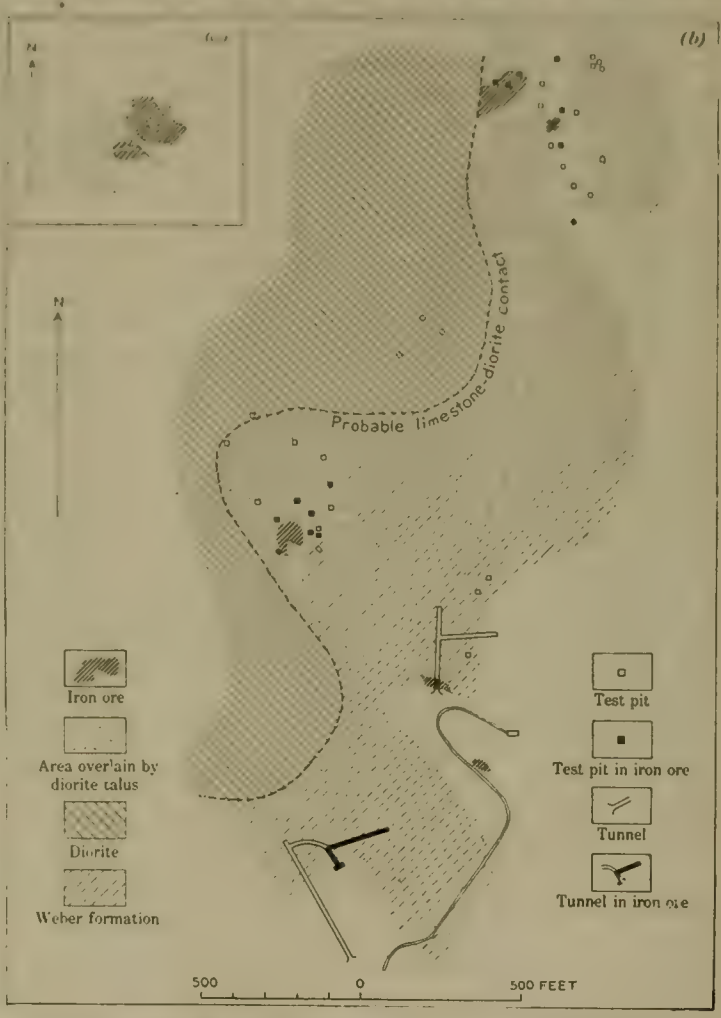


Fig. 3. Detailed Map of the Twenty Percent Creek (a) and Taylor River (b) Iron-Ore Deposits.

In general, then, the ore follows the diorite contact, replacing the calcareous portions in the adjacent Weber formation or the Leadville limestone where this is close enough. This association shows that the ore-bearing solutions were derived from the diorite, and the nature of the gangue minerals shows that they had a deep-seated source. The deposits are unfortunately situated with regard to topography and railroads. Aspen, the nearest railroad station, is 18 miles north of and 4000 ft. lower than the iron ores. Under great difficulty a branch line might be constructed to a point within a few miles of the Cooper creek deposits if they were extensive enough to warrant the expenditure, which is not the case. far the largest in the Taylor Peak district. Measured on the slope (35° S.W.) it has an average width of 450 ft. north and south and an average length of 750 ft. east and west. Three horizontal tunnels have been driven through it into limestone, so apparently a large part of the deposit is merely a surface blanket. With the average depth as shown by the tunnels, the quantity of ore may be estimated as being between 3,000,000 and 4,000,000 tons. Doubtless, however, portions of the deposit go to a much greater depth than the explorations indicate, so that a larger tonnage than that may be expected. All the other deposits should be measured in thousands rather than millions of tons.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Ten Mill District of Idaho

The Editor:

Sir—In connection with the recent 'stampede' into the Ten Mile district in Idaho county, Idaho, the statement has been made in Spokane, Washington, papers that the discoveries are in veins traversing a belt of quartzites said to be indistinguishable from those of the Burke section in the Coeur d'Alene district. The geology of the new camp might as well be correctly stated. I made a recent visit to a portion of the Ten Mile district, and all the rocks I saw were gneisses, schists, granites, diorites, and pegmatites, strongly resembling the Archean rocks of the Idaho Springs, Central City, and Georgetown mining districts of Colorado, and quite unlike the Belt series of rocks as represented in the Coeur d'Alene. The older members vary from typical gneiss to mica schist at one extreme and a rock containing so little mica that it resembles a quartzite at the other extreme. These rocks are contorted and much broken by intrusive granite which itself has a gneissic structure in places. The whole complex is intimately intruded by pegmatites. Some diorite dikes occur but are not prominent. The quartzite-like bands have a prevailing northerly strike and the predominant vein system in so far as I got acquainted with it cuts them at high angles. But the walls of the veins are as frequently pegmatite or typical gneiss as they are of the quartzite-like rock. This Archean area is apparently much more extensive than the Ten Mile district, and contains mines elsewhere. In short, there is nothing in the geology of the Ten Mile district that is peculiar to it. The district is simply a portion of the gold-bearing Archean area of central Idaho neglected until recently.

OSCAR H. HERSHEY.

Kellogg, Idaho, April 14.

Coal Land Prices

The Editor:

Sir—Though heartily in agreement with the general conclusion in your editorial of April 2, regarding the higher prices now asked for Government coal lands, I wish to criticise the statement that a higher price for land means dearer coal for the consumer. According to Ricardo's law of rent (which is generally accepted by economists), the price of any commodity, like coal, depends upon its cost of production at the leanest mines necessary to work to supply the market demands. The coal at these leanest mines, which are those "on the margin of production," is worth nothing in the ground as its selling price only covers the essential costs of production such as wages, supplies, and the interest and renewal of the capital invested in improvements and machinery. It is only at richer mines, where a surplus remains above the essential costs, that the coal has any value in the ground or any royalty can be obtained from the operator by the fee-owner. Hence a royalty on output, or its capitalization in the price per acre of coal land, represents a residual, not an essential, factor in cost of production and can not affect the price of coal to the consumer. If the Government does not retain the royalty for the people, either by lease or by a higher initial price for the land, it will be absorbed by private interests to the detriment of the revenue. In two cases my statements should be modified. First, where all the available coal land is controlled by one corporation as is thought to be the case with Pennsylvania anthracite. Here the price to the consumer is not the essential cost of production at the marginal mine, but 'what the traffic will bear'. Second, where present marginal or even sub-marginal coal land has a speculative value based on the possibility of cheapening working costs so as to leave a surplus for royalty.

R. B. BRINSMADE.

Morgantown, West Virginia, April 14.

Leasing Public Oil Lands

The Editor:

Sir—There is one point in Mr. Johnson's letter regarding Senate Bill No. 5488, published in your issue of April 16, that does not seem to me to be well taken. He says, "Any operator who will pay the Government a rental year by year to protect a lease is performing a service for conservation and should not be disturbed." This dictum appears to be directly opposed to the well known principle of the conservationists that private owners should not be allowed to obtain control of mineral lands merely to hold them for speculative future value. If the law permits a lessee to hold his lease without operating, it permits him to violate this principle. I do not wish to be understood as favoring any law that would compel wasteful methods as do some of our present laws, but I certainly am opposed to a law which would enable anyone, corporation or individual, to curtail production for speculative purposes. The principle of "dig or get off the dump" that has been discussed in connection with the annual assessment work on lode claims is equally applicable to oil, coal, and phosphate lands. If a lessee does not want the land in question for immediate use, why permit him to hold it and thereby keep others from utilizing it? Certainly the keeping idle of mineral lands that might be productive is to be deplored and the laws should be framed to prevent it. If, in special cases, it is desirable to allow a lessee to hold mineral land in idleness the rental for such idle lands should be greater than for similar lands that are being worked, great enough to be prohibitive if extended over any considerable period of time. Perhaps the best thing that could be done would be to leave the question of the use of leased lands in the hands of an executive officer having full power to deal with each case on its individual merits. The success or failure of this scheme would depend wholly upon the character and ability of the man holding the office.

HORACE F. LUNT.

Colorado Springs, Colorado, April 21.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling and smelting.

Panama Canal excavation during March totalled 3,067,479 cu yd, a daily average of 117,980 cu yd for the 26 working days. The amount of concrete laid during the month was 90,502 cu yd and 571,294 cu yd of fill were placed. The rainfall for March was 3.78 inches.

Management of men is an important factor in costs. H. P. Gilette makes the following among other suggestions. Group men in gangs according to their respective energies, and so plan the work as to make each gang as small as is consistent with efficient work. Then pay these gangs according to the number of units of work done by each.

Heat received by the earth under a high sun and a clear sky is equivalent, according to the measurements of Langley, to about 7000 hp. per acre. Though engineers have not yet discovered how to utilize this enormous supply of power, they will ultimately succeed in doing so. When that comes about centres of industrial activity may perhaps be transferred to the burning deserts of the Sahara, and the value of land determined by its suitability for the reception of traps to catch sunbeams.

Radioactive substances are constantly giving out large quantities of heat, presumably at the expense of their potential energy; thus when these substances reach their final non-radioactive state their potential energy must be less than when they were radioactive. Rutherford's measurements show that the energy emitted by one gram of radium in the course of its degradation to non-radioactive forms is equal to the kinetic energy of a mass of $\frac{1}{10}$ of a milligram moving with the velocity of light.

Tropical trees do not generally cut up into good fuel. Many of them are too hard or too twisted to be split economically. In one instance, where the amount of fuel per acre was estimated as by temperate zone standard, subsequent results showed that only 20% of the estimated amount was actually cut and corded up as fuel. The rest could not be split economically or was not worth cutting. This is a serious consideration where a steam plant is used, for it means that accessible fuel is soon exhausted and that it must then be hauled for a considerable distance.

In cyanidation of slimy material the chief difficulty is removing and obtaining the dissolved gold, or silver, from the slime. Many methods have been tried, and the ones chiefly in use today are the well known decantation process and various filter-press processes. The decantation is very slow, and, therefore, requires an enormous plant, and a large quantity of solution has to be handled in proportion to the weight of slime treated. The filter-press method has many advantages, but it requires a costly plant, and necessitates much handling and constant renewals.

Graduates of French engineering schools are to be sent to this country by the French Government to work for two years each in bridge-building and mining plants. A commission of two French engineers, Jules Boenfve and Henri Vetillart who have been appointed to find places for the graduates, arrived in New York City recently. Four students will be sent over each year and will work here for two years at a nominal salary, after which they will return to France in the service of the French Government.

Fishes were already well established and distributed over perhaps the greater part of the northern hemisphere at the beginning of Devonian times; and then there began suddenly a remarkable impulse toward the production of lung-breathers, which is noticeable not only in Europe and North America, but also probably so far away as Australia. In the middle and latter part of the Devonian period, most of the true fishes had paddles, making them crawlers as much as swimmers; many of them differed from typical fishes, while agreeing with lung-breathers, in having the basis of the upper jaw fused with the skull, not suspended; and some of them exhibited both these features.

Dry-rot fungus sometimes infects wood before it leaves the forest when felled timber remains stored there for some time. The first evidence of such infection is indicated by the presence of red stripes in the sawed wood. If such wood is thoroughly seasoned the mycelium present in the red stripes is killed. If the seasoning be neglected or imperfectly done, the mycelium, which possesses the power of remaining in a latent condition for some time, commences active growth when the wood is used in any part of a building where it is exposed to dampness, and this in some cases is unavoidable, as when the ends of joists are built into a wall. Under such circumstances dry rot eventually appears.

Pre-Cambrian is a term used by the United States Geological Survey to include all rocks supposed to have been in existence before those laid down in the Cambrian period, at the beginning of the Paleozoic era. In the early days of geological study all these pre-Cambrian rocks were supposed to be of igneous origin and to record a time before life on the globe began. Later, when both sedimentary beds and fossils were discovered in them, they were subdivided, usually into two variously named systems, the older of which, now generally known as the Archean, was supposed to be destitute of life and sediments, while the younger, now called the Algonkian, was supposed to mark the earliest beginnings of both. More recently sediments have been found and fossils suspected in certain Archean rocks, so that the distinction between these two great systems now depends on other points of difference, most of which are not quite so easily grasped or applied. Nevertheless the subdivision is useful, since the Archean and Algonkian are separated from each other by a great 'unconformity' and differ from each other physically as much as the Algonkian differs from the Cambrian.

Special Correspondence

SALT LAKE, UTAH

Ohio Mine and Mill.—Bingham Mines Co.—U. S. S. R. & M. Co. Mill.—Electrostatic Treatment of Zinc Ore.

The steel structure for the concentrating plant of the Ohio Copper Co. was designed and built for four units, each to have the capacity of 625 tons per 24 hours. The first two units of machinery were installed and set in operation late last year; the third and fourth units, foundations for which were originally laid, are to be installed later, some of the equipment having been provided. The plant was designed by W. A. Kidney and assistants, the former now being superintendent. The two units in operation are treating 1250 tons of ore every 24 hours, and Mr. Kidney believes the complete plant will be equal to the capacity of 3000 tons. The ore is received into cars at the base of the 1400-ft. incline which leads from the levels of the Cunningham adit to the level of the great Mascot tunnel. These cars are brought out in trains by electric locomotives through the great tunnel which has a length of 14,000 ft. The tunnel trackage is extended half a mile from the portal to the mill, the last 600 ft. being supported by a high steel trestle, by means of which the cars of ore are dumped into the mill-bins. The Mascot tunnel, its trackage, and ore-hauling facilities are owned by the Bingham Central Railway Co., in control of F. A. Heinze, who is also supposed to be the controlling spirit in the Ohio Copper Co. At present most of the ore received at the mill is taken from the level of the Cunningham adit and those above it, and consists of chalcopyrite, chalcocite, and copper oxides in a quartzite gangue. When later the ore shall come from levels below this it will contain practically nothing but sulphides. In anticipation of soon getting into the strictly sulphide bodies the mill was equipped with jigs for coarse concentration; but by reason of the present mill supply containing so much oxidized stuff the jigs are not now in use.

The ore in the receiving bins passes to a crusher of sufficient capacity to serve two sections of the mill, reducing the ore to 2-in. size. The crushed ore for one section passes through trommels, the oversize passing to a 20 by 6-in. Blake crusher by which it is reduced to ¾-in., the undersize joining the crushed ore in the boot of an elevator by which this material is raised to the top of the mill and fed into two double trommels—two in tandem. The fine from these is re-crushed by two sets of 36 by 15-in. Allis-Chalmers rolls; the oversize is re-crushed by one set of rolls of same size. The entire roll product now passes to four 7-ft. Monadnock Chilean mills, sold by the Trent Engineering & Machinery Co., the pulp coming to these mills through a distributing box that permits the lighter slime to overflow and go to hydraulic classifiers. The Chilean mills further reduce the pulp to about 24 mesh, the screens being of No. 28 and 29 wire. As an experiment one of these mills is being operated with only two rollers. M. P. Boss, who is interested in some of these experiments, thinks there is an advantage in allowing the pulp to partly settle in the mortar bed between rollers, and that this is accomplished by running with only two. The Chilean mill product now flows through a system of distributers to 27 V-shaped hydraulic classifiers for the two sections of the mill. These classifiers are built in three sections of nine each, each section occupying a bench with the concentrating tables. Each classifier, which has a length of about 12 ft., has two spigots, through one of which the coarse material feeds upon a table, and through the other the fine stuff feeds to another table. On the first, or highest, bench are James tables and Wilfleys; on the second and third benches are all Wilfley tables. There is a fourth bench of tables over which the middling from all the tables above is re-concentrated. Finally, the concentrate from all these tables is re-concentrated over the fifth bench of Wilfley tables, giving a shipping product that runs 17% silica, 27% iron, and 23% copper. The slime that overflows from the hydraulic classifiers, and the tailing from the concentrators, pass through a launder to the slime plant, where they undergo treatment by 90 Callow classifying tanks, the thickened slime being then passed over Wilfley tables; the slime from the tables and tanks goes to six buddles, each 20 ft. diam., having concrete surface with an inclination of 1¼ in. to the foot, and a speed of 1 rev. per min. Reverting to the first part of the process, the crushers and rolls crush wet, though it is proposed to operate them dry later. The concentration is in the ratio of 24 to 1 and about one-tenth of the product is obtained in the slime-plant. The tables that re-concentrate the middling from all the other tables make no tailing, nor do the tables that re-concentrate the concentrate; the reject from these is forced up to the Chilean mills by sand pumps. For January and February the recovery in the shape of a concentrate product represented 71% of the value as shown in the heads. The mill machinery is electrically driven and the water supply is taken from the Mascot tunnel. The town and settlement in the vicinity of the Mascot entrance and the Ohio Copper mill is known as Lark. It faces Salt Lake valley.

The Bingham Mines Co., managed by Imer Pett of Salt Lake, is operating on the old Dalton & Lark group, on which are opened the Lark, Brooklyn, and Lead Mine veins, which strike northeast and have a dip of 40° northwest. The ore is found in limestone bands in a quartzite country yielding a copper, lead, and silver ore. These properties are now entered through the Mascot tunnel. A cross-cut, which starts on this tunel at a point 10,000 ft. from the portal, was driven 900 ft. to the Brooklyn vein, on which a drift was run 1200 ft., almost to the old Brooklyn shaft. J. E. Bergh, superintendent of the property, states that shipments amount to 700 tons per month. A recent shipment of one carload sampled 25 oz. silver, 5.6% copper, and 30% excess of iron. Some of the shipments contain 25 to 30% lead. This company owns the Commercial mine, situated on the Bingham canyon side, and from it shipments of 100 tons per day are made. Joseph Hyland is superintendent of the Commercial.

The milling plant of the United States S., R. & M. Co., at Midvale, is treating 250 tons per day of lead-zinc-iron ore, supplied by the company's mines in Bingham district. The methods involve concentration by jigs and tables, followed by drying the zinc-iron concentrate and passing it through Huff electrostatic separators, parting the iron from the zinc. First, the ore is run through a crusher, then elevated and passed through a trommel having ¾-in. perforations, the undersize passing to the bins, and the oversize to 12 by 30-in. rolls, the crushed product of the latter going to the same bins. The material in the bins is then elevated again and reduced by a second set of rolls and screens to $^{5}/_{16}$-in. size, and then by similar methods is sized for the jigs into four grades, which are $^{5}/_{16}$-in., 6, 8, and 10 mesh. The jig product is a lead concentrate, and it amounts to 65% of the concentrate product of the mill. All the jig tailing is further pulverized to 10 mesh and passed over Wilfley and Overstrom tables, the first 11 tables making a lead concentrate and a zinc middling, the latter being re-concentrated by six other tables. The table tailing is passed to a 4 by 16-ft. tube-mill, by which it is reduced to 30 mesh, and thence through a Richards classifier to six Wilfley tables, making lead and zinc concentrate. The slime is finally treated by seven Sherman slimers. The zinc-iron concentrate and zinc middling are then taken to the electrostatic section of the plant. They are first put through two Bartlett & Snow dryers, whereby the 12% moisture contained is entirely eliminated. The product then passes through an automatic feeder into the first dryer, from which it is conveyed to an elevator and by the latter it is dumped into the second dryer. This material, as it comes from the concentrating plant, carries 21 to 24% iron, 4 lead, 20 to 23 zinc, 5 silica, 2 lime, and, approximately, 30 sulphur. After being dried it is sized and graded for the electrostatic machines by means of a series of impact screens; the coarsest of these grades, containing about 32% iron and only 7 zinc, is held out and sent to the smelting plant. The finer screen sizings that follow

result in making three grades: first the oversize of 20 mesh, the oversize of 60, and that which will pass 60 mesh screens. The electrostatic plant consists of five units, each unit being made up of three machines—one concher and two finishers. The resulting zinc product contains 92 of that metal and 4 from the most product still contains about 8% zinc. The plant can handle 15 tons per day. J. R. Mongin has general charge of the milling plant, O. M. Cozzens being foreman of the concentrating section, with Allan McOwen at the electrostatic plant.

MEXICO

Greene-Cananea Improvements — Amparo — Cinco Minas — Asientos Developments — Mitchel Mining Co. in Receivers' Hands — San Juan Litigation.

Arrangements for electric haulage of ore are being made by the Greene-Cananea Copper Co. The necessary equipment has been ordered, and within the next three or four months the ores of the Elisa, Capote, and intermediate properties will be handled by electric traction. New ore bins are being constructed at the Capote mine, and from these bins the ores will be conveyed to the smelter by rail. The tunnel connecting the Elisa and Capote properties will be the route of the electric ore trains, and when an extension of this tunnel to the Henrietta mine is completed ores from the latter will be delivered also at the Capote bins. As further underground connections are made the electric haulage will be extended. The Greene Cananea is now operating 6 of its 8 furnaces, and it is stated that the ore now being smelted is 25% richer than the greater part of that handled last year. The officers of the Lucky Tiger Combination Gold Mining Co. are anxiously awaiting the decision of the Southern Pacific directors in regard to the building of the projected line into Douglas and along the Bavispe river in Sonora. Such a line would give the company's rich El Tigre mine transportation facilities. If the Southern Pacific decides to postpone construction, it is stated that the Lucky Tiger may undertake the building of an electric line to connect with the Nacozari railroad. Power plans under consideration include a hydro-electric installation on the Bavispe river, or the erection of an oil-burning power-plant at either Izabel or Douglas. The capacity of the concentrating plant at El Tigre is to be increased from 100 to 250 tons daily. A zinc-separating plant similar to that in successful operation at the properties of the Calumet & Arizona Co., near Cananea, will be installed by the Santa Fe Mining Co., owning mines in the same section. The ores are similar to those of the Calumet & Arizona.

The Amparo Mining Co., the only American mining concern of the State of Jalisco now on a dividend basis, earned profits of ₱668,537 in 1909. The company's total revenue was over ₱1,500,000. The 50-stamp mill was in commission 344 days, crushing 63,398 dry metric tons of ore, which yield concentrate and bullion to the value of ₱1,400,017. High-grade ore shipped netted ₱44,048. The cost per ton of ore mined, milled, and marketed was ₱11.24. The ore in sight above the 700-ft. level at the close of the year was estimated at 360,000 tons, and the probable ore below that level at 350,000 tons. The company has ordered equipment that will increase its reduction capacity 1000 tons monthly. The Cinco Minas Co. (Marcus Daly interests), is preparing to ship high-grade ore from development work in the old Cinco Minas in the Hostotipaquillo district. It is expected to market about 100 tons monthly. A wagon-road to give the mines connection with the Southern Pacific is being built. A 25-ton experimental plant is in commission at the mines of the Regina Mining Co., in the Ameca district. This company is a recent re-organization of the Philadelphia Copper & Gold Mining Co. The Chapala Hydro-Electric & Irrigation Co. will be unable to deliver power to mining concerns of the Hostotipaquillo and Etzatlan districts until late in the year. This is a result of the recent agreement with the Guanajuato Power & Electric Co. for a division of territory, a clause providing for an exchange of power in emergencies, making necessary changes in voltage plans and equipment.

The Robert S. Towne interests have added to their extensive holdings in Mexico by leasing, for a period of 15 years, the properties of the Compañía Minera Lead Queen y Anexas in the Asientos district of the State of Aguascalientes. A royalty of 2½% of the gross value of the ore extracted will be paid the owning company. The lease is with the Mexican Metallurgical Co., the Towne concern operating the San Luis Potosí custom smelter, and the products will be shipped to that plant. A concentrating plant may be erected. Walter M. Brodie, engineer for the Batopilas Mining Co., estimates that the Batopilas mines in Chihuahua have produced 25,000,000 oz. of silver in the last 30 years. The workings have a total extent of about 76 miles, inclusive of the stopes. Mr. Brodie reports that at the 100-stamp mill and concentrating plant, where direct water-power is used, crushing and concentrating is carried on at a cost of 80 centavos per ton. The mines of the Palmarejo & Mexican Gold Fields, Ltd., of London, at Chinipas, in the Arteaga district of Chihuahua, are to be immediately equipped with machine drills. A new reduction plant with a capacity of 300 tons daily is planned, and construction may be started before the end of the year. Unwatering is in progress at the mines of the Parral Consolidated Mining Co., in the Parral district. The company's new concentrating plant, recently completed, will not be placed in commission until the unwatering is finished. The Mitchell Mining Co., a copper concern widely advertised a few years ago, which operated through subsidiary companies in the State of Guerrero, is in the hands of a receiver, Joseph F. Schwab having been appointed by a New York court. The appointment resulted from a suit brought by Frederick Cuthbertson in October, 1908, to recover $57,800. The subsidiary companies are the La Dicha Mining & Smelting Co. and the La Dicha & Pacific Railroad Co. Copper properties were acquired, a 200-ton furnace and 25-ton converter erected, and some copper produced. An 83-mile railroad to give the properties connection with the Pacific port of Acapulco was projected, and some materials purchased. Operations were suspended more than two years ago. The Mitchell Mining Co. was organized in 1902 with a capital of $5,000,000, and later this was increased to $8,000,000.

Part of Jalisco, Mexico.

The full text of the Supreme Court decision in the San Juan Mining Co. case, which has just been made public, shows that, contrary to general opinion, the Court went into the merits of the case fully, and that there is little possibility of further litigation. Juan Baigts, a Mexican, former owner of the San Juan mine in the Taviche district of Oaxaca, recovered possession of the property by suing the San Juan Mining Co., an American concern, in the Third Civil Court of Oaxaca. He based his suit on a clause

in the original contract of sale which provided that in the event a deal for the Escuadra mines, also in the Taviche district, was not carried out, the San Juan contract should not hold. The Escuadra deal failed, but the San Juan company, which had taken over the property from the men originally concerned in the negotiations, was in no way connected with it. The Supreme Court holds that the Oaxaca court, in returning the mine to Baigts, infringed Article 14 of the Constitution of Mexico, which deals with legal rights. The San Juan is the principal producer of Oaxaca.

BISBEE, ARIZONA

Railroad Extension to Gulf of California.—Gold at Altar and Quijotoa.—Ore Developments in Bisbee Mines. — Life of Mines.—Ore Shipments.—C. & A. Report.—Geological Work at Bisbee.—Copper Queen Benefit Association.

Within the last few days it has been rumored that the Sandoval-Henderson concession for a railroad across northwestern Sonora would be utilized by the El Paso & Southwestern giving it an outlet to the Gulf of California. The road will be constructed by a separate corporation, which, however, is said to be financed by Phelps, Dodge & Co. The terminus will be Puerto Lobos, on the Gulf, and the route will be by way of Caborca and Altar, Sonora, to Tucson, Arizona. The district of Altar is becoming celebrated for its placers, many of which contain gravel yielding more than $1 per cubic yard. There are also numerous quartz mines in the vicinity of Caborca which will become profitable when better transportation facilities are available. Farther west, between Caborca and the Gulf, are many partly developed copper deposits which are remarkable for their gold content. There has been an active movement of prospectors into the region through which the road will pass, and preparations are being made for the development of a town at Puerto Lobos, now called La Libertad. Reports of valuable placer discoveries at Quijotoa, 80 miles west of Tucson, have resulted in attracting many people to that district. Important locations of rich ground are said to have been made by a syndicate headed by S. W. Purcell, of Tucson. Quartz veins of great promise are also being developed in the same district.

Mining operations are active throughout the Bisbee portion of the Warren mining district. The Copper Queen is shipping to its smelter at Douglas about 2400 tons of ore per day that will average higher than 6% copper. The shipments in March reached 51,400 tons. The mixture of oxide and sulphide ores brings the average composition to approximately 18.5% silica, 9.3 alumina, 27 iron (metallic), and 17.5 sulphur. Recent developments of sulphide ores have been made in the bottom of the Sacramento shaft at a depth of 1700 ft. On approximately the same horizon a large stope of oxidized ore has been opened, containing considerable copper glance associated with the oxidized material. Development in the Copper Queen mines is proceeding at the rate of 5000 ft. per month, and the proportion of ore revealed per foot of development is somewhat greater than in past years. This is undoubtedly due to a better understanding of the geology of the district. Following the year's work by J. M. Boutwell, beginning in the autumn of 1908, a geological department was organized under the direction of Eugene M. Sawyer, aided by A. Notman, and M. J. Elsing, which has since continued the critical study of the Copper Queen holdings, with results that have proved highly advantageous. A detail survey of the whole area owned by the company has been made, and new workings are planned in view of the geological indications. The extent of the porphyry intrusive is much greater than was originally supposed. No general alignment is yet recognizable, but the trend of the orebodies in a southeasterly direction is a marked feature, with an important chain of small orebodies in a southwesterly direction as revealed by the workings from the Cole shaft of the Superior & Pittsburg company. While no large orebodies are yet reported from the Denn-Arizona, the most easterly mine in the group, significant discoveries of sulphide ores have been made, and active development is proceeding. For a time driving was done southward from the Denn shaft, but the larger work is now being conducted in the opposite direction, following near the Dividend fault.

To the west of the more northerly Copper Queen holdings great bodies of oxidized ores have been developed in the mines of the Shattuck-Arizona. At the present time this company is shipping 200 tons of oxide ore per day that averages 17% copper, and the quantity of lower-grade ore revealed is very great. Joseph Walker, the superintendent, is pushing development at these mines with great rapidity, and in a few months arrangements will be complete for making much larger shipments.

The Calumet & Arizona and the Superior & Pittsburg are adding immense bodies of ore to their reserves. These companies, which are operated by the same staff under the general management of L. W. Powell, also organized a geological department, originally under direction of W. B. Gohring, who has now become mine superintendent, he being succeeded as geologist by Ira B. Joralemon, aided by F. De Wilde and J. S. Olmstead. Development operations have been remarkably fruitful in these mines, and the amount of ore now known is greater than at any period in their history. The great mass of primary sulphide ore in the Oliver shaft of the Calumet & Arizona has been so far proved in an area 150 by 150 ft. on the 1350-ft. level. This extends up to the 1200-ft. level, and a drift at 1450 ft. has

Greene-Cananea Concentrator.

nearly reached the point where it should cut the orebody. In the Irish Mag the new development has been so successful as to leave that property potentially as important as it has been in the past. Extremely valuable developments are being made in the lower levels of the Junction mine, a Superior & Pittsburg property. A rich sulphide body, averaging about 10% copper, has been explored on the 1450-ft. level for a distance of 200 ft., with a width of approximately 65 ft. This orebody is unique, so far as this district goes, in having well defined hanging and foot-walls. The dip of the vein averages about 40 degrees. It has been penetrated by a drift on the intermediate level 50 ft. below, and it is also being explored on the 1300-ft. level. This ore consists of an extremely fine-grained compact sulphide of iron with chalcopyrite, rich in chalcocite, near the footwall where it will average 20% copper, the grade diminishing to about 6% toward the hanging wall. The work at the Junction shaft is under the superintendence of J. C. Collins. One of the largest bodies of oxidized ore today available in the Bisbee mines is in the Hoatson shaft of the Superior & Pittsburg. Recent work in the Biggs has shown extensive bodies of sulphide ore. Altogether the outlook for a long and prosperous existence of the Bisbee mines is better today, as judged by proved orebodies, than at any period in the past. Furthermore the work is being directed in the light of known geological relationships that render development less a matter of chance, and the discoveries of large masses of rich sulphide ore in the deepest levels yet reached increase the prospects for the continuance of mining here to much greater depths. There is no question that these lower ores represent primary sulphides. This fact, and the high copper content found, are full of significance for the future of Bisbee. It is interesting to note that in some of these deeper ores gold is found to the extent of 0.15 oz. per ton.

MANILA, PHILIPPINE ISLANDS

Lode Mining in Benguet District — Report by Division of Mines —Bua Mining Co —Benguet Con — New Properties —Oil Drilling

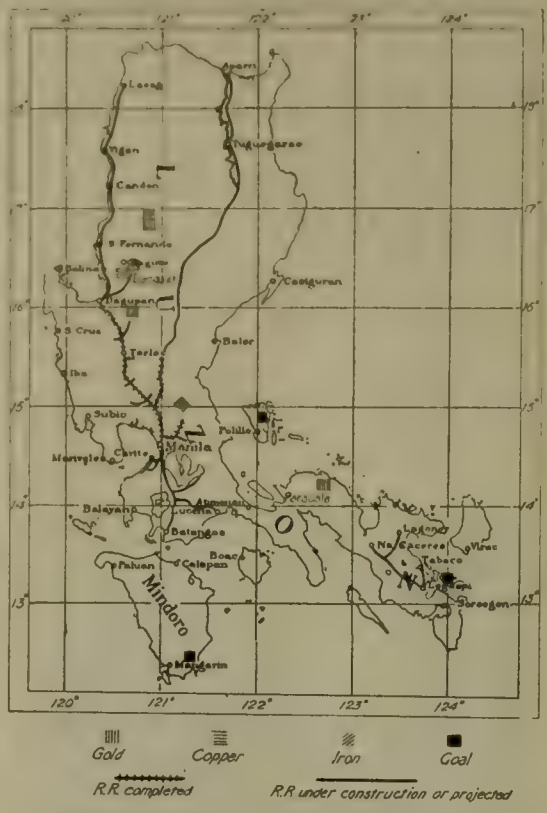
At present the production of gold in the Philippines comes principally from the Benguet district where lode mining is carried on and from the Paracale district where dredging operations have proved successful. During the coming year lode mining should bring returns in Paracale and dredging will be further developed. The third gold mining district is Masbate in which development work has been going on steadily and there is reason to believe that it will soon rank as a producing camp. An account of the dredging operations in Paracale was given in a recent article in these pages. Additional information regarding the Benguet district is now available. F. T. Edding field mining engineer of the Division of Mines, has just returned from a short trip to Baguio, where he investigated the mineral districts to note particularly the progress in the work of mining and development. The following report has been given out by the Division and is preliminary to that which will appear later in the Mineral Resources.

Although Benguet was the first district to begin successful mining and is, perhaps the most widely known of the Philippine mineral districts little has been published up to the present as to the character of the deposits and of the work that has been done there. The mineralized district extends from the headwaters of the Antamok, on the north, to the headwaters of the Batwaan on the south, and from camp John Hay and the Bued river on the west for a distance of six miles to the eastward, thus comprising an area of about 45 sq. mi. The majority of the deposits are quartz veins, varying from 1 to 30 ft. wide, and in one case reaching 47 ft. They appear, for the most part, to be true fissure veins in andesites. Toward the south and west are reported contact deposits between andesite and diorite, and andesite and limestone. The classes of vein matter are white quartz veins, crystallized banded quartz, calcite, calcite and rhodochrosite, brown manganese and quartz, material which appears to be mineralized andesite, and brecciated material. Most of the ore is about 50% free milling, but numerous veins are found which do not 'pan a color', but are high in telluride and kindred minerals. The veins have a general strike of east and west and a dip of about 60°, usually to the south. Most of the properties are easily reached by trail or wagon-road and are so situated that water-power can be utilized for running a mill. Labor seems plentiful and cheap, the average prices paid are:

	Per Day.
Common labor	₱0.70 to ₱1.00
Miners	1.30 " 1.70
Native carpenters	1.70 " 2.50
Japanese timbermen	1.70 " 2.50
Japanese carpenters	3.00 " 3.50
	Per Ft.
Contract labor:	
Prospect pits	₱1.00
Driving	5.00
Timber:	
Posts, 7 by 1 ft.	₱0.70 each
Lagging, 2 to 3 in. by 12 ft.	0.10 "
Sawed lumber	₱45 per 1000 ft.
Mining and milling	₱5 to ₱8 per ton.

Filipinos from other provinces are preferred to the Igorots for miners and millmen. They are steadier and better workmen. Japanese are used as timbermen in some mines on account of their greater strength and adaptability. The companies now existing are the Antamok Valley Mining Co., Madison Gold Mining Co., Bua Mining Co., Benguet Consolidated Mining Co., Igorot Mining Co., Muyot Mining Co., Major Mining Co., Copper King Mining Co., Camore Clayton Co., and Kias Hill Gold Mining Co. In addition the prominent groups of claims are: the Ebert, Topside, Vicente Volpiedad, Lorenzo Pau, McElroy, Calvin Horr, Murphy, Missionary, and McDill.

The only companies at present producing are the Benguet Consolidated and the Bua. The Bua is working two veins at Gonock, one a quartz vein 1 to 3 ft. wide, the other a rhodochrosite vein 3 to 5 ft. wide, striking N. 10° E. and dipping 65° to the south. The veins have been opened up by drifts for a length of 500 ft. and have been cut 100 ft. below by a tunnel 600 ft. long. They are working 54 Filipino miners, and 7 Japanese timbermen and produce about 20 tons per day. The ore is mined by the system of overhand stoping, filling with waste broken during mining. The stope extends the entire 500 ft., and has ore chutes every 30 ft. The ore is dumped into a bin near the mouth of the adit, from which it is trammed for a distance of about one kilometre to a second bin, which feeds into a two bucket gravity aerial tramway, stretching across the Antamok valley to the mill. The mill is run by a waterwheel with a rope drive. It consists of six stamps with two copper plates. The tailing is cyanided, in six sand leaching tanks,



Map of Northern Portion of Philippine Islands, Showing Location of Benguet District.

and then dumped into the river. The average value of the ore is said to be ₱14 per ton.

The Consolidated sustained severe losses in the cyanide plant during the baguio last fall and in consequence has reduced its output until the plant can be refitted. They had been working a good strong lode which is said to run ₱30 to ₱200 per ton. The lead was opened up on four levels 50 to 90 ft. apart, the lower levels being reached by a small incline shaft with a skip and an underground station. The usual feed of the mill was 20 to 25 tons per day. The ore was fed to a crusher, then to stamps and amalgamation plates. The tailing is classified and leached by a sand and slime leaching plant. The leached slime was filtered in a Ridgway vacuum-filter. The introduction of a vacuum-filter was a pioneer step in the Philippines and will, undoubtedly, lead to greater activity along the same line.

The Camote is one of the largest ore deposits in the district. The vein is manganese and calcite and is said to be 47 ft. wide. A large amount of ore has been developed and 1500 ft. of workings have been driven. It is said to 'catch ₱6.50 on the plates alone'. The company lost a 3-stamp mill in the landslide last fall but will undoubtedly erect another mill in the near future.

The Headwaters have put in 3000 ft. of drifts and adits,

showing four veins which run generally east and west, and dip 45°. They are working 44 men in the mine, 21 on road construction, and are preparing to install a 10-stamp mill of 1000-lb. stamps, tube-mills, a cyanide plant, and a filter-press. The Muyot is said to have 2400 ft. of drifts, adits, and raises, in a vein 4 to 20 ft. wide and averaging ₱6, and is at present working 60 Filipinos and two white men. The Madison has about 1000 ft. of work on two veins which are claimed to be the same as the Bua. The Topside has 500 ft. of work on two veins. The Copper King has 2000 ft. of work on four veins, varying from 2 to 10 ft. This ore contains lead, copper, and considerable free gold.

The Kelley group, on the north slope, has four veins: No. 1 running east and west and stands vertical; No. 2, N. 60° W., dipping 60° north, No. 3, S. 60° W., and No. 4, N. 34° W. If these directions are maintained the veins will all intersect. The intersection of No. 3 and 4 has already been opened. The outcrops of these veins are well marked. No. 1, particularly, shows as a strong high dike on the bank of a stream. Two thousand feet of driving has been done on the veins which vary from 4 to 10 ft., and are said to run ₱12 to the ton. They carry no free gold but are rich in tellurides. On the south slope Mr. Kelley has cut four more veins with 1500 ft. of workings. These veins run generally east and west and are from 2 to 16 ft. wide. About half of the gold in this group is free milling.

The Major Mines Co. has discovered a large number of veins on its property. The No. 3 vein on the Low Potential claim is most unusual. It is made up of bands of crystallized brittle quartz, separated by horses of andesite, and having a width of 4 to 10 ft. Most of the veins on this property pan high. When in full operation this company should be one of the largest producers in the islands. The Antamok Valley M. Co. has perhaps the largest holdings in Benguet with a large number of adits cutting some promising veins. Lorenzo Pau is working 12 claims; the Vicente Volpiedad, six claims with two or three good leads. Brown & Peterson are developing some ground. Calvin Horr has done a great deal of work proving up several good leads, one of which is 8 ft. wide, and is said to carry ₱8 in gold. The Camote Clayton, McElroy, McDill, and the other properties all have more or less work done. One company alone claims to have cut 132 different distinct veins on one group of claims; a most remarkable record. Some mills are already being erected in the southern part of the district.

The great number of veins, their uniform direction and their dip are significant facts. A peculiarity of the district is that the veins often occur in groups of four. The Division of Mines will have a party working in this field during April, May, and June, and the character of these deposits will then be carefully studied and the veins mapped. The geological map published in 1906 by the Division will also be carefully revised by W. D. Smith, Chief of the Division, and extended to the east and north.

The oil situation has not changed greatly. The Bahay Valley Oil Co. is drilling and one other company is about to begin but it is too early to report results.

LONDON

Oil Speculation Follows Rubber.—Anglo-Maikop.—Oran Oil Co.—Newfoundland Oilfields Co.—Trinidad Oilfields.

The London speculative market is at present absorbed in rubber-shares with oil as a good second, and large amounts of capital are being readily subscribed. The Commonwealth Oil Corporation has been before the public for some years and its fortunes have been unfavorable so far. This company owns property in New South Wales, 100 miles to the northwest of Sydney. The exploitation of the oil-shales proceeds slowly and the more recently discovered coal seams receive the greater share of attention. Another company owning shale lands in the same district has been floated recently, the Australian Oil Co. The Maikop district of the Caucasus is especially in fashion. It suddenly sprang into note last autumn, and already several companies have been floated successfully. This week the Maikop Midland Oilfields was introduced to the public. It has been formed as a subsidiary of the Anglo-Maikop Corporation. The Maikop district is situated toward the western end of the Caucasus about 50 miles from the port of Tuapse on the Black sea, and is at the opposite end of the Caucasus from Baku which is on the Caspian sea. Boverton Redwood and A. W. Eastlake have reported favorably on the properties acquired by the Maikop Midland and will act as technical advisers to the company. The capital is £157,500 divided into 150,000 ordinary shares of £1 each and 150,000 deferred shares of 1s. each. Of these shares, 100,000 ordinary and 20,000 of the deferred are offered for public subscription, the remainder going to the Russian owners together with £20,750 in cash, and to the Anglo-Maikop Corporation, which has guaranteed the success of the present issue. The Maikop Oil Proprietary is another of the recently formed companies. Paul Dvorkovitz, well known in connection with the Russian oil industry, is managing director and technical adviser. The capital is £252,500, divided into 250,000 ordinary shares of £1 each, and 50,000 deferred shares of 1s. each. Of these 125,000 ordinary and 12,500 deferred are offered for public subscription. The whole issue is underwritten by the promoters. The International Maikop is the third during the week. The properties acquired were selected by the representative of J. S. Bergheim, one of the board, and the prospective managing director. Mr. Bergheim is chairman of the Nigeria Bitumen Corporation. The capital of International Maikop is £83,000, divided into 320,000 ordinary shares of 5s. each and 60,000 deferred shares of 1s. each, of which 160,000 of the former are offered for public subscription. This issue has also been underwritten. The fourth company is the Maikop Premier Oil Syndicate. Thompson & Hunter are the engineers and the commercial part of the business is in the hands of Matheson & Co. The syndicate has a working capital of £19,000. The oil deposits in North Africa are represented in London by the promotion of the Oran Oil Co. which has been formed for the purpose of acquiring the petroleum lands and works in Algeria belonging to the French company Societe Anonyme des Mines de Petrole d' Ain-Zeft. This property is about 70 miles east of Oran and 15 miles from the Mediterranean coast, and is on the line of railway connecting Oran and Algiers. It has been worked so far in a small way only. There are eight wells, but only two are being pumped at present. A refinery has been built with a capacity not greater than 500 barrels of crude oil per month. Boverton Redwood, William Topley, and M. J. Stephan are all of opinion that with additional capital the output could be greatly increased and a profitable business established. The object of the present flotation is to raise the funds required. The capital of the new company is £175,000, of which £55,000 in shares is alloted to the promoters together with £30,000 in cash, while 120,000 shares are being offered for public subscription. The promoters pay £48,000 in shares and £24,000 in cash to the French vendor company, and they guarantee the subscription of 80,000 of the shares offered to the public. Newfoundland has supplied another investment in oil. The Newfoundland Oilfields Co. has been formed for the purpose of acquiring and developing oil-bearing land on the northwest coast of Newfoundland near Parsons Pond. The commercial agents for the sale of the products are Meade-King, Robinson & Co. oil merchants, Liverpool, one of the partners of which firm, William Smellie, is a director of the company. Boverton Redwood and J. D. Henry have reported on the property and made suggestions for its development. As far back as 1812, Mr. Parsons, who gave his name to the district, discovered the existence of oil in the locality, and a well was first sunk in 1867 by Mr. Silver of Halifax. Subsequently in 1895 the Newfoundland Oil Co. commenced drilling and provided some machinery. It is for the object of extending the operations thus begun that the present flotation has been undertaken. Mr. Henry estimates that £40,000 will be sufficient to put in order and equip six of the present wells and to drill six others, besides providing a power-house, a pipe-line, and storage tanks. The oil yields on refining, 18% benzine, 38 kerosene, and 41 of heavy oils and paraffin wax. The company starts with excellent

economic conditions, for the position on the sea coast gives easy communication to the world's markets, and the Government is providing a protective import duty. The capital of the company is £200,000, of which £77,400 in shares and £17,800 in cash is the purchase price, and £12,200 represents commissions and cost of forming the company. The 80,000 shares now offered to the public have been underwritten and 42,600 shares are held in reserve. The present flotation will provide £50,000 as working capital. The Trinidad Oilfields is the name of a company formed to acquire oil lands in the Guapo and La Brea districts of the Island of Trinidad. There are three wells in operation that 'struck oil' at depths of 712 ft., 672 ft., and 520 ft., respectively. The oil has an asphalt base and leaves little paraffin wax residue, so that it is specially applicable as fuel. The deposits are close to the sea, and the oil will therefore be cheaply exported to the neighboring islands in the West Indies and to parts of South America. Reports on the property and on the oil produced have been made by Thompson & Hunter, and by Boverton Redwood. The prospectus of the company offers 175,000 shares of £1 each to the public. These have been underwritten at a commission of 6% together with a call on 40,000 shares. The vendors receive £85,000 in shares and £68,000 in cash. With the working capital obtained by this flotation, approximately £100,000, it will be possible to erect a plant that will produce 3000 tons per month at first, and 6000 tons within two years. The cost of producing will not be more than 15s. per ton and may easily be much less. The directorate is composed of sound business men.

NEW YORK

Copper Situation.—High Cost Producers Must Curtail.—Surplus, and Producers Assn. Figures. — Silver Market Improves. — Canadian Minerals.—Market Conditions.—Mason Valley.

The copper situation is an absorbing topic of interest. The underlying tone is optimistic, but the prevailing impression is that some time will be required to put the metal market in better position. It is evident that the high-cost copper producers must prepare for a period of lean and diminishing profits. In the present unorganized state of the industry curtailment by agreement is out of the question. The Calumet & Hecla, which recently cleaned up its unsold metal at 13c. and makes a satisfactory profit at that figure, would hardly agree to any policy of curtailment, though for some time this company has not been crowding production. The new low-cost porphyries, such as Utah and Nevada Con., could hardly curtail to any marked extent without cutting off their dividend payments, which have but just begun, and the shareholders who have struggled through the earlier years of development, would not endorse such a policy. Amalgamated Copper, with a large surplus and a low dividend rate, is prepared to worry through a lean period and can very calmly see its high-cost competitors go out of commission for the time being. It is plain that consumption is more difficult to tabulate than is production. It has been claimed that consumption was increasing and was overtaking the output, but, going back over the figures of the past fifteen months, or since January 1, 1909, it is seen that production is running about 10% ahead of consumption, a condition which the users of copper understand perfectly and do not propose to alleviate unless compelled to. The selling agencies state that the demand for wire bars used by power-transmission companies is hardly one-half what it should be, and this item alone if brought up to normal would turn the scale between producer and consumer. It is deferred business such as this which must come to market in time that gives the copper statisticians an optimistic tone in spite of the momentarily discouraging position. The annual report of Aron Hirsch & Sohn of Germany estimates 1909 world output at 834,940 tons, as against 746,585 tons in 1908; 702,044 tons in 1907; and 741,654 tons in 1906. The increase in the world's accumulated stocks during 1909 is estimated at 64,000 tons. The figures of H. R. Merton & Co., of London, for the year's production are 839,300 tons. Greene-Cananea is one of the high cost coppers which is being forced to a policy of curtailment. The output for the quarter ended March 31 was 10,780,000 lb., as against 11,952,000 for the same period a year ago. Copper costs are about 10½c. per pound, on which basis the management prefers not to push production. Some of the old stockholders of the Greene Consolidated Copper Co. are again threatening litigation, claiming that there has been no proper accounting by the present management of the cash with which the Greene Cananea started operations. The position of Granby is now well known, its copper costs admit of practically no profit on the present market. The Rio Tinto of Spain, the oldest and one of the most important copper mines of the world, is now working by the open-cut method and the magnitude of its operations is noteworthy. In 1909 twelve steam shovels of the largest capacity, 50 locomotives, a thousand wagons, and several thousand men were employed in the removal of the overburden. Seven million tons of hard rock requiring drilling and blasting were removed. This is an engineering operation of greater magnitude than is involved in any one section of the Panama Canal work. Speaking of the metal situation, the chairman of the Rio Tinto board said at the recent annual meeting: "The future of the copper market rests entirely in the hands of the large American producers, and I am confident that consumption would in no way be harmed if moderately higher prices were obtained by the regulation of their output." The furnaces of the British Columbia Copper Co. smelter are being enlarged to admit of the handling of the ores from the New Dominion Copper Co. The contract is being arranged and work on the new basis is expected to begin shortly. So far as the public is concerned, the copper surplus and the postponement of any possible merger has worn out the enthusiasm prevailing for a year or longer and a new interest is being sought. The International S. & R. Co. is pressing its position in the smelting industry. The new Utah smelter, to be blown in by June 1, is expected to show such an increase in earnings as will permit of the dividend rate being advanced to 10% soon thereafter. In addition it is expected that an announcement will soon be made of plans for the erection of another smelter and refinery, in preparation for which, treasury stock will be issued and valuable rights offered to the stockholders. The Mines Company of America, operating the Creston and the Colorado mines, at Minas Prietas, Sonora, Mexico, earned $63,111 for the first quarter of 1910. Dividend requirements were $60,000, so that only a nominal amount was carried to surplus. In view of the declining earnings it is evident that unless some of the new territory now being prospected develops into producing ground the profit earning days of the Mines Company will soon terminate. The properties made a great deal of money for those who took them over when the present company was formed.

Smelter, Greenwood, British Columbia.

T. L. Livermore has announced his intention of resigning as the chairman of the Copper Producers' Association. It has been rumored that the Association itself would dissolve, on the theory that the monthly figures given out are being

used unfairly for speculative purposes. It is not believed that such a step will be taken, however, as the immediate conclusion would be that the copper surplus would become so burdensome that figures could no longer be given out. The public has been quick to grasp the value of the statistics gathered by the Association, and as they are by far the most valuable figures ever collected in the history of the copper industry, it is to be hoped they will not be discontinued. The basis for the somewhat mysterious recent decline in North Butte is shown in the annual report of the company, now in press. Ore reserves are figured at 822,200 tons of an average copper content of 41/4%, or 85 lb. of copper per ton; a total copper output of 69,887,000 lb. On a 13c. copper market, figuring costs at 9.78c., the average for 1909, the profit per pound would be 3.22c., or a total profit of $2,250,361, equal to $5.62 per share upon the company's capital of $400,000.

The situation in silver is fully as interesting as is the copper metal market. When the Indian Government recently placed an import duty of 5 to 15% upon all silver brought into India, it was anticipated that such action would greatly restrict the buying from that country, which is one of the heavy consumers of the white metal. Oddly enough the enactment seems to have stimulated buying. China, probably the largest user of silver in the world, has also been in the market. These demands, coupled with an announcement of the Canadian Government, that some 7,000,000 oz. of silver will be used in the coinage of new silver dollars, have combined to put the price of silver up to a higher level than has been reached for many months. Quotations at 53 1/2c. have been recorded and further advances are hoped for. While Cobalt properties have been able to produce silver so cheaply as to make enormous profits even at low prices, each advance in price adds just so much to net earnings. The silver camps of Mexico will feel the stimulation of an advancing silver market much more keenly. The leading Guanajuato producers have long felt the need of more margin between gross returns and operating expenses. Every fractional advance in silver above the present market will insure something above the 'swapping of an old dollar for a new one' for Guanajuato, Zacatecas, and many other gold-silver camps of Mexico, whose large bodies of low-grade ore will be developed into big long-lived producers if conditions will but reasonably insure any profit commensurate with the size of the undertaking. The Nipissing Mines Co. shows in its annual report a production for the year 1909 4,646,877 oz. of silver, for which an average price of 51.547c. per ounce was realized. Costs, estimated per ounce, as copper costs are estimated per pound, were 16.39c. per ounce. Total profits were $1,644,869, of which the shareholders of the Nipissing Mines Co., the holding company, received $1,500,000 in dividends, the treasury retaining a surplus of $1,543,989. If, in addition to the tremendous earning power, on comparatively small investment, Cobalt could add the element demonstrated ore reserves, proving a definite era of production for its mines, the camp would be the wonder of the world. Nipissing figures ore in sight at 6,539,200 oz., or a life of some eighteen months at the present rate of production. The large territory of this company gives it a commanding position, and its known ore reserves are not to be taken as defining the property's productive limits, but the element of uncertainty has proved of enough weight to rob Cobalt of its public following. There is a renewal of the rumor of a large Cobalt consolidation, not denied by the representatives of the various companies supposed to be interested, the reply being that as yet there has been no attempt to work out any details.

Andrew Friedman and Julius A. Lewisohn have been added to the board of directors of the Miami Copper Company.

The total mineral output of Canada in 1909 was a little over $90,000,000, an increase of over $3,000,000. The silver output was 27,878,000 oz., valued at $14,358,310, of which nearly $13,000,000 was the output of Cobalt mines. The gold production amounted to $9,500,000, a slight decrease as compared with last year. The output of the Yukon district, however, was $3,960,000, which was an increase of $360,000. The Sudbury nickel deposits yielded 28,845 tons valued at $3,913,012. Pig iron amounted to 757,162 tons estimated at $9,581,955, being an increase of 20%. The coal output showed a slight decrease, being valued at $24,431,351.

The markets of the East have been featureless. The attack by the Government upon the participants in the cotton pool has counteracted in part the effect of the postponement of the decision in the Standard Oil and Tobacco Trust cases. The avowed intention of the Department of Justice to stop trading in futures is something of a facer for the speculators, who are now all up in arms proclaiming themselves as wholly legitimate and as engaged strictly in the merchandising of staples. A collapse of London's rubber boom is predicted almost hourly. Inasmuch as the demand for crude rubber is largely due to its use in automobile tires the financial paragraphers have become fixed in the habit of referring to the expected denouement as a 'puncture'. Seriously, however, the expected crash is an unsettling element.

It is reported here that the North Butte Co. has reached the Edith May vein by diamond-drill at a depth of 2800 ft., some 600 ft. below any of North Butte's present workings. The drilling was done from the Diamond shaft, and the core showed high-grade ore. The width of the vein is estimated at 45 ft. It is believed here that negotiations now under way for the absorption of the Clark properties at Butte, will be carried through. There is more stress being laid upon the apex controversies at Butte and the fact is that welding the properties into one ownership will eliminate all of these questions. The statement is made that the Amalgamated has existing disputes over vein ownerships with nearly every independent operating company in Butte, and there is no doubt that apex questions are responsible for the surprising action in leaving North Butte out of the consolidation.

The death of Thomas F. Walsh, the foundation of whose fortune was made in the Camp Bird mine at Ouray, Colorado, has called attention to that property and its enormous production. The Walsh estate is estimated at some $8,000,000 to $10,000,000, most of which was accumulated from mining ventures in Colorado. The British Columbia Copper Co. shows a net profit of $51,300 for March, as against $41,000 for February, the increase being partly due to lowered copper costs. British Columbia is improving in this regard, and must in the future be counted among the low-cost producers; March figures were 7.83c. per lb. for copper in New York; February costs were 7.88c. The fire at the mill of the Goldfield Consolidated had some adverse effect upon the reviving market in the Nevada stocks, but on the whole the disaster was viewed with greater philosophy than might be expected. The absorption of convertible bond issues put out by mining companies has made this a favorite method of financing. In many instances, the results have been most satisfactory, from both the standpoint of the purchaser and the company's treasury. The Mason Valley Mines Co. has added a new feature to its $1,000,000 bond issue just being offered to the public. The mortgage provides that the company is to pay annually to the trustee, as a sinking fund, 20c. for each dry ton of ore treated, the payments to be reduced proportionately as bonds are converted or redeemed. Some $400,000 of the proceeds of the bonds are to be used in the erection of a smelter of 800 tons daily capacity, which will handle the company's output and also do custom work. Joseph F. Schwab has been appointed receiver for the Mitchell Mining Co. This concern was at one time quite a bidder for market prominence in the East mostly through the efforts of George Mitchell, the promoter. The company's assets consisted of stock in the La Dicha Mining & Smelting Co., and the La Dicha & Pacific Railroad Co. Among mining engineers the La Dicha is a fund for a little reminiscence. When the property was first taken up by the Mitchell company one well known engineer reporting upon the ground which carries an orebody that is almost a blanket formation took his measurements for width on the dip of the vein with the result that gross value ran up to almost fabulous figures; an error of which the promoters were not slow to take advantage.

General Mining News

ALASKA

(Special Correspondence.) The Lon De Van Mining Co has purchased the Sea Level compressor plant and will install it on the company's property on Georges Inlet. The adit is now in 125 ft.——A 200 ft. shaft is being sunk at the Goodroe mine.——The Standard Alaska Co., at Thorn Arm, is opening a good body of copper ore.——The compressor plant at the H mine is running full blast and several stopes are being worked on the 150 ft. level.——The Suizer mine has added 14 men to its payroll.

Ketchikan, April 16.

ARIZONA

COCHISE COUNTY

The report of the Calumet & Arizona Mining Co., at Bisbee, for the year of 1909 has recently been mailed to the stockholders showing that the total receipts for the year amounted to $5,054,664. Dividends amounting to $800,000 were paid with a cash balance at the end of the year of $813,360. There were 27,630,950 lb. of copper produced at an average cost of 13.047c. per lb.——The California & Paradise Mining Co., operating the Leadville mine in the Paradise district, has completed the installation of a hoist, 30 hp. boiler, and No. 5 Cameron sinking pump. The shaft has been retimbered and development resumed.— The cross-cut on the 325 ft. level of the Centurion at Dragoon has opened a body of copper carbonate and red oxide ore.——At Courtland the diamond-drill in the Mamie broke into the old workings which are gradually being drained.

Globe, Arizona.

GILA COUNTY

(Special Correspondence).—The first churn-drill on the Live Oak property is in good sulphide copper ore at the depth of 180 ft. This hole will form a surface connection with the drifts on the 300-ft. level of the mine.——Work underground at the Miami is still confined to blocking out the ore above the 420-ft. level, and preparing the haulage level for the electric haulage system. All construction work is to be completed within six months and production should be commenced by the first of the year.——Churn-drilling continues on the Cordova property with various results. The three holes drilled have shown the existence of sulphide assaying less than 2% copper. The work is carried on by the Hovland & Smith interests, in conjunction with that at the Warrior and Live Oak properties.——The Warrior Development Co. is shipping the usual 100 tons per day of 10% ore. No sulphide ore has yet been mined at this property and very little has been cut by the churn-drill.——At the 660-ft. level the National Mining Exploration Co. has opened an 8-ft. fault of gossan material, containing considerable specular hematite and a small amount of copper.——The work at the Arizona Commercial property, for the next few months at least, will consist of development work on the lower levels of the mine. The smelter force and most of the miners have been discharged and a large part of the office force will be discharged May 1. The smelter has been shut down as the water on the eighth level has been too heavy for the pump to handle and the development has fallen behind.

Globe, April 22.

MOHAVE COUNTY

At Needles 100 men are at work rushing to completion the big concentrating mill of the United States Smelting, Refining & Mining Co. The machine shops and warehouses are already finished, as are also the foundations for the big mill proper and an elevator trestle. Shipments of ore are being received daily for the smelter, which has been repaired and which will probably blow in during May.——R. F. Keith, consulting engineer for the Tom Reed mine, in company with J. H. Hobbs, spent several days at the mine inspecting both mine and new mill. He was very much pleased with the orebodies being opened on the Tom Reed claim, about 1500 ft. west from the main working shaft, and also with the mill. He stated that the Tom Reed would probably resume paying dividends in May. Mr. Keith expects to return in several weeks to make an examination of the Ruth mine in the Silver Creek district.

PIMA COUNTY

The shaft of the Twin Buttes Mining & Smelting Co. is now down 700 ft. and drifts have been started on the ore body. A good grade of ore is being opened and the company is figuring on erecting a smelter.——Shrote & Alford, operating the Golden Eagle mines 65 miles west of Tucson, have ordered a mill which will be installed at an early date.

PINAL COUNTY

The cross-cut from the bottom of the 200-ft. incline shaft at the La Coronado mine, 18 miles north of Florence, cut an 8 ft. orebody. Drifts have been started on the vein and a good grade of copper ore is being opened. B. Reed is superintendent.

YUMA COUNTY

The cross-cut north on the third level of the Yuma Consolidated property has opened a 3-ft. orebody containing a fair percentage of chalcocite and chalcopyrite. The company discounted the payment on its bonds by paying $23,000 which was not due till June. This leaves only the final payment of $23,000 due.

CALIFORNIA

BUTTE COUNTY

The Western Gold Dredging Co. has been incorporated at Oroville to work a portion of the ground on Thompson's flat which it has secured under lease.——The machine shops of the Natomas Consolidated Dredging Co., at Thermalito, have been completed and all the machinery is now installed giving the company facilities for handling any of the repair work on the dredges.

CALAVERAS COUNTY

Owing to the scarcity of water at the Little Daisy, near Mountain Ranch, the mill is only being run a portion of the time though good clean-ups are reported.——The last clean-up at the Moosehead is reported to be the largest in the history of the mine. There is a fair supply of water in the ditch and piping will be continued for the next two or three months.——A body of rich ore has been opened in the Mount King mine of R. B. Parks, near Hodson.

INYO COUNTY

The Loretta copper mine east of Bishop is being reopened under the management of J. G. Kirchen. The main shaft is down 400 ft. in commercial ore and two adits have been driven to cross-cut the vein. The mine was shut down about a year ago owing to a dispute among the stockholders of whom Charles M. Schwab is the largest individual owner.

NEVADA COUNTY

It is reported that operations are to be resumed at the Pine Hill mine in the lower part of the county. A good grade of copper-gold ore has been opened but the property has been idle for some time on account of litigation. It is close to the line surveyed for the California Midland railway and could ship the ore or build a smelter at a favorable

location.——Excellent headway has been made at the Birchville mine near Graniteville since operations were resumed at the property. The mine has been unwatered and the 10-stamp mill running for the past three weeks. Water-power is being used now, but as soon as the snow melts wood will be hauled in and the boilers fired up.

SHASTA COUNTY

The cross-cut on the 1000-ft. level of the Reid mine, at Old Diggings, opened a 12-ft. vein and is being driven to intersect a smaller vein that is known to exist beyond the main one. This gives the company 400 additional feet of backs.——The Balaklala Copper Co. has almost completed the railroad from the sawmill to the mine, a distance of a mile and a half. The company is now working about 500 men.

SIERRA COUNTY

(Special Correspondence).—Los Angeles capitalists have acquired the Twenty-three and Joker claims at Alleghany. ——Reports of a strike among the Alleghany miners are without foundation.——The Standard has made a clean-up of 1700 lb. of ore and shipped about 140 lb. of bullion to the mint. The tailing has been sacked for shipment to the Selby smelter. The new owners of the mine contemplate the early installation of a small mill.——The Black Warrior quartz claim which adjoins the Standard on the north, has been taken under bond by Davis & Richardson, of Monterey.——The adit of the Forest Queen has broken through the lava into bedrock. It is expected to cut the channel shortly.——The California gravel mine has been taken under bond by Nevada capitalists.——The Four Hills has suspended operations until supplies can be brought in.—— The Penberthy has cut a shoot of rich ore at a depth of 20 ft. Clyde Penberthy is superintendent.——The Caesar Mining & Exploration Co. is working on a 4-ft. vein and expects to install an electric power-plant this summer.

Alleghany, April 25.

SISKIYOU COUNTY.

(Special Correspondence).—Chase & Hicks have leased the water of the Scott Bar Hydraulic Mining Co., and are operating three giants on the upper channel. Water is delivered under a pressure of 300 lb. Several $25 and $30 nuggets, in addition to considerable coarse gold, have been extracted. It is planned to extend the 17-mile ditch 7 miles farther to increase the flow.——A number of rich discoveries have been made recently by prospectors in Quartz valley.——The Mono mine is opening good ore and paying regular dividends. The mine is equipped with a 10-stamp mill, but only about 20 tons of ore are being handled per day. T. M. Newcomb, one of the chief owners of the New Idria quicksilver mine, is president.——The Hathaway Mining Co. has placed orders for a new plant of machinedy with a San Francisco firm. The new management is arranging for more aggressive work.——Operations will be resumed shortly at the Plow Boy.——Several properties in the Blue Ledge copper district are receiving attention, but the distance from transportation and lack of reduction facilities is handicapping work. It is again rumored that the Blue Ledge Copper Co. is considering the installation of a smelter.

Yreka, April 23.

TUOLUMNE COUNTY

(Special Correspondence).—It is expected that complete operations will be resumed at the Shawmut mine between May 1 and 15. A new hoist has been installed and other improvements made.——It is reported that operations will soon be resumed at the Contention mine, in the Knight's Creek district, with A. C. Morrison as manager.——W. E. Booker and L. L. Coper, who recently secured a lease on a part of the Jumper ground, near Stent, have begun driving an adit toward a supposedly rich shoot of ore, which they expect to reach before long.——The Over mine, on Bald mountain, operated by Hamilton & Davies, and in which several small pockets have been found during the past year, a few days ago yielded $500.——Preparations have been commenced for erecting a mill at the Tarantula mine. A compressor and machine-drills were recently installed and excellent progress is being made in the development of the property. T. B. Russell is manager.

Tuolumne, April 25.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence).—Construction work has been put under way by the Conqueror Mining & Milling Co. in the building of a boarding house, and grading started for the new 100-ton mill.——The new compressor plant at Marshall-Russell adit on Miller mountain was started up last week. Two Rand compressors with a capacity of five drills each have been installed. One is to be run with electric and the other with water-power. O. N. Marihugh is manager.——From a shipment of one carload of dump matter from the Centennial mine to the Mizell mill at Idaho Springs, a saving of 45% was effected on the plates. The tailing gave 31%, making a total saving of 84%. David Kennedy, the manager, states that work on the new mill of 50 tons capacity will be started about May 1.——The United States Mining Co. has secured a five-year lease upon the Doves Nest group of eight claims on Bellevue mountain. A lateral is to be driven westward from the Newhouse tunnel, and as soon as the Central adit intersects the Bellman vein, another lateral is to be driven east to connect with the one being run from the Newhouse tunnel. The operating company purposes constructing a 500-ton mill to be built below the dumps of the Newhouse workings. H. B. Clifford, of New York, is manager.

Georgetown, April 23.

GILPIN COUNTY

(Special Correspondence).—A pool of miners has started work in the unwatering of the shaft on the Forks mine. The shaft is down 400 ft. and it is proposed to sink another 100 ft.——Sinking has been resumed on the Federal mine. ——The East Pewabic mine has been taken under bond and lease by the Gilpin-Hurricane Mining Co.——The Daisy mill in Gamble gulch has been started and the machinery is being fed ore from the Marine mine on Tip Top mountain.——The shaft on the Gold Flint mine has reached a depth of 400 ft. On the fourth level there is exposed a 12-in. streak of ore that mills $62 per ton in gold and silver.

Central City, April 22.

LAKE COUNTY

The installation of a 1200-gal. pump at the Wolftone shaft of the Western Mining Co. on Carbonate hill marks the commencement of a vigorous campaign to develop the lower horisons in that district. The Western Mining Co., which is controlled by the Guggenheim interests, owns or leases a group of claims, including the Maid and Henrietta groups. When these interests consolidated these different groups it had been demonstrated that the territory contained one of the largest sulphide deposits in the district. It had been traced continuously for more than 1000 ft. from the Maid and Henrietta to the Wolftone. For several years the company has kept a large zinc mill busy handling zinc sulphide. The installation of the large pump at the 1000-ft. level means that the company intends to carry on a more extensive system of development in the lower limestone, and the result will be increased shipments.——The early resumption of operations on the Long & Derry property by the Anona Mining Co. will mark a renewal of activity in a portion of the district which has been idle for the past year. Long & Derry hill was the scene of a gold excitement a few years ago, but as satisfactory results were not achieved there was a general cessation of operations.——A. E. Hanifen, owner of the Louisville, is working the property through the Yak tunnel and taking out a considerable tonnage of sulphide ore. The Louisville is one of many properties which are being successfully worked through the big bore that now taps a region three miles long from California gulch almost to the Mosquito range.

OURAY COUNTY

The Wedge property, north of Ouray, was the centre of considerable excitement recently on account of a rich find made in the mine. About six inches of brittle silver was cut which will run up into the hundreds, if not thousands, of

ounces per ton. This streak is in addition to the large amount of ore already blocked in the mine which will assay in the neighborhood of $200 per ton. The property is being worked under lease to F. M. Jackson and promises to be a bonanza for him.——The Wanakah Mining Co., operating the Bright Diamond mine, has purchased a new tram to be erected from the mine to the American Nettie mill, which it has under bond and lease. New mill machinery will be installed. The mill is under process of overhauling and will be equipped with machinery suitable for treatment of the ores. In putting in this tram it was decided to have it entirely new throughout. After the tram is in, a compressor plant will be installed. At present development is hindered by the fact that the ore being extracted has to be thrown away on account of lack of room to store it at the mine. The installation of the compressor plant means a relief in this particular and will enable the company to carry out its systematic plan of development. Arrangements have been made with the Colorado Smelter Co. to take care of the entire output of the property, concentrate as well as crude ore, and upon the early equipment of this property largely depends the blowing in of the smelter.

TELLER COUNTY

The orebody opened recently on the Trilby property on Bull hill is improving. The vein when opened showed a width of 1½ ft., but in being followed has widened and now measures more than 2½ ft. between walls with no decrease in value. The ore is at a depth of 1300 ft., and the shoot, believed to be the extension of the vein exposed on the level above, gives assay returns of from 1 to 11 oz. gold per ton. The Trilby is one of the steady gold producers, and ore is shipped both by lessees and on company account.——Machinery for the Camilla mine on Guyot hill has been ordered and will be installed upon delivery by F. B. Goetz and Denver associates, who recently secured a four years' lease on the property from the owning corporation, the El Paso Extension Mining Co.——A small but rich seam of sylvanite has been opened in the old vein exposed in the Christmas property, situated on Bull hill and operated under lease by George Potvin.

IDAHO

BOISE COUNTY

(Special Correspondence).—Announcement is made at Idaho City, in Boise basin, that the Woodburn placer properties have been sold by H. L. Woodburn to Charles Herrick, of Loraine, Ohio, for $125,000. The properties include the East Hill and Gold Hill groups, formerly operated by K. P. Plowman, which have been worked by Mr. Woodman during the last ten years. These placer holdings include 45 miles of ditches and flumes by which water for hydraulic work is delivered from More and Elk creeks.

Boise, April 23.

SHOSHONE COUNTY.

Machinery for the reduction of the tungsten and gold ores of the Golden Winnie property at Murray will be purchased at once. E. M. Smith, president of the company, has gone to Denver and Eastern points to place orders for a concentrator, Card table, rock crusher, and rolls. The new flume and ditch which carry the water to the mill-site have been completed. Sufficient ore has been blocked out to keep the reduction plant running for two years. The ore contains about 35% in tungsten and $18 in gold per ton. The Golden Winnie has been worked as a gold property since its discovery 18 years ago. It was learned only a year ago that large quantities of tungsten ore had been thrown away in the search for gold.——The management of the Capitol Mining Co. announces that a contract for 250 ft. of work has been completed at the Capitol mine in the Osburn district, the job having been started in November. The company has stopped work until after the annual meeting in July, at which time it is understood the purchase of machinery will be decided on and a compressor and other equipment added so that development can proceed more rapidly. The lower adit is in 300 ft. and will be driven 800 ft. more. When the vein is reached at a point under the orebody found in the upper levels a depth of 800 ft. will be available. The company has expended more than $30,000 on its work.——Galena ore has been cut on the Rosander group of claims, adjoining the Idaho Northern group in the Murray district. The claims are within three miles of the railroad, with which they are connected by a good wagon road and are traversed by three veins which have been prospected by more than 300 ft. of development work.

MONTANA

BROADWATER COUNTY

The introduction of new capital has created an interest in the Radersburg district, and the opening of some of the more prominent properties on an extensive scale promises to bring that district into public notice as one of the greatest gold producing portions of the State and possibly in the West. The three most prominent properties at the present time are those being operated by the Keating Gold Mining, the Ohio Keating, and the Black Friday companies, all of which are being equipped with electrically driven machinery for developing the ground at depth. The only handicap to the district at the present time is the lack of railroad facilities, the ore being hauled in wagons a distance of from 12 to 18 miles in order to be shipped to the smelters. Several proposals for the building of a railroad, to connect with the Northern Pacific railroad, probably at Toston, are being considered, and it is highly probable that the road to the Radersburg mines will be built during the coming summer or fall. This will greatly decrease the cost of handling ores and add materially to the profits of the mining companies.

NEVADA

ESMERALDA COUNTY

The Precious Metals lease on the Atlanta has, at a depth of 730 ft., reached the St. Ives vein, 370 ft. from the shaft. Some days ago a vein of promising looking quartz, alunite, and kaolinite was cut through, but this was not believed to be the main vein that was being looked for. The belief proved correct, and a few days ago the hanging wall of the main St. Ives vein was penetrated. A drift along the hanging wall, stripping the vein on that side, was run for some feet, and now a cut is being sent through the vein at two points, 40 ft. apart. From these drifts will be run to thoroughly explore the low-grade shoot that the vein proves to be at a point of exposure. The foot-wall has not been reached, although development has entered the vein for more than 20 ft.——Seventy stamps are steadily dropping in the Goldfield Consolidated mill, the temporary tramway from the railroad and crusher bins to the stamp-bins in the mill easily handling the 550 to 600 tons of ore per day that is being treated. In the meantime a big force of men is kept busy on the work of reconstruction, and as rapidly as equipment and supplies are received, everything is in readiness for them. The mill is steadily handling 70% of its full capacity, and at the same time reconstruction is being rushed as rapidly as is possible consistent with good work. In the meantime enough ore is being shipped to smelters to make up the 30% of the regular capacity of the mill, that is stopped because of the fire. The company is preparing a statement of the fire for the stockholders and will soon give out the date for the completion of the repairs.

NYE COUNTY

(Special Correspondence).—The Tonopah Extension management has decided to install coarser screens on the batteries and place the second tube-mill in operation. The sinking of the shaft on the Combination claim, 1500 ft. east of the main workings of the Round Mountain Mining Co. is well under way. The shaft has attained a depth of 20 ft. and will be sent to the 200-ft. level before lateral work is commenced. A hoisting plant is being installed. In the main workings of the company a winze is being sunk from the 800 to the 900-ft. level, 1000 ft. west of the shaft. The mill is running on ore from the Los Gabo and Great Western veins and is handling 120 tons of ore per day.——The Fairview is developing good ore in the west portion of the property. The main vein is 7 ft. wide with the ore averaging $12 to $15 per ton. Four raises are being driven to open

shoots exposed in the adit lateral workings. The mill is running steadily on ore extracted in course of development.——The Shoshone mill will soon be operating at full capacity, sufficient ore being guaranteed by lessees to keep the plant in operation.——It is expected to resume operations on the Sassy Sal lease on the Blue Jacket within a few weeks.——Edward Double, of Los Angeles, has made the final payment on the Allison placers on the main gulch at Manhattan and has started a force of men at work under Patrick Hollin. Mr. Double has also taken a lease on the placers of Top Knob No. 2 and is interested in the Four Leaf, operating below Central.——T. A. Johnson, manager of the Johnnie mine, states that the March production of the mill exceeded $14,000, and that the April clean-up will exceed this. The company is contemplating the installation of electric power and the enlargement of the mill. Excellent ore is being developed.——Jim Butler lessees are maintaining steady shipments of ore assaying over $30 per ton.

Tonopah, April 22.

OREGON

BAKER COUNTY

In the Susanville district at the present time the Gold Bug mine which is being developed by W. H. Turner, of Spokane, is probably the most active. A short time since the shaft was completed from the 200 to the 300-ft. level and a drift driven on the vein from the station 100 ft., at which point a winze has been sunk 50 ft. In the winze there is 2 ft. of ore that will average $75 per ton. Assays taken from the ore run from $30 to as high as $480. A new hoist is to be installed and the winze sunk another 100 ft.——One ton of ore from the Mammoth mine has been shipped to the Tacoma smelter for a trial run.——Operations are to be resumed at the Zenith mine.——Over 3000 sacks of shipping ore is reported to be ready at the Highland mine on Rock creek north of Sumpter and shipping will commence the early part of May.

SOUTH DAKOTA

LAWRENCE COUNTY

Denver parties, headed by W. G. Evans, of the Denver Tramway Co., have given to Stearns-Roger Manufacturing Co. the contract to construct a gold dredge at a cost of $100,000, to be operated at Mystic, a station on the Burlington railway, south of Lead.

TEXAS

BREWSTER COUNTY

Considerable ore has been shipped recently by the Boquillas company from Marathon on the Southern Pacific. This ore is hauled to the shipping point from the crossing of the Rio Grande at Boquillas, 90 miles distant. The mine is situated on the Mexico side of the river and is carried to this side by means of an aerial tramway. Traction engines are used to haul the ore wagons to and from the railroad shipping point.

UTAH

JUAB COUNTY

The station for the new pumping plant at the Centennial Eureka is nearly completed and will be ready for the machinery as soon as the pumps are forwarded to the mine. As soon as these are started the usual tonnage will be mined and 300 men employed.——The Raymond-Illinois property has been closed down temporarily on account of the heavy flow of surface water. This interrupts the work in the spring for about 60 days and it is presumed that operations will be resumed at the end of that time.——At the Eagle & Blue Bell the orebody has been opened 220 ft. above and 200 ft. below the 1000-ft. level, and the company is now preparing to open a new shaft by sinking from the surface and raising from the 1000-ft. level.

SALT LAKE COUNTY

Actual construction work has begun on the 18-mile railroad to be built by the Utah Copper interests from its mammoth Bingham mines to the Garfield concentrators and smelter, and the intention is to have the work completed and freight trains running between those two points within the year. The Utah Construction Co. has secured the contract for the grade work, which in Bingham canyon is extremely heavy. There are fills requiring from 30,000 to 70,000 cu. yd. of earth, and tunnels of 650 to 600 ft. One bridge will be 220 ft. high. The longest bridge will be close to the town of Bingham. Taylor Brothers have already started work on their sub-contract near the mouth of the canyon; E. M. Boyer and associates of Springville are making preparations to commence work immediately on their tunnel contract, and before the end of May it is thought that not less than 2000 men will be engaged on the work. A reservoir to contain 100,000 to 150,000 gal. of water to supply the various gangs along the line of work is now being built on a bluff above Lead Mine station, the headquarters of the Utah Construction Co. A 10-mile pipeline will convey the water from the canyon to the reservoir and there will be a system of laterals sending the water to the camps below.

Eastern Nevada and Southern Utah.

WASHINGTON

STEVENS COUNTY

(Special Correspondence).—J. W. and E. C. Fryett, W. Townsend, and E. J. Cheatham have filed articles of incorporation, to operate under the title of the Buckskin Gold Mining Co.; capital $1,000,000.——The shaft on the west slope of Hungary hill, on the Factor group, is down 75 ft., where a station is being cut for the purpose of cross-cutting to the vein. Ore was found 20 ft. below the surface which assayed about $12 per ton. An adit, in 155 ft., is to be extended to intersect the vein.——On the North Star mine an adit is in 170 ft. A winze has been sunk, 20 ft. in from the portal, to a depth of 50 ft., following a stringer of ore which has increased from 18 in. to 6 ft. in width, at a depth of 150 ft. below the surface. The ore assays as high as an ounce of gold per ton, and a general sample $9.85 per ton.——In the First Thought mine the diamond-drill has revealed a new shoot of ore 140 ft. from the bottom level, in an opposite direction from a diamond-drill discovery of $600 ore, the latter about 500 ft. distant from the main workings.

Orient, April 23.

BRITISH GUIANA

The 10-stamp mill of the Aremu Mining Co. at Aremu commenced operations March 1. The shoot in the mine has been opened for over 200 ft. on two levels and assays from $15 to $20 per ton. The machinery at the mine consists of a central electric plant which furnishes power for the hoist, crusher, and mill, three 84-hp. Worthington boilers, and 120-hp. Mackintosh & Seymour engines direct connected to two 75-kw. Bullock generators. About 11 cords of wood per day are used which costs $2.50 per cord laid down at the mine. The land of the company is suitable for rubber production and the management has had the ground planted to rubber trees as it was cleared for fuel.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS

COAL OR MINERAL LANDS

Lands containing coal are held to be mineral lands within the meaning of that term as generally employed in the laws regulating the disposition of the public domain. And it has been the general policy of the Government to reserve mineral lands from grants of the public lands.

United States v. Northern Pac. R. Co., 170 Fed. 498, Apr. '09.

LOCATION OF MINING CLAIM—ENTRY ON OPEN LANDS

An entry under the mining laws was not invalid because the person entering the same had been upon the land before it was opened to entry and had remained thereon or in close proximity thereto during the expiration of the period fixed by the act of congress until after 60 days from the time the lands were opened to entry.

LeClair v. Hawley, (Wyo.) 102 Pac. 853, July '09.

EASEMENT IN CONNECTION WITH MINING CLAIM

A conveyance to a mining company owning claims of the perpetual right to use adjoining tracts of land for a shaft and for dumping grounds, was held to be an easement, and that the improvements placed thereon in the working of the claims, together with the tracts of land constituted appurtenances to the mine and claims.

Park City Meat Co. v. Silver Min. Co., (Utah) 103 Pac. 254, June '09.

MINING LOCATIONS—ADVERSE CLAIMS.

The United States statutes which provide for the prosecution of adverse claims to mining locations, are said to apply only to adverse claims arising out of independent or conflicting locations of the same ground; they do not apply to controversies between co-owners claiming under the same location.

Allen v. Blanche Gold Min. Co., (Colo.) 102 Pac. 1072, July '09.

LEASE OF MINES—RECOVERY FOR EXPENDITURES

In action for damages for breach of contract to sub-lease lands for mining on the contingency that the sub-lessees found paying ore, they were held entitled to recover for expenditures made in endeavoring to find such paying ores, though their prospective profits would be too uncertain and speculative as a basis for recovery. The measure of damages in such a case was said to be the actual expenditures incurred in the exercise of their work.

Ragland v. Conqueror Zinc Co., (Mo.) 118 Southwest. 1194, May '09.

INJURY TO MINER—PROOF OF NEGLIGENCE.

In an action for the death of a miner alleged to be caused by the negligence of the mine owner and operator, it was held proper to prove that the injury was caused by an overhead blast fired by an independent contractor, in order to show that the injury was not the result of the negligence of the mine operator. A court cannot be required, in such a case, to compel a witness to state whether a third person had discharged his duties to his own employees.

Travis v. Sloss-Sheffield Steel & Iron Co., (Ala.) 50 So. 108, June '09.

OIL WELLS—LIABILITY OF OWNER FOR POLLUTION OF STREAM.

The owner of an oil well is not liable for injuries to real estate bordering on a stream, the waters of which were polluted with oil and salt water, where such pollution was necessary to the enjoyment of the well, and where it was shown that the owner of the well had exercised due care to avoid the injury and was not actuated by malice. The question for the jury to determine was whether the owner of the well had made a reasonable use of it and had exercised diligence to prevent the injury.

Ohio Oil Co. v. Westfall, (Ind.) 88 Northeast. 354, May '09.

Personal

[illegible] invited to send [illegible] notes and travels. Short items are preferred to long articles.

R. H. CHANNING is in San Francisco.

FRANK H. PROBERT is at Bisbee, Arizona.

GEORGE H. GARDY is at Fonopah, Nevada.

JAMES DOUGLAS has returned to New York.

J. MORGAN CLEMENTS was in San Francisco.

W. H. WEED has gone to Kingman, Arizona.

COLARTNAY DE KALB is at Douglas, Arizona.

L. D. RICKETTS has gone to Morenci, Arizona.

CHARLES JANIN has returned to San Francisco.

OSCAR H. HERSHEY was in San Francisco this week.

R. H. SARGENT is lecturing at Northwestern University.

J. H. WINWOOD has returned to Salt Lake from southern Utah.

U. S. GRANT lectured on 'Some Alaskan Glaciers' at Chicago recently.

DESAIX B. MYERS has moved his office to 321 Story Building, Los Angeles.

H. S. IMLAW is now superintendent of the Highland Boy mine, Bingham Canyon, Utah.

C. S. HERZIG, of the Constant Herzig Co., is examining a mining property in West Virginia.

ROBERT H. RICHARDS has just returned from a professional trip to Virginia and to New York City.

M. R. RICHARDSON is now chief chemist for the Mazapil Copper Co., Concepcion del Oro, Mexico.

W. J. ADAMS has been ill with typhoid, but is now convalescent at his home in San Francisco.

R. Y. HANLON is in San Francisco. He will return to Korea, sailing on the *Chiyo Maru* May 3.

A. A. HAMERSCHLAG delivered the Commencement Day address at the Michigan College of Mines, April 22.

LEE FRASER has left the Aguacate Mines Co. to become engineer for the Abaugarez Goldfields of Costa Rica.

J. E. SPURR, of Spurr & Cox, Inc., has been appointed consulting geological engineer to Camp Bird, Limited.

EDMUND D. LACHMAN, stores manager for the Dolores Mines Co., Madera, Chihuahua, is in San Francisco on his way to the mine.

BERNARD MACDONALD will go to Parral shortly. He is designing a mill and cyanide plant for the Veta Colorada M. & S. Co., at that place.

W. R. JEWELL, formerly mineral expert with the Department of the Interior, has resigned and will open offices at Bakersfield, California, to examine and report on oil properties.

R. H. CHAPMAN, who is organizing topographic work for the Canadian Geological Survey, will be at work in the Selkirks and Kootenay district in May. His address for the summer will be Victoria, British Columbia.

The Prospector

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

J. K., Korea: No. 1, chrysocolla; No. 2, massive magnetite.

J. H., Austin, Nevada: No. 1, fine grained diorite; No. 2, syenite.

R. V., Prescott, Arizona: Altered feldspathic rock with talcose inclusions.

O. B. A., Whitehills, Arizona: No. 1, chloritic quartzite with small cubes of pyrite; No. 2, kaolinized light granite; No. 3, gneiss with magnetite; No. 4, hornblende-chlorite

schist; No. 6, hornblende-chlorite schist; No. 7, porphyrite; No. 9, diorite.

J. C. H., Quartz, Montana: Micaceous hematite. Value depends on size of deposit, purity, and shipping facilities.

A. E., Sulphur, Nevada: Breccia coated with hornsilver and some embolite.

PUBLICATIONS RECEIVED

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

ECONOMIC GEOLOGY OF THE FELDSPAR DEPOSITS OF THE UNITED STATES. By E. S. Bastin. U. S. Geol. Surv., Bull. 420. Pp. 85, ill., index, maps. Washington, 1910.

The principal feldspar quarries in the United States are in New England and the Middle Atlantic States, and the annual value of the product is now about half a million dollars. Mr. Bastin discusses the chemical and physical character of the feldspars, their geologic occurrence and origin, and the methods of mining and milling, and describes in detail the deposits worked at the numerous quarries.

MEASUREMENT OF PULP AND TAILING. By W. J. Sharwood. Pamplet. Pp. 22, ill. London, 1910. The Mining Magazine. Price 50 cents.

The interesting and instructive articles published by Mr. Sharwood in The Mining Magazine has been published in a little pamphlet that every millman will want to have at hand. The conversion tables and detailed statement of methods will be of daily use.

BITUMINOUS OR OIL-SHALES OF NEW BRUNSWICK AND NOVA SCOTIA, ALSO ON THE OIL-SHALE INDUSTRY OF SCOTLAND. By R. W. Ells. Canada, Dept. Mines, No. 55 and 1107. Pp. 73, ill. Ottawa, 1910.

A report prepared under the joint auspices of the Geological Survey and the Mines Branch and discussing both the geology and economics of the subject.

ANALYSES OF ROCKS AND MINERALS. By F. W. Clarke. U. S. Geol. Surv., Bull 419. Pp. 323. Washington, 1910.

This is a tabulation of all analyses made in the Survey laboratory from 1880 to 1908. In the introduction Mr. Clarke has given new figures of the average composition of rocks.

OLD GRANITES OF THE TRANSVAAL, AND SOUTH AND CENTRAL AFRICA. By C. B. Horwood and A. Wade. Pamphlet, reprint from the Geological Magazine, Oct.-Dec. 1909.

COMMERCIAL PARAGRAPHS

The CONSTANT-HERZIG CO. is about to undertake examinations of properties in Utah and Nevada on behalf of London clients.

T. H. PROSKE, Denver, recently shipped two 15-ft. D 24 Ajax drill sharpeners to George W. Jackson, Inc., for use on the New York aqueduct at Yonkers, New York.

The AMERICAN STEEL CASTING CO. succeeds to the business of the Pacific Jupiter Steel Co., of San Francisco. The offices of the new concern is in the Sheldon building.

The Utah and western Wyoming interests of the PNEUMELECTRIC MACHINE CO., of Syracuse, New York, manufacturers of the Pneumelectric coal puncher, have been placed in the hands of the Utah Engineering & Machinery Co., 523 New House building, Salt Lake, Utah.

Myron G. Doll, for several years connected with the Denver office of the SULLIVAN MACHINERY CO., is now local manager for the company at Salt Lake, with offices in the Dooley building. He succeeds Matt. Brodie, who takes a position in the department of foreign sales.

THE CANTON BOILER & ENGINEERING CO., Canton, Ohio, has recently completed an order for ten 60-ton ladles for the Cambria Steel Co., Johnstown, Pennsylvania. This makes seventeen 60-ton ladles that this company has built this year, in addition to a large number of 20, 30, and 40-ton ladles.

RALPH ARNOLD and C. A. FISHER have opened an office in the Ideal building, Denver, and will undertake especially the examination of oil, coal, and other non-metalliferous deposits and underground water in the Western States. Mr. Arnold will continue his individual work in the California oilfields, making headquarters at Los Angeles.

Market Reports

LOCAL METAL PRICES.

San Francisco, April 28.

Antimony	12—12¾c	Quicksilver (flask)	49 - 49½
Electrolytic Copper	16¼—16½c	Spelter	7—7⅛c
Pig Lead	4.75—5.70c	Tin	36—37½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Apr. 21. £ s. d.	Apr. 28. £ s. d.
Camp Bird	1 11 6	1 12 9
El Oro	1 8 0	1 7 6
Esperanza	2 8 9	2 8 9
Dolores	1 8 9	1 8 9
Oroville Dredging	0 10 0	1 10 0
Mexico Mines	8 13 9 ex div.	8 12 6
Tomboy	0 18 9	0 18 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, April 28.		Closing prices, April 28.
Adventure	5⅞	Mohawk	48
Allouez	40	North Butte	32½
Atlantic	7	Old Dominion	33¾
Calumet & Arizona	61	Osceola	136
Calumet & Hecla	575	Parrot	14
Centennial	16½	Santa Fe	1⅞
Copper Range	66½	Shannon	11½
Daly West	8¼	Superior & Pittsburg	11½
Franklin	11½	Tamarack	52
Granby	42½	Trinity	6
Greene-Cananea, ctf	8⅜	Utah Con	21
Isle Royale	14	Victoria	3
La Salle	11½	Winona	6½
Mass Copper	6½	Wolverine	120

(By courtesy of J. C. Wilson, Mills Building.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, April 28.		Closing prices, April 28.
Amalgamated Copper	69⅞	Miami Copper	21¾
A. S. & R. Co.	78⅜	Mines Co. of America	⅛
Boston Copper	17⅜	Montgomery-Shoshone	⅝
B. C. Copper Co.	5⅞	Nevada Con.	19⅝
Butte Coalition	20⅝	Nevada Utah	¾
Chino	11½	Nipissing	10
Davis-Daly	2	Ohio Copper	3½
Dolores	6	Ray Central	2⅞
El Rayo	2⅞	Ray Con.	18⅛
Ely Central	1	South Utah	2
First National	2½	Superior & Pittsburg	12½
Giroux	7½	Tenn. Copper	28⅜
Guanajuato Con	1⅛	Trinity	6½
Inspiration	7½	Tuolumne Copper	3¼
Kerr Lake	8¼	United Copper	6¼
La Rose	4¼	Utah Copper	43
Mason Valley	8½	Yukon Gold	4¼

SOUTHERN NEVADA STOCKS.

San Francisco, April 28.

Atlanta	$ 14	Mayflower	$ 2
Belmont	2.60	Midway	28
Booth	14	Montana Tonopah	82
Columbia Mtn	6	Nevada Hills	65
Combination Fraction	42	Pittsburg Silver Peak	72
Daisy	7	Rawhide Coalition	30
Fairview Eagle	14	Rawhide Queen	32
Florence	2.25	Round Mountain	49
Goldfield Con	7.90	Silver Pick	9
Gold Kewenas	6	St. Ives	17
Great Bend	2	Tonopah Extension	80
Jim Butler	16	Tonopah of Nevada	7.25
Jumbo Extension	30	West End	35

(By courtesy of the San Francisco Stock & Exchange Board.)

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EDITORIAL.

RIO TINTO, undoubtedly the greatest single copper mine now producing, worked last year on ores having an average copper content of only 2.349 per cent. A little over a million and three quarters tons of ore were produced.

NORTH BUTTE, it is announced, will hereafter issue quarterly reports. The annual report recently issued was excellent in character, and evidently the policy of secrecy which has provoked so much unfavorable comment is to be abandoned.

FAIRBANKS people have been watching the Haiditarod district anxiously this winter. Good reports have come back to the Tanana city, and at last reports eight steamboats were drawn up loaded and ready to start down the river with the first breaking of the ice.

FIRE-PROOF construction in and around mines is rarely possible. The most important places may, however, be safeguarded. The recent fire at Goldfield has brought out a point in favor of the zinc-dust precipitation process, in that the presses and their contents were found uninjured even though two of them had been hot enough to volatilize some of the zinc. It is customary to store the gold in a safe after precipitation, but in this case is was stored during precipitation.

OPINIONS of those in close touch with the copper market are that the publication of monthly figures of production and consumption of copper have a disturbing effect, and therefore the issuance of such information may shortly be discontinued. Unquestionably one result has been to develop spasmodic features in the market. Buyers of metal and traders in stocks suspend activity as the date of publication approaches, and feverish speculation has resulted in an effort to buy and sell in accordance with prevailing interpretations of the facts presented. There is in truth a lack of sufficient detail in the monthly statement, which results in throwing only a half-light upon the situation. The sources of consumption still remain unrevealed. Until more can be determined and given to the public on this side of the matter a fundamental factor needed to forecast the demand is absent; it only changes the point in the game at which some one has to guess what cards the others hold and then to boldly bid for making trumps. To suppress publication would seem to be a step backward. The better thing would be to give additional information. The spirits of evil walk in darkness, and the copper market is too

deep a mystery with the light available today to stand deliberate protection of manipulations that can be done only in the shadow.

Reclamation and Army Engineers

A tentative suggestion comes from Washington to the effect that the President plans to detail an Army engineer as Director of the Reclamation Service in place of Mr. F. H. Newell. Whether this is determined or is merely a toy balloon sent up to attract sharp-shooters, is uncertain. Unfortunately there is reason to suspect that the project is serious. When Mr. R. A. Ballinger was made Secretary of the Interior it was widely published as coming from him that he would 'get' the Reclamation Service, and it has been an open secret that there has not been that harmony between the Secretary and the officers of the Service that under the previous Administration did so much to promote the efficiency of that great Bureau. Civil engineers have been especially proud of the record made by Mr. Newell and his associates. They have demonstrated that it is possible under conditions of Government service, to build great engineering works honestly and efficiently. The Army engineers, frankly, have been jealous of any movement to place construction of public works in the hands of civilians. The officers of the Corps of Engineers are excellent routine administrators, as would be expected from their training. They are men of high character, and with their system of retiring allowances, which are denied to civilian employees, it is possible to keep them in the service. Fewer men resign to enter private practice than in other branches. All this may be frankly admitted without conceding that they should be placed in charge of all engineering work. In practice they have not proved to be especially brilliant engineers, and the bulk of their work is done by civil engineers employed by them, but denied high rank and pay. The original reason for giving them charge of public works, that they might be profitably employed in times of peace acquiring experience, broke down when during the Spanish War so few were transferred to active service. The Army has its own work and its men should be kept at that. There is no more reason why Army engineers should build irrigation cañals than for them to have charge of the post-offices.

Appoint a Trained Man

The bill providing for a Federal Bureau of Mines has passed the Senate and, having been already approved by the House, will now go to conference for consideration of the amendments. It is believed that there will be few difficulties in reaching an agreement and that the bill will soon become a law. Thus ends a long campaign for legislation, and begins another of administration. Among the amendments proposed by the Senate the best was one changing the name of the proposed head of the Bureau from Commissioner to Director and raising the salary from $5000 to $6000. In giving the new officer the same title and salary as the Director of the Geological Survey, in placing the Bureau in the Department of the Interior, and in transferring to it the Technological Division of the Survey, Congress has indicated in a significant manner the wish that the new Bureau shall work in harmony with the Survey and be as like to it as possible. In this Congress has interpreted correctly the best thought of mining men, and we hope that the President will keep this in mind when he appoints the new Director. It is provided that this officer "shall be thoroughly equipped for the duties of said office by technical education and experience." We hope this provision will be observed both in letter and spirit. The high standing of the Geological Survey has come mainly from the fine spirit of the men belonging to it and the character of subordinates in any organization is influenced if not determined by the men at the head.

It is too early to even guess who may be appointed. Mr. John Hays Hammond naturally comes to mind, since, according to frequent press dispatches, he is the one mining engineer who is among the President's familiar friends. We doubt if the place would appeal to Mr. Hammond, as he would need to work as a subordinate to the Secretary of the Interior and would be the junior member of a large official family. If a Department instead of a Bureau had been created, and a position in the Cabinet were under consideration, it might well be another story. Aside, however, from Mr. Hammond's wishes, of which we believe he has given no indication, there would doubtless be objection to him urged by certain interests which will properly be considered. The movement for a Bureau of Mines originated in the West, but it was the coal miners and operators who finally won the battle; and the work transferred to it from the Survey relates to coal mining almost exclusively. Under the circumstances it is natural and right that the first Director, at least, be one thoroughly in touch with the problems of coal mining. Mr. Hammond's experience in that direction we believe is limited largely to his connection with the Stone Cañon mines. His large business interests might well prevent his being more than a nominal chief, and his relations with that intangible group known as 'Wall Street' would antagonize labor leaders who are vitally interested in the new Bureau. Mr. Hammond is a brilliant executive and has rare judgment in selecting assistants and in handling men. He has shown his repeated interest in the work of this Bureau, but we doubt both his interest in the appointment and the advisability of its being offered to him.

When one turns to others there are so many who might fill the place with distinction that choice would be difficult. If the President is wise he will, we think, appoint one of the officers of the Geological Survey already in touch with the work and familiar at once with its needs and the methods of Government administration. The obvious man is Mr. J. A. Holmes, the present Chief of the Technological Division of the Geological Survey, which will constitute the nucleus of the new Bureau. By training, experience, and ability he is excellently qualified, and his rare devotion to the work is well known. It would be a fitting appointment; but the essential thing after all is that a trained man be put in the place. To the new Director, whoever he may be,

we offer in advance our good wishes and our hearty support. The MINING AND SCIENTIFIC PRESS has favored the creation of such a Bureau for many years, and we take pleasure in at last seeing the starting of a work that we believe capable of great benefit to the whole mining industry, from the man with the pick, up the shaft through the offices of superintendent and engineer, to the counting room of the operator, and so out to the great general public.

Coal-Land Prices Again

In our Discussion department, Mr. L. K. Armstrong, whose thorough knowledge of mining conditions in the Northwest enables him to speak with especial authority, takes exception to our position with reference to the new prices now being asked by the United States Government for its coal lands. The subject is a large one and worthy of close attention. We are glad to publish Mr. Armstrong's letter though we remain unconvinced. We do not care at this time to argue further regarding certain of the questions raised, including that regarding the legality of a possible leasing system. We do not believe that such a system can be summarily dismissed as unconstitutional. Certainly the matter has been discussed at Washington among excellent lawyers without the objections raised being considered insuperable. It is interesting to note, however, that in his testimony before the Committee to Investigate the Interior Department, Mr. George Otis Smith, Director of the Geological Survey, urged the higher pricing of the land as a means of avoiding the necessity for a leasing system; a suggestion which seemed to appeal forcibly to several members of the Commitee. The argument is very simple: Fix the price of the land too high to make it profitable to hold for speculation, but not too high to permit operation, and then sell in reasonable units to any one desiring to purchase. This, it is urged, will automatically reserve to each generation the solution of its own problems without preventing present development. In one minor matter Mr. Armstrong is mistaken as to the facts. The new prices are now in effect, so far as coal lands have been classified and are for sale in the United States, and coal lands have been sold and are being sold at the new prices. The law simply fixes a minimum price and imposes no maximum. For many years the lands were sold at the minimum, but beginning when Mr. Garfield was Secretary of the Interior and continuing under Mr. Ballinger, they have been sold at prices fixed after an examination of each forty-acre tract. One thing more we would like to emphasize, and that is that to Mr. Roosevelt, on whose order the system was changed, the amount of the increase was considered unimportant so long as the rights of the United States, representing the people as a whole, were preserved. This, we believe, is the correct position. Measured against the total reserve, the amount of coal needed for present development is small, both in the United States and Alaska, and might be freely given, if need be, to anyone prepared to put the coal on the market. What is important is to keep the way open to save to society as a whole the 'unearned increment' on the lands not yet needed for development, and there is no way to do this so easy and so sure as by retaining ownership.

Minister Enrique Creel

Despite the growing magnitude of foreign investment in Mexico, critics of the Republic, friendly and unfriendly, are accustomed to ask, "after Diaz, what?" Great financiers are unlikely to err in their judgment of the stability of the Government, and their opinion is reflected in the market quotations of its bonds. Measured by this standard the conclusion is inevitable that the men whose business it is to make banker's profit out of national securities take no gloomy view of the outlook in Mexico. Evidently they are not disturbed by the further query, which no man can certainly answer, "after Diaz, who?"

President Diaz is ceaselessly building; his constructive faculty in government is constantly in evidence, and his policy is one of progressive conservatism. The presence of Señores José Yves Limantour, Olegario Molina, and Justino Fernandez in the cabinet, has long been a guarantee of stable and honorable administration of public affairs, and it has been appreciated within and without the Republic. The recent death of Señor Ignacio Mariscal, secretary of foreign affairs, created a vacancy which has just been filled by the appointment of Señor Enrique Creel. This must give universal satisfaction, as it is a further guarantee that the engine of state will not race to destruction when the time comes for changing the governor. Señor Creel is one of the ablest men in Mexico, a shrewd resourceful financier, who has built a goodly inheritance into a vast fortune by the methods common to financiers, but without blemish of 'graft'. He has been active in the mining and railroad development of the country for twenty years. He has been a powerful factor in the development of the fiscal and railroad policy of Mexico, which has stood the test through years of financial peril that sorely tried the soundness of the structure. He has won distinction in the diplomatic service as ambassador from Mexico to the Government at Washington. Señor Creel is a business man and a statesman. He is beyond doubt one of the most forceful characters the country has produced, and his elevation to the cabinet means that another dominant influence making for peace and progress has been added, which will aid any future president to maintain a course commanding the respect and confidence of the Nation and the World. The possibility of his succession to the presidency is precluded by the Mexican Constitution, which requires that the chief magistrate shall be the son of Mexican parents. Señor Creel's mother was native to the soil, but his father was an American citizen, formerly United States Consul at Chihuahua. Thus he is disqualified in a similar manner to Señor Limantour, whose father was a Frenchman. But, as ministers entrusted with important portfolios, these men will preserve the traditions of the Diaz régime, and will continue the policies that have been leading so rapidly to the expansion of Mexican industry.

Cost of Dredging in Russia and Siberia

Translated for the MINING AND SCIENTIFIC PRESS
By W. H. SHOCKLEY

The following costs are from a report of the Commission of Engineers,[1] organized by the Permanent Consulting Bureau of Gold and Platinum Producers on the 'Utility of Dredges in Russia', published in *Gold and Platinum*, June 15, 1909. In the tables the ruble is taken at 50 cents American for ease of calculation; the exact value is $0.514567.

Classification of expenses.[4]	In the Ural. Summer period,[2] seven months.	In the Ural. Winter period,[3] five months...	In the Ural. Yearly total....	In the Yenisei. Summer period,[2] seven months.	In the Yenisei. Winter period,[3] five months...	In the Yenisei. Yearly total....
I. Prospecting[5] ...	...	...	$350	...	...	$500
Total	..	....	$350	....	....	$500
II. Preparatory work:[6]						
Cleaning claims.	...	...	500	...	...	750
Clearing basin of ice for the spring work of the dredge...	...	...	150	...	...	200
Building side canals[7]	...	...	...	...	...	100
Making roads for transport of wood	...	...	75	...	...	100
Furnishing clear water for boilers[8]	...	...	50	...	...	100
Making small dams and sluices[9]	...	...	50	...	...	100
Transport temporary blacksmith and artisans	...	...	75	...	...	100
Total	....	....	$900	....	....	$1,450
III. Pay of workmen:						
3 runners	$735	$375	$1,110	$945	$375	$1,320
3 engineers	525	375	900	787	375	1,162
3 oilers	367	225	592	420	225	645
3 stokers	315	...	315	420	...	420
1 washer	123	...	123	158	...	158
1 water-carrier.	90	...	90	90	...	90
2 wood-carriers[10]	180	...	180	180	...	180
1 blacksmith....	157	113	270	245	175	420
1 " helper.	105	75	180	145	82	227
1 machinist.....	175	...	175	263	...	263
1 carpenter.....	...	105	105	...	135	135
5 laborers.....	525	...	525	575	...	575
3 laborers.....	...	225	225	...	248	248
1 watchman....	...	50	50	...	60	60
Total	$3,297	$1,543	$4,840	$4,228	$1,675	$5,903
IV. Materials:						
Wood[11]	1,968	...	$1,968	$1,968	...	$1,968
Lubricating material for a 5-ft. dredge[12] ...	500	...	500	600	...	600
Spare parts and material used for repairs[13]..	...	1,500	1,500	1,500	1,500	2,000
Total	$2,468	$1,500	$3,968	$3,068	$1,500	$4,568
V. Salaries of management:						
Manager and expert per annum	...	...	750	...	...	750
Assistant manager	...	...	450	...	...	450
Storekeeper	...	...	300	...	...	375
Apprentice	...	...	150	...	...	225
Total	...	...	$1,650	...	...	$1,800
VI. Taxes:[14]						
Land tax.....	...	...	125	...	...	125
Business license.	...	...	155	...	...	155
Personal business licenses..	...	...	50	...	...	50
Boiler tax[15].....	...	...	30	...	...	50
Mining police tax	...	...	25	...	...	...
Support of Gold Miners' Council	...	...	50	...	...	650
Total	...	...	$435	...	...	$1,030
VII. General expenses:						
Insurance	...	...	300	...	...	300
Correspondence (stamps, etc.).	...	...	125	...	...	200
Delivery of mail	...	...	75	...	...	...
Traveling expenses	...	...	250	...	...	175
Office expense...	...	...	25	...	...	50
Repairs to roads[16]	...	...	50	...	...	75
Repairs to houses[17]	...	...	150	...	...	200
Heating and lighting dwellings	...	...	250	...	...	375
Medical aid.....	...	...	300	...	...	500
Upkeep of two horses in the Urals and four in the Yenisei.	...	...	250	...	...	300
Driver	...	...	150	...	...	180
Watchman on the claims....	...	...	150	...	...	180
Accident insurance of workmen	...	...	200	...	...	300
Reception of visitors	...	...	50	...	...	75
Upkeep of agent in nearest large town	...	...	180	...	...	180
Total	....	....	$2,505	....	....	$3,290
VIII. Sundry small expenses	...	...	352	...	...	459
Grand total...	.....	.....	$15,000	.....	.....	$19,000

(1) The members of the Commission were: I. P. Beresnevich, A. A. Gerasimof, E. V. Grishin, A. P. Kyznetsof, C. I. Littauer, C. L. Perelman, N. P. Podsosof, I. I. Rogovin, D. M. Rebakof, and A. A. Savinik.

(2) The Commission takes the summer period from April 1/14 to November 1/14 because most of the dredges begin in the first half of April and finish in the second half of October—a period of seven months. The expenses for that period are exclusively operating expenses. These double dates refer to the two calendars.

(3) The Commission counts the winter period as the five months from November 1/14 to April 1/14, during which time the dredge is repaired and got ready for the following season. The expenses during this time are exclusively on account of repairs.

(4) For this estimate of the working expenses of a dredge the Commission has in view, besides the remarks under the several items of expense, the following general considerations: (*a*) At present most of the dredges employed in Russia are open-connected with buckets of 4½, 5, 6, and 7 cu. ft. capacity. The Commission determines the annual output of dredges working under normal conditions as:

[illegible]

A 4 ft. dredge with close-connected buckets is equivalent as regards production to a 5 ft. and a 5 ft. dredge is equivalent to 7 ft. dredge of the ordinary open-connected type. (b) In determining the different items of expense the Commission has had in view the probable maximum expense, and on this account the present estimate should be regarded as a limit which the expenses of a rightly organized dredging enterprise should not exceed, unless in reality, there are local conditions altering some of the items. (c) The estimate is worked out for the two regions where the dredging industry is most largely developed at present, namely, the Ural and the Yenisei Taiga. For other auriferous districts the data of the estimate should be multiplied by a coefficient dependent on the greater or lesser cost of labor and transport in the said districts. (d) The Commission is unanimously of the opinion that working in three 8-hour shifts is the best system; and that all the organization of the dredge should be directed toward increased production. (e) The Commission considers it essential that the manager and the expert should be one person, since this combination gives great economic and technical advantages. (f) The foregoing estimate is based on a 5-ft. dredge with a production of 190,500 cu. yd. in a season; for other dredges the expenses for supplies should be altered, while the other items remain unchanged.

(5) This item refers only to the detailed prospecting needed for running the dredge, and assumes that the general prospecting for determining the value of the claims has already been carried out. The more thoroughly this latter prospecting has been done, the less the expense for the present item, and vice versa.

(6) In enumerating the expenses of the preparatory work all possible items are included, but it is to be remembered that only under rare and extraordinary conditions will all these items of expense exist at once. When working in river-beds the majority of the preparatory expenses are obviated.

(7) Side canals are found necessary with a short bucket-ladder in narrow workings and in the absence of rounded pontoon-corners. In new dredges this expense is absent.

(8) With a sufficient quantity of running water this expense is absent.

(9) This expense occurs when the dredge is working old claims, and depends on the amount of water, the slope of the valley, and the leakiness of the ground. Under unfavorable conditions it may reach $750 per annum.

(10) The number of wood-carriers depend on the amount of wood consumed, and must be increased for a large dredge.

(11) The amount of wood used for fuel can be estimated at 0.035 of the ground excavated, or for a 5-ft. dredge working 190,500 cu. yd. in a season, 1406 cords at $1.40 per cord. This amount includes the delivery to the dredge. In the Ural estimate is included the forest tax, which does not exist in the Yenisei.

(12) The Commission does not give details for determining the amount of lubricating material; this includes crude oil, oleonaphtha, cylinder oil, tallow, belt-oil, grease, waste, hemp, packing, etc.

(13) The expense under this item is taken at $1500 to $2000 for a 4½ to 5 ft. dredge, and from $2000 to $3000 for a 6 to 7 ft. dredge. This expense includes all sorts of repair material, such as iron, steel, copper, zinc, coal, and wood.

(14) The taxes are based on the assumption that the dredging company owns 1350 acres, which area is large enough to guarantee the normal amortization, and the initial expense of fitting up the claim for one dredge.

(15) The boiler tax varies from $30 to $50, and depends on the size of the boiler.

(16) Here is understood the road to the claim.

(17) By this is understood repairs to dwellings and the sanitary upkeep of the claims.

The average normal expense for working one cubic yard, not including amortization, is as follows: (A) For ordinary (open-connected) dredges with the capacity given. (B) For close-connected dredges with buckets having the capacity given.

A.	In the Ural.	In the Yenisei.
4½ cu. ft.	9.00c.	11.50c.
5 " "	8.00	10.25
6 " "	7.00	9.25
7 " "	6.50	8.50

B.	In the Ural.	In the Yenisei.
3 cu. ft.	8.00	10.25
5 " "	6.50	8.50

Counting the average value of a zolotnik of gold at 4.80 rubles, or one dolya at 5 kopecks, we find that to cover the expenses of operating a dredge, not counting amortization for preparing the claims, the gravel must contain per cubic sagene: (C) For ordinary dredges with the capacity given. (D) For close-connected dredges with buckets of capacity given.

C.	In the Ural, doll.	In the Yenisei, doll.
4½ cu. ft.	44.80	57.00
5 " "	40.00	50.60
6 " "	35.50	45.50
7 " "	32.00	41.90

D.	In the Ural, doll.	In the Yenisei, doll.
3 cu. ft.	40.00	50.60
5 " "	32.00	41.90

The above-mentioned estimate of expenses was signed by the following members of the Commission: C. I. Littauer, A. P. Kyznetsof, A. A. Savinik, I. P. Beresnevich, N. P. Podsosof, and I. I. Rogovin.

In 4 (*a*) of the above report it is stated that a 5-ft. close-connected dredge ought to be equivalent to a 7-ft. dredge of the ordinary type. I think that this equivalency is wrong, for the capacity of a dredge depends upon two multipliers, the number of buckets and their size. In the opinion of the majority of the members of the Commission a 7-ft. dredge of the ordinary type should give 10 to 11 buckets per minute, or a maximum of 77 cu. ft. per minute. A 5½-ft. dredge (5-ft. dredges are no longer built in Russia) should give 18 buckets, or 99 cu. ft. per minute. Thus the relation between the two dredges

is 77:99, or 7:9, that is, a 5½-ft. close-connected dredge ought to be equal to a 9-ft. dredge of the ordinary type. (A. Gerasimof.*)

The following factors may be found useful in converting Russian statistics into English standards.

One pood = 36.113 pounds.
One pood pure gold = 21,157 rubles = $10,886.72.
One zolotnik = 0.137 Troy ounces = 2.835 of pure gold = 5.50964 rubles.
One dolya = 0.0014286 Troy ounces = $0.029532 of pure gold.
One 2000-lb. ton = 55.382 poods.
One pood = 0.0180564 tons.
One ruble = $0.514567 = 25.375 pence.
One ruble per cubic sagene = $0.04053 per cubic yard.
One ruble per pood = $28.50 per ton, $0.01425 per pound, $0.000977 per Troy ounce.
One zolotnik per cubic sagene pure gold = $0.223 per cubic yard.
One zolotnik per cubic sagene = approximately for placer gold $0.20 per cubic yard.
One dolya per cubic sagene pure gold = $0.0023245 per cubic yard.
One dolya per cubic sagene of placer gold = approximately $0.002 per cubic yard.
One zolotnik per 100 poods pure gold = $1.57 per ton, 2000 pounds.
One dolya per 100 poods = $0.0164 per 2000-lb. ton.
One zolotnik per 100 poods of placer gold = approximately $2 per cubic yard.
One dolya per 100 poods of placer gold = approximately $0.02 per cubic yard.
One cubic yard of gravel is reckoned as 3000 pounds.

COEUR D'ALENE LITIGATION SETTLED

The dispute over conflicting title to certain orebodies has been settled by agreement between the Bunker Hill & Sullivan M. & C. Co. and the Federal M. & S. Co., on terms arranged by the presidents of the two companies, with the advice and approval of their respective counsel, managers, and engineers. The terms of the settlement are given below:

1. The Federal company is to dismiss all litigation by it and by the January company, and the three companies are to interchange mutual releases of all demands.

2. The Federal company is to convey to the Bunker Hill company all of the Wardner properties owned or controlled by it and all interests which it has in such properties lying between Government gulch and Elk creek, and is to assign to the Bunker Hill company any and all stock owned or controlled by it in companies whose mines are situated between these boundaries. This includes the Federal company's mining claims, real estate, water rights, millsites (except sufficient ground to accommodate a new mill, the selection of which, if made at all, must be done before the contemplated conveyance is completed), mill, power, and mining plants, and all the appurtenances and equipment other than office appliances and any unused mining supplies. It embraces generally all the assets of the Federal company, commonly designated as its Wardner properties. The title to be conveyed to be free and clear of all encumbrances.

3. The Federal company reserves the right to mine in a workmanlike manner and work out expeditiously that portion of its properties which is free from any conflict with the Bunker Hill company described as follows: (1) All of the ground embraced within planes drawn vertically downward through the surface boundary lines of the Emma and Last Chance mining claims, together with the ground between planes drawn vertically downward through the northerly and southerly side-end lines of the Last Chance claim extended westerly in their own direction to their intersection with the northerly side-end line of the Bunker Hill mining claim extended westerly in its own direction. (2) All of the ground bounded by vertical planes drawn downward through the west end-line of the Tyler mining claim extended southerly in its own direction, the east end-line of the Viola mining claim extended southwesterly in its own direction and the northerly end-line of the Stemwinder mining claim as originally located extended westerly in its own direction. (3) All ground within planes drawn vertically downward through the surface boundary lines of the Omaha mining claim. Together with the right for this purpose, to use the mill mining plant and other necessary adjuncts and accessories. Said right to mine to continue until the ground is no longer susceptible of profitable working, the ground to be deemed worked out and exhausted whenever the Federal company shall have continued mining for a period of four consecutive months without making a profit.

4. In consideration of the foregoing to be done by the Federal company, the Bunker Hill company shall cause its capital stock to be increased to 327,000 shares of the par value of $10, and shall issue to the Federal company the 27,000 shares of increased capital.

RAILWAYS AND COAL IN ALASKA

The development of Alaska by railway construction and by the opening of the coalfields is of great importance both to Alaskans and to residents of the Western States. The Geological Survey issues every year several reports on Alaska, among them a volume containing a summary of the conditions of mining in Alaska and articles on subjects or regions of special interest. One of these volumes, Bulletin 284, issued in 1906, contains a discussion of possible railway routes in Alaska, together with a map showing the distribution of the mineral deposits and the practicable railway routes by which they may be reached.

The same volume contains a report discussing the possible markets for Alaskan coal and stating that the high grade of the coal and its coking qualities make it a valuable asset in the industrial advancement of the Pacific coast. The composition of Alaskan coals is given, and the possibility that they may have to compete with California petroleum is considered.

The bulletin contains also brief reports on the Bering River, Matanuska, and Herendeen Bay coalfields. The edition of the corresponding bulletins for 1906 and 1907 (Bull. 314 and 345) are exhausted, and only a few copies of the report for 1908 (Bull. 379) are available for distribution. Bulletin 345 contains the most complete economic map of Alaska yet published, showing the location of the gold placers, the gold and silver lode mines and prospects, the copper mines and prospects, the tin deposits, the coal-bearing rocks, and the areas that contain workable coal beds.

*Mr. Gerasimof is the dredge expert of the Putiloff Works.

Pine Canyon Smelter

STAFF CORRESPONDENCE

The plant of the International Smelting & Refining Co., in Utah, has a site on the mesa at the mouth of Pine canyon which drains from the Oquirrh range. The site overlooks Tooele valley and the southern end of Salt Lake. It is 700 ft. higher than Tooele station of San Pedro, Los Angeles & Salt Lake railroad, and about 1000 ft. above the surface level of the lake. The company has built and put in operation the Tooele Valley railroad from Tooele station to the smelter-site, a distance of about five miles. The plant is on the opposite side of the main range from the Highland Boy mine of the Utah Consolidated Copper Co., and the mine and smelting plant are connected by an aerial tramway, erected by the Trenton Iron Works. The mine terminal is at an altitude of about 7000 ft., the summit over which the line crosses is at 9000 ft., and the smelter terminal is at about 5000 ft. The smelting plant is so far advanced that it will probably be ready to operate some time in July. The brick stack is an imposing structure, 25 ft. diam., and 350 ft. high, in the construction of which the ordinary grade of brick was used. The main flue, extending from the stack to the reverberatory furnaces, is 18 by 20 ft., and 1300 ft. long. The steel roaster building is built in two sections, with 16 McDougall roasters in each section, each roaster being 16 ft. diam. The fume, which will come from the roasters, is to be drawn into dust-chambers, hopper bottomed; the roof being held by outside iron girders. The structure enclosing these chambers is 140 by 120 ft. The fume passes from the dust-chambers through a 16 by 17-ft. flue into the main stack. The calcined ore in the roasters will be taken by electric haulage to the five reverberatory furnaces, Anaconda type, each 102 by 19 ft. The copper matte to be produced in the reverberatories will be drawn by gravity to the converters through iron launders lined with clay. Five stands of converters, made by Power & Mining Machinery Co., have been installed in a steel building erected for this purpose. The tilting of the converters is to be effected by electric motors. The converter building has one 60-ton electric crane for handling the blister copper and converter slag; also two transfer cranes, traveling at right angles to the track of the main crane, and set 60 ft. high. The two cross traveling cranes receive the slag pots from the main crane and carry them to points over the reverberatories into which the slag is emptied through spouts. This is considered a unique feature, and one by which the transfer of the converter slag is expedited. H. N. Thomson, who is to be superintendent of the plant, states that by the calcining process in the roasters the sulphur in the ore probably will be reduced to 6½%. The five reverberatories will have the capacity of 1500 tons of charge in 24 hours. The ore that comes from the Highland Boy mine will be dumped from the tramway buckets into bins, and taken thence by electric cars to the receiving bins, and from the latter by belt-conveyor to the crushing and sampling mill, by which it is sampled and crushed to ½-in. size before being fed into the roasters. The mill is of steel and concrete. The power-plant, housed in a brick structure, contains two 750-kw. electric generators, Westinghouse make, one direct current and the other alternating. These are to be steam driven, four Sterling boilers supplying the steam, deriving the necessary heat from the reverberatory furnaces, utilizing what would otherwise be waste heat. These generators are to supply power for motors all over the premises and for electric haulage and lights. In the power-house are also two blowing engines to supply the blast for the converters. The electric power now used is transmitted to this place from the plant of the Telluride Power Co. The blacksmith shop and boiler shop occupy one steel building; in the main building are the machine shop, carpenter shop, store-room, laboratory, and general offices. Construction work began a year ago, those in direct charge of designing and construction being C. H. Repath, chief engineer, and J. B. McIntosh, construction engineer; all under general authority of E. P. Mathewson.

Pine Canyon Plant of the International Smelting & Refining Company.

Limitations of One and Five Stamp Batteries

Written for the MINING AND SCIENTIFIC PRESS
By ALGERNON DEL MAR

The choice of machinery for any particular gold ore depends upon the chemical and physical characters of the precious metal and its enclosing rock. The chemical problems rest upon the facility with which gold forms an amalgam with mercury, and failing this its affinity for some solvent such as cyanide of potassium. The physical or mechanical problem may be due to moisture in the ore, or to its hardness. Amalgamators may be divided into two schools, those who claim that inside amalgamation is a farce, and those who claim that in most cases it is necessary if the object be to obtain a maximum extraction on the plates. The former hold that crushing with rolls or single unit stamps is sufficient because all that is required is for the crushed ore to pass over the plates. The latter desire units of five stamps and inside amalgamation with or without inside plates. They claim that the mercury should have a longer time to mix with the gold particles than that possible when the only contact is on the outside plates. On this difference of opinion and its practical results has hung the fate of many mining enterprises.

It is a notable fact that amalgamating inside single-unit batteries has in most cases been abandoned and the cyanide annex has come to be depended upon for a profitable extraction. There are exceptions, no doubt, as there are exceptional deposits of ore. It is impossible, however, to amalgamate inside single-unit batteries and they must be considered only as crushing machines. The screen surface being so great, and the area between the dies and screen opening (other than that occupied by the stamp) being so limited, any particle that will pass the screen is at once thrown out. This means that any mercury fed inside is thrown out before it has had time to mix with the ore. Making an inside clean-up of a single-unit battery is seldom worth the time wasted. It is not important to take out the dies at a monthly clean-up unless they need to be turned or replaced. With a 5-stamp unit this is not so even if the width at discharge is only 12 inches. The mercury has time to mix with the ore and forms more or less amalgam before being thrown through the screen.

In an amalgamating test the sample of ore is ground with mercury, or the ground ore is thoroughly mixed with mercury, the pulp is diluted with water, and the amalgam collected. This represents, in one sense, the amount recoverable by amalgamation, but it does not represent the amount recoverable by amalgamating with a single-unit mill. Why not duplicate the action that takes place in practice? Make two tests, the first as above outlined, running the pulp over ten feet of amalgamated plates, and the other by passing ground pulp, that has not been mixed with mercury, over the same length of plate. If the results are the same there is no question of the preference. There are many ores that plate easily outside the mortar and there are many that do not. To expect fine gold or coarse gold that may be coated with some objectionable material, to amalgamate by simply running over a sensitive plate is to expect too much. This gold must be well mixed with mercury first, as is done inside a 5-stamp unit. The usefulness of this system, however, has its limits because single-unit batteries crush ore at less expense and the cyanide process may permit recovery of the gold that escaped amalgamating. The preference is a question of profits, which means definite preliminary experiments before committing the mine to its final trial. Because a machine can crush ore at less expense is little recommendation for its use unless the ultimate result is a gain.

To reason inductively, to arrive at some generalizations, certain figures must be assumed as representing results actually obtained by experiment on a given ore. The tests necessary are: (1) Fineness

TABLE NO. 1.

Units.	Milling and Amalgamating. Value.	Ext., %	Ext.	Cost.	Profit.	Cyaniding. Ext.	Ext., %	Cost.	Profit.	Totals. Ext., %	Ext.	Cost.	Profit.
5	$5	85.00	$4.25	$1.95	$2.30	....	..	....	....	85.0	$4.25	$1.95	$2.30
1	5	70.00	3.50	1.45	2.05	$1.35	90	$1.10	$0.25	97.0	4.85	2.55	2.30
5	10	85.00	8.50	1.95	6.55	1.35	90	1.15	0.20	98.5	9.85	3.10	6.75
1	10	30.00	3.00	1.45	1.55	6.30	90	1.10	5.20	93.0	9.30	2.55	6.75
5	15	85.00	12.75	1.95	10.80	2.00	90	1.15	0.85	98.0	14.75	3.10	11.65
1	15	46.66	7.00	1.45	5.55	7.20	90	1.10	6.10	94.0	14.20	2.55	11.65
5	20	85.00	17.00	1.95	15.05	2.70	90	1.15	1.55	98.5	19.70	3.10	16.60
1	20	57.50	11.50	1.45	10.05	7.65	90	1.10	6.55	95.7	19.15	2.55	16.60
5	30	85.00	25.50	1.95	23.55	4.05	90	1.15	2.90	98.5	29.55	3.10	26.45
1	30	66.66	20.00	1.45	18.55	9.00	90	1.10	7.90	96.6	29.00	2.55	26.45

TABLE NO. 2.

5	5	85.00	4.25	1.95	2.30	....	80	1.15	....	85.0	4.25	1.95	2.30
1	5	75.00	3.75	1.45	2.30	....	80	1.10	....	75.0	3.75	1.45	2.30
5	10	85.00	8.50	1.95	6.55	1.20	80	1.15	0.05	97.0	9.70	3.10	6.60
1	10	57.50	5.75	1.45	4.30	3.40	80	1.10	2.30	91.0	9.15	2.55	6.60
5	20	85.00	17.00	1.95	15.05	2.40	80	1.15	1.25	97.0	19.40	3.10	16.30
1	20	71.25	14.25	1.45	12.80	4.60	80	1.10	3.50	94.0	18.85	2.55	16.30

TABLE NO. 3.

5	5	85.00	4.25	1.95	2.30	....	90	1.15	....	85.0	4.25	1.95	2.30
1	5	75.00	3.75	1.45	2.30	....	70	1.10	....	75.0	3.75	1.45	2.30
5	10	85.00	8.50	1.95	6.55	1.35	90	1.15	0.20	98.5	9.85	3.10	6.75
1	10	76.66	7.65	1.45	6.20	1.65	70	1.10	0.55	93.0	9.30	2.55	6.75
5	20	85.00	17.00	1.95	15.05	2.70	90	1.15	1.55	98.5	19.70	3.10	16.60
1	20	85.63	17.15	1.45	15.70	2.00	70	1.10	0.90	95.7	19.15	2.55	16.60

to which ore must be crushed which is assumed to be the same in both classes of machines. 2. Amalgamation by thorough mixture, running the pulp over plates. 3. Amalgamation by running crushed ore over plates. 4. Concentration of tailing from No. 2. 5. Concentration of tailing from No. 3. 6. Cyanide extraction and concentration of tailing from No. 2, 3, 4, and 5.

For the sake of argument we will assume the saving of test No. 2 to be 85%, representing the action of a 5-stamp unit. The question is, what percentage of saving must the single-unit battery maintain to be equally efficient, or, a cyanide annex being necessary, will this addition prove economical? The cyanide recovery in both cases may be assumed to be 90%. If the two types of mill made the same percentage of recovery by amalgamation, the preference would be for that crushing at the least expense, but it is doubtful if the single-unit will give as high recovery by amalgamation or cyanidation as the 5-stamp unit. Not having a chance to try the crushing capacity of the two types of mills it may be assumed that experience has shown the ratio to be about three to four; in other words the 5-stamp unit will crush three tons per day per stamp, while the single unit will crush four tons at the same expense. The expense and extraction sheet is as follows:

Unit.	Milling and Amalgamating. Milling.	Extraction.	Cyaniding. Cost.	Extraction.	Concentrating. Cost.	Extraction.
5	$1.95	85%	$1.15	90%	$0.30	90%
1	1.45	....	1.10	90%	0.30	90%

Table No. 1 shows the application of this cost-sheet to a free-milling or oxidized ore. To obtain the same profit per ton as the 5-stamp unit the single-unit need only amalgamate 60% of a $500 ore providing as stated above, the extraction by cyanide in both cases is 90%. As the ore increases in value so does the necessary extraction by the single unit. If the cyanide extraction is 80% in both cases we have Table 2, showing that the lower the cyanide extraction the higher must be the amalgamating efficiency of the single unit. For low-grade ores that will not pay for cyaniding the single unit will pay as well with a much less extraction by amalgamation. Table 3 shows the results when there is a wide difference in the cyanide extraction that is hardly to the credit of the single unit. For a concentrating ore the greater the amount saved as a concentrate, the more favorable the single unit will appear. A few actual examples may be profitably considered.

1. A quartz ore which by test 2 shows an extraction of 42% and by test 3, 25%. The extraction in the concentrate averages 91% of the tailing in both cases. The cyanide extraction is so low that it is out of the question. The ore averages $6. The cost of milling with the single unit is estimated at $1.10, with the 5-stamp unit $1.45. A profit of 25c. per ton in favor of the single unit is shown as below.

Single unit:	Extraction.	Cost.	Profit.
Amalgamation	$1.50	....	....
Concentration	4.10	....	....
Total	$5.60	$1.10	$4.50
Five unit:			
Amalgamation	$2.50	....	....
Concentration	3.20	....	....
Total	$5.70	$1.45	$4.25

2. An ore amalgamating 5% and yielding by concentration 1%, in both cases the cyanide extraction being 81%, when the ore is reduced to 150 mesh and only 30% when ground to 20 mesh. The ore averages $18 per ton. Cost of milling $1.45 and $1.95 plus in each case 30c. for re-grinding. Cyanide treatment $1.55. The profit in favor of the single unit is equal to the difference in cost of crushing the ore.

Single unit:	Extraction	Cost	Profit
Amalgamation	$0.90		
Cyanidation	13.85		
Total	$14.75	$3.50	$11.25
Five unit:			
Amalgamation	$0.90		
Cyanidation	13.85		
Total	$14.75	$3.80	$10.95

3. An ore amalgamating 83% by test 2, and 68% by test 3. The extraction by concentration is 61 and 58%; the cyanide extraction 78% in both cases. The ore averages $12 per ton. Cyanide cost $1.35 per ton. Milling cost $1.40 and $1.05, including concentrating. In this case the tailing will not pay to cyanide and the balance of profit is in favor of the 5-stamp unit.

Single unit:	Extraction.	Cost.	Profit.
Amalgamation	$8.15	....	....
Concentration	2.25	....	....
Total	$10.40	$1.05	$9.35
Five unit:			
Amalgamation	$9.95	....	....
Concentration	1.25	....	....
Total	$11.20	$1.40	$9.80

I have made out a pretty good case for the single-unit stamps but the point I wish to make is that before a final decision is made the ore must be thoroughly tested in such a way as will most nearly represent the actual conditions existing in practice, and the result worked out mathematically. If there appears to be little difference adopt the 5-stamp unit as being less cumbersome and needing less floor space and fewer working parts.

McKITTRICK-SUNSET OIL REGION, CALIFORNIA

California now stands first among the States in production of petroleum, which is its most valuable mineral product, gold now ranking second. In 1909 the State produced between 50,000,000 and 60,000,000 bbl. of oil, valued at about $30,000,000. This enormous production has naturally attracted general attention to the oilfields of the State, which are now being actively explored and exploited. A report on the McKittrick-Sunset oil region, in western Kern and eastern San Luis Obispo counties, prepared by Ralph Arnold and H. R. Johnson, has just been published by the United States Geological Survey as Bulletin 406. The region covered embraces about 1800 sq. mi., and includes the most productive territory of the McKittrick, Midway, and Sunset fields and the undeveloped or less developed Devils Den, Temblor, and Carrizo Plain districts. Large areas of public lands in this region have been withdrawn from entry pending legislation or re-classification. The recent report gives an account of the geography, topography, and general features of the region.

Geologic Bases of Mining Law

By Courtenay De Kalb

*The intricate and complex adjustments of right and equity necessitated as a condition for the peaceable utilization of the material of the earth, as distinguished from mere possession and occupancy of the surface, is the work of the mining lawyer. The concrete substance of the earth is the basis which underlies the whole body of the mining law. It is therefore evident that the facts of economic geology determine the essential validity of reasoning within this department of the law, and the ends of justice are subserved in proportion as the mining law proceeds from a correct conception of the phenomena and processes recognized in connection with the valuable materials found in the earth's superficial envelope. Primarily the legislator, and the judiciary which interprets the law in the face of specific facts, are concerned with phenomena, that is, with things as they are found to exist. The repetition of certain phenomena, such as the occurrence of metals in conjunction with other minerals in lodes, veins, and other deposits, presenting similar characteristics, leads to generalizations, and to anticipation of the recurrence of like phenomena as the exploration of the earth proceeds, and upon such probability of finding a continually increasing number of examples of already familiar geologic conditions laws are framed to dispose of and to safeguard human rights in the extraction of valuable mineral substances. It is well to keep in mind that we are nevertheless dealing with an aggregate of isolated facts of experience, from which natural laws may to some extent be deduced, and that the function of the lawyer is to elucidate concrete fact, while that of the judge is to determine what is the fact in each individual case. It is not natural law, nor the supposed results of natural law, that constitutes the concern of the body of man-made law, but the ascertainment and proper interpretation of phenomena. I believe it may be safely affirmed that the errors in mining law proceed largely from the human tendency to generalize too freely upon an insufficient accumulation of evidence. It is pleasing to the human mind to systematize, to trace out origins and the logical sequence of events. But as soon as we have set in order our knowledge of a set of conditions, and have declared in favor of a natural law apparently competent to explain them, we have closed our case, so to speak, and the decision thus reached acquires a hold upon the intellect which blinds it to the reception of new and discordant fact. The shackles of dogma limit the freedom of observation. I do not mean to imply that we should regard the geologic conditions we confront as erratic occurrences in a chaotic world, but it is necessary to disabuse oneself of the notion that finality has been reached in explaining the relations of rocks, ores, and other substances in the earth. The mining lawyer must preserve his pragmatic adaptability of thought.

On the other hand, a function of the geologist is to gather knowledge and correlate it for the deduction of laws and general principles. How far these may be accepted in the interpretation of phenomena for the meting out of justice is a problem of great difficulty. The preponderance of testimony is not a safe guide in such matters, and the weight of authority is hard to measure. The more important service of the economic geologist as an expert witness lies in pointing out facts which only a trained observer can recognize, and in demonstrating relationships which the non-technical man could not discover. The more of fact and the less of theory in his testimony, the more valuable it is for the purposes of the courts. Having frankly acknowledged that inferences from general principles are likely to lead to injustice in determination of right and equity, I may presume to venture with greater freedom into a consideration of certain large geologic conceptions which are fundamental.

We know the outer envelope of the earth to an exceedingly shallow depth. The deepest mine in the world has penetrated only 5300 ft. This is the Calumet & Hecla in Michigan. The mines which exceed 4000 ft. in depth are few. By the processes of erosion by winds and waters, aided by frosts and the sun's heat, rocks that were once deep-seated are now exposed to view. In a few places it is estimated that the rocks at present visible had certainly been buried to a depth of about eight miles. Accordingly it will be seen how limited has been our opportunity to gain a knowledge of the deeper portions of the earth. All we know is the mere upper shell, a small fraction of the rocky exterior, which is called the lithosphere. Concerning the rest all is speculation. The interior of the earth may be a homogeneous mass; or it may consist of materials segregated by reason of superior specific gravity. Some geologists maintain that the heavier metals must be concentrated toward the centre of the earth, which is therefore denominated the barysphere. The mean density of the earth is about five times as great as water; the density of the exterior part with which we are familiar is 2.6. That involves a specific gravity at the centre of 15 if the density were to progressively increase from the surface inward. It is conceivable that simple pressure acting upon a homogeneous mixture of materials of the same average chemical composition as the lithosphere could produce this result. It is absolutely certain, however it be accomplished, that the mass of the earth becomes progressively more dense toward the centre. It is not necessarily true, however, that the deeper interior of the earth is the source of the metals which we find concentrated into veins and other deposits. Even when the economic geologist speaks of the material found in veins as having a deep-seated origin he is still referring to relatively shallow depths. It is capable of mathematical demonstration that the pressure is so great as to close absolutely the spaces which we call capillary openings in the rocks at a depth of certainly no more than nine miles, and it is inconceivable that contributions of solution carrying mineral matter, or of volatile compounds of metals or other substances, can be derived from greater depths. The only exception to this statement is involved in the manifest

*Address delivered before the San Francisco Bar Association.

invasion of deeper-seated material during periods of mountain making. An uplift of a great range of mountains, like the Andes, for example, giving an average elevation of as much as two miles and in places reaching even four and five miles, shows that a vast amount of material below the non-porous lithosphere has flowed upward, and this, of course, has brought with it entrained gases, and water. Such solutions are called magmatic water, and they are active solvents for metals, and for metallic and earthy salts. In this way, through volcanic action, fresh material, capable of depositing minerals in fissures and open spaces in the rocks, is brought up from considerable depths, but it is important to note that there can be no continuous flow of such gases or solutions from the deeper masses of the earth's material that have closed in behind the portion which has thus invaded the upper shell of the earth.

Before proceeding farther with the argument for the probable source of the minerals in veins, it is well to point out that from the earliest periods in the history of the earth inequalities in pressure over various areas have resulted in uplifts and local eruptions of the deeper-seated material, forming continents and mountains. The erosion of the continental masses and mountain ranges has brought about a distribution of this material covering great areas with sands and gravels and silt deposits, and carrying dissolved matter into seas and oceans. The sands and gravels, technically called clastic material, have consolidated into sandstones and conglomerates, while by simple precipitation, and by the secretions of organic life, the dissolved matter has been thrown down in the form of limestones, deposits of chert, of salt, and of gypsum. The net result has been to cover the earth with such secondary deposits, the accumulation of ages having spread a great mantle of sedimentary rocks, aggregating in places many tens of thousands of feet. The average thickness of this mantle would be difficult to estimate, but it amounts to several miles. It varies extremely, and over large areas has either been removed by erosion, or never existed because of the high elevation. It must be noted also, that deeply buried sediments, under the influence of high temperature, and in the presence of the contained moisture, may become plastic and alter into crystalline rocks, resembling some of those which have consolidated from the interior magmas that have intruded from below. The whole mass of the superficial rocks of the earth, has, therefore, been derived from the upper portion of that original material which is loosely called volcanic, and in the aggregate it represents the average chemical composition of this primary matter. It contains the metals that were in that primary matter—no more and no less. But there has been a segregation of these constituents, so that some of the sedimentary rocks are lean and others relatively rich in minerals. None contain commercial quantities, but the significant fact is that the metals are there, and if solvents of sufficient power circulate through them these metals can be dissolved, and they will ultimately be precipitated under favorable conditions. In this way concentrations of metals can take place independently of any immediate volcanic agencies. The continual flow through rock pores of waters, containing carbonic acid gas can thus dissolve metals and reprecipitate them in fissures, or in porous strata, and thus produce veins, masses, or beds of such a grade of valuable content as to admit of their economic exploitation. It is also true that a similar leaching of crystalline rocks of distinctly volcanic origin is constantly taking place. Thus it is seen that the filling of veins may occur through the agency of solutions circulating in the upper rocks, as well as from solutions derived from the deeper-seated volcanic magmas.

Much has been written concerning deposits due to a segregation of the metalliferous constituents of volcanic magmas. That such concentrations occur can not be doubted. In a few cases the segregation has been carried on to such an extent as to produce valuable masses of ore. Usually, however, such concentrations have been so feeble that subsequent additional concentration by solutions has been necessary to yield workable deposits. The recent development in America of immense low-grade deposits of copper minerals, known as disseminations in porphyry, has brought this class of ore into prominence. In a certain sense such deposits represent segregations, that is, they consist of magmas into which were originally concentrated considerable quantities of copper minerals. Subsequently the copper was leached downward from the surface enriching a zone at no great depth, so that it contains a workable amount of the metal.

From the foregoing it is clear that ore deposits are of many kinds, and that the simple conception of a vein traversing other rocks, and filled with valuable minerals, is by no means the universal form. Indeed the number of such simple veins of sufficiently high grade to be economically worked is limited, and the tendency of modern mining is to take increasing account of the possibilities of exploiting larger masses of low-grade ores which possess few of the characteristics of the type commonly known as lodes and veins. It is necessary, however, to consider this type, since it has always been the most conspicuous, and has constituted the fundamental form out of which the basal mining law of America has grown. I limit this to American law for the reason that it proceeded from geological assumptions which did not trouble the lawmakers in other countries where the rights of the miner were confined within vertical planes extended downward through the superficial boundaries of the property. The American law proceeded from the relatively simple conception of a vein as a recognizable deposit in a fissure or narrow zone, which the miner owning the apex was entitled to follow wherever it might lead, though it should extend beyond the limits of the claim. Such veins were the predominant type that attracted the attention of the early miners in the West. They are characteristic of the Mother Lode in California, and the experience of the Californian and Nevadan miners was largely responsible for the adoption of the principle of the extralateral right. In order to explain this type it is necessary to consider the origin and characteristics of lodes and veins. It must be understood in the

beginning that, so far as we know, such phenomena are confined to the upper shell of the earth. This is because the upper portion of the earth, being free from the high pressures existing at greater depths, is more susceptible to fracture, and the fractures formed remain as lines of weakness. At considerable depths fractures would heal under compression, and be no longer distinguishable, and at very great depths fracturing is inconceivable. The material of the earth would there behave precisely as a plastic mass, and could be squeezed, but not broken, like lead under pressure. But the movements of the earth cause dislocations and fissures near the surface. The rigidity of the outer shell of the earth is not great. In fact the rigidity of the highly compressed mass at the centre is six times less than steel. The earth is constantly subject to varying stresses tending to deform it. These are partly induced by astronomical bodies, and are partly due to contraction resulting from the loss of heat. The contraction has taken place through distortion of the outer envelope, great segments becoming depressed, forming the basins occupied by oceans, while the continents represent minor segments thrown up in an effort to relieve the strain. In addition to these movements on a grand scale there has been a localizing of the movements at certain places where the deformation has become excessive, producing mountain ranges, where the inner mass of the earth has invaded the upper layers. Here the movements have become exceedingly complex, and relatively violent, so that fracturing has been almost universal. Not only have there been elevations and foldings of the superincumbent strata, but lateral pressure, producing a most complicated network of fissures. Great fissures have been formed, but these are invariably accompanied by infinite minor breaks, traversing the rocks in many directions.

To what extent fissures thus formed may remain open until filled by deposits from mineral-bearing solutions depends upon depth below the surface. The pressure increases with such rapidity that it is doubtful whether fissures which can remain open are possible as deep as 5000 ft., and except for vugs, which are open spaces of such shape that arch action may come into play to support the pressures, and prevent collapse, open rents have not been found in mining operations except within a few hundred feet of the surface. The method by which veins are formed along fissures is, accordingly, not the simple one of crystallization of mineral salts out of solution. The deposition is generally a result of chemical interchange between the substances conveyed in solution or in gaseous emanations, and the material composing the permeable zone, which, by a continuation of this process, becomes a vein, a lode, or a metalliferous mass. Such chemical interchange is known in geology as metasomatosis.

If two rocks are rubbed together abrasion occurs; if the pressure is great enough while this movement is taking place, portions of the rock near to the two opposing surfaces become crushed, and the original structure is destroyed. The rock may become disintegrated and partly broken into fragments, called breccia. This is what frequently follows from those movements of the earth which produce fracturing and faulting of the rocks. After such a process of disintegration the crushed portion of the rock is usually more permeable, and it is also in a state admitting more readily of chemical interchange. If you wish to dissolve a lump of salt it can be more promptly done by first reducing the salt to a powder. If a lump of salt be pulverized and a solution of silver nitrate be poured upon it the salt rapidly passes into solution, and as it does so it reacts with the silver nitrate. The result is that the silver unites with the chlorine of the salt, forming silver chloride which deposits as a solid precipitate, while the sodium of the salt unites with the nitric acid of the silver nitrate and passes into the solution as sodium nitrate. This will illustrate the process of chemical interchange, which in a much more complex manner leads to a solution of rock with a corresponding deposition of other chemical compounds which crystallize and fill the permeable zone with a new set of substances, thus forming a lode or vein. It is now plain why deposits of minerals tend to follow the zones of faulting, crushing, and brecciation, and why such phenomena are more frequent in regions which have been subjected to volcanic action. In volcanic action are found the forces that produce the dislocations of the rocks preparing favorable receptacles for veins, and it is accompanied with the emission of mineral-bearing solutions and gaseous emanations which bring in the substances that yield valuable deposits for the miner.

It is also to be noted that the invasion of magmas from below commonly starts with an uplifting of the superincumbent rocks, so that extensive fissuring precedes the actual eruption, and the final outflow of lavas occurs along some of these lines of weakness. Hence the lava is quite likely to open a fissure where crushing had taken place, and it will cool in contact with the walls of rock which are in a favorable condition for chemical interchange. As the lava cools it contracts, and shrinks away from the walls, thus admitting of greater permeability along the line of contact between the two. This reveals why so many deposits are found in contact with, or closely associated with volcanic rocks.

It must be further explained that when such chemical interchange is effected the result will be one of three kinds; either no change of volume follows, in which case the line of weakness is healed and rendered dense, and further flow of solutions practically ceases; or the change is accompanied by a loss of volume; it produces expansion. Where loss of volume occurs the permeability of the zone is maintained, and prolonged mineralizing action may go on; where there is increase of volume pressure is exerted by the altered mass against its enclosing rocks, and this usually causes extensive fracturing and crushing of the new mass which may lead to its further alteration and to successive periods of deposition of minerals. Furthermore, a vein is frequently less resistant to pressure than the unaltered bounding rocks, and hence later volcanic action is likely to re-open such fissures, so that a lode once formed is quite likely to be faulted and brecciated subsequently, when a new cycle of mineralization will be

inaugurated. After volcanic disturbances have ceased a set of complicated movements generally follows, due in part to readjustment of the dislocated rocks until equilibrium has become re-established and also the shrinkage of the crystalline volcanics on cooling induces a settling and readjustment of the superincumbent and surrounding rocks. A region once disturbed is subject to a prolonged series of movements, favorable to the formation of suitable zones for the mineralizing action of solutions and gases, and these zones are more abundant and more complicated near the surface than at greater depths. Simplification and narrowing of fissures in depth is a matter of common observation in almost every mining district. It is particularly in evidence in the desert regions, and is characteristic of the famous deposits at Goldfield, Nevada. There the mineralized zones are extremely irregular in shape and width, but become less complex farther down. Moreover their erratic shape renders inapplicable the term lode, so that the United States Geological Survey has adopted the name of reef for these occurrences.

A distinction must be drawn between a lode and a vein. A lode is a mineralized zone of a somewhat tabular form. It possesses a longitudinal extension which is large compared with its width, and its lateral boundaries are approximately parallel. It may or may not have clearly defined walls. The mineralized zone may grade into unaltered rock on either side, but the body of the lode is an altered mass readily distinguishable by its mineralogic differentiation from the bounding country rock. An economic distinction between a lode and a vein can not be made in these days when the tendency is to exploit low-grade ores. Usually a lode is a mineralized zone of relatively low concentration of valuable minerals.

A vein is properly a mineralized zone with sharply defined walls. It need not be economically valuable, but its differentiation from the enclosing rocks is essentially more clear and unmistakable. A vein may exist within a lode, or it may be held between walls of rock which have undergone little or no alteration. A great many veins are associated with relatively wide zones of altered rocks. The whole mass then becomes a lode, within which is included the vein. The two are in reality only different phases of the same geological phenomenon. They grade into each other, and often no discrimination between them is possible. It would be as well perhaps to frankly accept the lawyer's propensity to classify as veins those deposits which have well defined walls. The reason why some sort of distinction seems necessitated is that a lode may contain many veins, the apexes of which may constitute valid bases for the location of independent mining claims. Lodes are often of such great width that it would be quite impossible to establish legal rights within the narrow limits of a claim. An essential feature of a United States mining claim is the grant of the extralateral right. This permits an owner of such a claim to invade the property of another in following his deposit. In order to validate this extraordinary right he must be able to clearly distinguish the lateral limits of his deposit. The importance of the walls then becomes paramount. Whether we choose to call the deposit which he follows a lode or a vein it must be set off from the enclosing rocks by recognizable boundaries, the ideal form of which would be plane surfaces. Actually the plane surface is the exception but a clear change in mineralogic character between the deposit and the adjacent rocks is an essential legal requirement. This was reiterated in unmistakable language in a recent decision (Golden Murphy Nev. 103 Pac. 994 July, 1909) where the court held, "where one claims extralateral rights under the Acts of Congress, because of a vein existing and appearing in his ground but which has no well defined boundaries, and when his claim is controverted, he must in order to exercise such rights, show a ledge or body of mineral-bearing rock of such value as will distinguish it from the country rock or from the general mass of the mountain. The material must in texture and value be such as to show the existence of a vein, and proof of the fact that the rock is broken, shattered, and fissured, and mixed with calcareous substance, though it may show a conglomerate mass, does not establish within the meaning of the statute a vein. But when the walls or boundaries are well defined, the vein differentiated from the adjacent country, and the kind of materials mentioned constitute the filling, then evidence of slight value in mineral will be sufficient. What constitutes a discovery that will validate a location is a very different thing from what constitutes an apex to which attaches the statutory right to invade the possession of and appropriate the property which is presumed to belong to an adjoining owner. The question of a sufficient discovery of a vein, or the validity of a notice of location, is substantially different from one relating to the continuity of a vein on its dip from the apex, and which tests the rights of the undisputed owner of the surface to what lies underneath and within his own boundaries."

The foregoing clearly states the need of having recognizable bounding walls, and it also affirms the economic requirement of value. The latter is fundamental in the eye of the law, and yet it is uncertain and evasive. A vein may contain valuable substances, but because of its leanness, or its narrowness, it may not be possible to operate it commercially at a profit. The geologist recognizes no economic limitations. He depends upon composition and structure only. He defines a vein by its characteristics as a natural phenomenon. As geologic knowledge enlarges the significance of what may commercially be an unimportant vein so far as exposed may become important as an indication of probabilities which can be verified only by exploratory work. Reasoning from geologic premises a man may conform to the legal requirements of ordinary prudence in undertaking operations for the development of a vein which at the apex may have no value in a commercial sense.

In the end all things in which man can obtain property right, and which may become the subject of litigation, are what the courts define them to be. The geologist is thus forced to employ terms in such a sense as will not be in conflict with their legal in-

terpretation. On the other hand the jurist must depend upon those whose business it is to study the special facts adjudicated, for guidance in making correct distinctions. As at present employed there is lack of agreement concerning the use of the word 'lode'. We speak of lode-claims when in fact we should call them vein-claims, for the reason that a lode may be so immense in size as to be wholly incapable of inclusion within the lateral boundaries of one or many mining claims. To give an example, let us assume that a crushed zone is 900 ft. wide, which is by no means exceptional. If it have fairly well defined lateral boundaries which are approximately parallel, and if the material within these boundaries is mineralized, this mass would conform to the definition of a lode, but it is clear that on such a lode as many as three parallel mining claims could be located, none of which would have more than one wall, and one could show none at all. If the material of the lode were homogeneous it is manifest that the middle claim would lack the essentials for validating an extralateral right. I am not here to argue against the so-called 'law of the apex', but it is worth while in passing to point out the difficulties in according justice under the terms of the statute which has established this principle. It fails even in the case of the very natural phenomenon which has given the name of lode-claim to these possessory rights. In the cases of large irregular masses, and of the broad extensions of disseminated copper ores to which reference was previously made, the application of the law of the apex is manifestly absurd, and yet such deposits are in no sense capable of being held under placer locations. The geologic conception upon which the law was framed was a narrow and imperfect one, which does not square with the facts.

The law states that an owner of a claim may follow the vein on all its dips, angles, and spurs. No difficulty arises in relation to dips and angles. A vein following fracture lines may reverse its dip without losing continuity. It may vary in its course or strike, by making sharp angles, but these vagaries are easily harmonized with rights conceded by a mining claim. A difficulty is introduced, however, by spurs. These may be of two kinds. A spur is a branch. It may lead off from the vein, vertically, horizontally, or at any angle between these extremes. From the explanation given of fracturing, fissuring, and faulting, it will be understood how complicated the associated fracture-lines may become. The peculiar form of the veins at Leadville compelled the adoption of a local rule whereby in that district extralateral rights are by common consent discarded, and compromise has become the resort in many other camps. The essential inadequacy of the apex law is thus brought into prominence. In limestone regions the difficulty is also great. Limestone is readily soluble, and hence ore deposits form with special facility along the contacts of limestone with other rocks, and along the joint-planes, bedding planes, and other fissures. Furthermore the tendency of limestone is to dissolve more readily at some places than at others, so that the deposits widen into masses of extremely irregular shape, and all semblance of well defined walls is lost. Here the law of the apex breaks down utterly. The zinc-lead deposits of the Joplin district, in Missouri, are an example of the erratic type to which I have called attention. Fortunately these occur in a region originally occupied for agricultural purposes, so that the common law principle is there in force, which reduces the rights of owners to a simple determination by surveys. Another instance of orebodies which have occurred without regard to the principle of lodes or veins is afforded by the copper deposits at the Copper Queen mines, at Bisbee, Arizona. Here great masses of rich ore are found in blocks disseminated through a large area. These blocks are often entirely separate from each other, with no connecting veinlets or other leaders. In order to find them the whole mass of rock has to be cross-cut at such frequent intervals as to avoid the possibility of missing them. Deposits of this character are in absolute defiance of the simple conception of a vein which can be followed on its dip downward into the earth.

The mineral deposits which we have been considering have been formed in one of three ways, or by a combination of them, namely, (1) By deposition from solution as a result of crystallization from such solutions or by chemical replacement of the original rocks by matter brought in dissolved in the solution. (2) By chemical interchange in the presence of gaseous emanations bringing metallic compounds in a volatile state, a characteristic of nearly all tin deposits. (3) By actual intrusion of mineral-bearing volcanic rocks, which may or may not require further concentration by solution and re-deposition within the intruded mass. It has been seen that these deposits may possess any shape, and be of extremely variable magnitude. Also it is noteworthy that the enrichment may not be uniform—in fact it rarely is—and the enriched mass may become progressively leaner away from some central zone of higher metallic concentration, forming what are known as stockwerks.

It is now needful to consider an entirely different class of deposit, known as placers. It is evident that the law does in this case proceed from a consideration of origins, confused again by narrow geologic conceptions. The world waits for a definition of 'placer' that will hold in law. In view of the divergent opinions and rulings I might be justified in calling a placer deposit one that can be located under the mining law with the consent of the Department of the Interior as a claim carrying with it no extralateral rights. The original intention was to give mining rights in a deposit laid down superficially, as a gold-bearing gravel bed, to which the Spanish word 'placer' was applied. From deposits formed by sub-aerial agencies, through the wearing away of rocks and veins, and the concentration by streams of the heavy metallic or metalliferous substances, the extension of the idea to deposits thrown down by precipitation from the waters of lakes and oceans was natural. Thus salt, gypsum, soda, and borax, conform to the notion of superficial accumulations of valuable minerals. Such deposits may be buried subsequently by the formation of sedimentary rocks above them, or by lava flows. The rich gold

gravels of certain Mexican rivers as Cretaceous were deeply covered by great deposits of volcanic tuffs followed by lava capping. Yet because of their origin they remain placers none the less. A buried placer may be included in foldings and dislocations of the rocks during later mountain making epochs and may be left standing in tilted positions bearing a resemblance to lodes and veins without alteration of its character. It still remains a placer because of its geologic origin. It is undoubtable that the intent of the law was to grant claims to deposits of such origin lying horizontally, but horizontality is never more than approximate, and as between an inclination of five degrees, or forty five, or even ninety, a distinction would be merely arbitrary, and without real justification. The law has, however, made a point of position. A lode claim will not be given patent unless it goes downward into the earth. This would, apparently, leave a so-called 'blanket' vein, when found in a horizontal position, subject to valid location as a placer. Evidently the only way to reach some of these cases is by special legislation, as has been done in regard to coal beds which, on the ground of origin, would clearly fall under the head of placers, being formed by superficial accumulations of vegetable matter. By what stretch of imagination petroleum deposits were ever classified as placers is hard to see. They certainly do not represent original deposits laid down on the surface or precipitated from surface waters. They are mainly due to complicated chemical reactions altering organic matter in sandstones, shales, and some limestones, into a substance having not the remotest resemblance to the original material acted upon. To some extent petroleum may in a few cases have been derived from reactions occurring in volcanic magmas. In any case it has not been formed directly in the exact spot where found, but has been concentrated into pools and porous layers of rocks by seepage, and it may often have been gathered from beds of great thickness. Moreover, the exact amount so concentrated in any area can not be known, nor can the owner of any portion of the earth's surface be limited to the extraction of that which lies under his claim, since he may drain neighboring ground, or lose what might have laid under it by drainage to adjacent wells. These peculiarities have been met in States where the land was already owned in fee, by the introduction of a leasing system, paying royalty on the amount actually extracted. The adoption of a similar procedure by the Government as applicable to oil on the public lands would seem almost necessitated as a matter of equity.

An interesting case under the placer laws has arisen in connection with the phosphate deposits of Idaho and Utah. These occur in rocks of pelagic origin, and the phosphate was formed by the secretions of animal life. The deposits accordingly conform, on the basis of origins, to the geologic conception of placers. But as originally laid down they were of such feeble concentration as to be of no commercial importance. Subsequently, however, the percolating solutions dissolved and reprecipitated the phosphate of lime in enriched layers. This action is precisely similar to that which has produced many metalliferous deposits where the disseminated metals have been gathered into veins by leaching and subsequent precipitation in favorable channels. In this view there is no sharp distinction possible between these phosphate beds and some veins of gold, lead, or zinc and they should consequently be capable of valid location as lode claims. It happens, however, that these beds, lying conformably with other sedimentary rocks, folded into gentle flexures, would enable a lode-claimant to control miles of the deposit by virtue of the extralateral right, thus favoring monopoly on a large scale. The Department of the Interior has in consequence withdrawn these deposits from location pending Congressional action, which is clearly needed in order to deal justly with the situation.

The brief discussion given of the salient features of mineral deposits indicates that the mining law as it now stands was based upon ideas of geologic characteristics that were too simple to cover the facts as they are found in nature. Great deposits of ores of iron, gold, lead, copper, and other metals vary so widely from the form of a lode as conceived for the purposes of a lode-claim as to render the law inapplicable to them except by distorting it from the original intent of its framers. The extralateral right demands, as a condition precedent to its equitable concession, a form and limitation in width of deposit which does not exist in a vast number of cases. The placer claim is made to include deposits which are not placers in the true sense of the word. The multiplication of special acts of Congress only leads to complexity, which to a large extent would have for its sole purpose the rectification of difficulties brought about by the injection of the principle of the extralateral right into our legal system. While admitting the essential reasonableness of the law of the apex in many cases, it is an inevitable conclusion that the ends of justice would be subserved by a return to the ancient usage of the common law in real property as applied to mines of all classes.

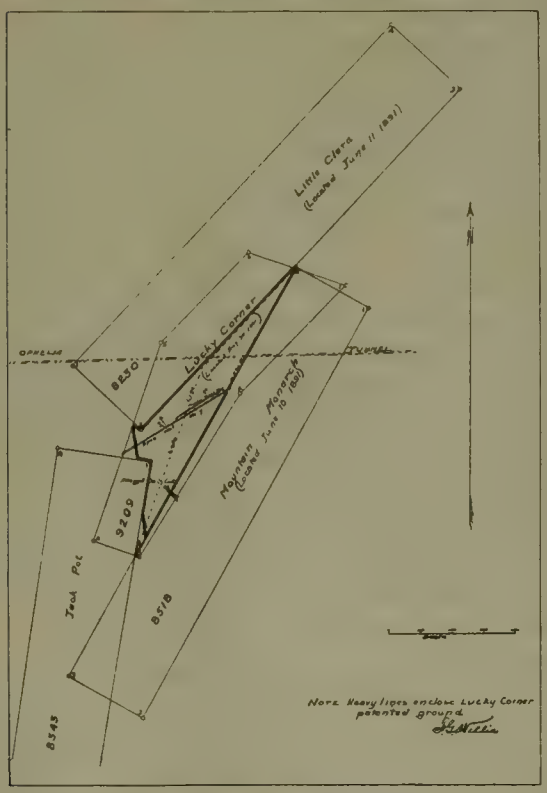
ANALYSIS OF ROCKS

The chemical work of the United States Geological Survey has long commanded the general attention, and many of the reports of the Survey's chemists have become reference works in colleges and universities. One of the Survey's chemical bulletins (Bulletin 305), on the analysis of silicate and carbonate rocks, by W. F. Hillebrand, has been translated and re-published in Germany, and the home and foreign demand for it has completely exhausted the edition printed. A new and revised edition of this manual, numbered Bulletin 422, has, therefore, just been published. Mr. Hillebrand, the author, was for 28 years one of the Survey's chemists and is now chief chemist of the Bureau of Standards of the Department of Commerce and Labor. The two classes of rocks considered form the bulk of the earth's crust, and although the bulletin was not prepared primarily for economic purposes, the methods and principles described may be applied directly to economic work. The rocks of these two classes contain many valuable metals and minerals.

Extralateral Rights Again

Written for the MINING AND SCIENTIFIC PRESS
By HORACE V. WINCHELL

Some new phases of our national mining law were developed in an interesting lawsuit in the Federal Court at Denver recently. The plaintiff company is the Doctor-Jack Pot; owner of the Lucky Corner, a fractional lode-claim patented more than five years ago. The defendant corporation is the Work Mining & Milling Co., owning the Little Clara lode-claim, patented and contiguous to the Lucky Corner on the west. The claims are at Cripple Creek, Colorado. The Lucky Corner is junior in date of location and patent to the claims lying both east and west and as patented is approximately diamond-shaped. Its located end-lines are parallel by virtue



of location corners upon patented ground. Its side-lines are not parallel either as located or as patented. If the discovery vein therefore crosses both side-lines, the claim has no extralateral rights. The relation of the claims is shown in the accompanying figure, furnished by the courtesy of Hills & Willis, of Cripple Creek.

The suit was brought by the owners of the Lucky Corner claim for the purpose of establishing extra-lateral rights upon two veins alleged to be not the discovery vein, and hence secondary veins apexing in the Lucky Corner and dipping into the Little Clara. Judgment was also sought in large amount for ore extracted beneath the surface of the Little Clara by the defendant company, where, as a matter of fact, the ore was first discovered. Up to this point the case is not out of the ordinary. The novelty arises from the fact that the plaintiff made no attempt to prove a discovery vein in the Lucky Corner, nor to prove that the said discovery vein crosses either end-line of the claim as located. Relying solely upon the presumption in law that a patented claim has a valid discovery, the plaintiff asked the court to rule that it is also to be presumed that the course of the apex of the presumed discovery vein is parallel to the longer lines of the claim, so that if followed it would cross one end-line; and therefore in the absence of conclusive affirmative proof to the contrary the claim has extralateral rights upon all secondary veins within the planes of the located end-lines. Such a ruling would throw the burden of proof as to the course of the primary or discovery vein in the plaintiff's ground upon the defendant instead of making it part of the plaintiff's case to show clearly by what right he seeks to recover damages for ore extracted from beneath the surface of adjoining property.

In the case at hand the situation was still further complicated by the fact brought out in the testimony that the Lucky Corner claim never had a valid discovery; that it lies almost wholly in a gulch and that the discovery workings are in loose gravel. How then could anyone prove that a discovery vein which does not and never did exist crosses the side-lines of the claim? In what direction then are the extralateral rights of a claim which has no discovery vein? Shall such a claim, entered and acquired by fraudulent misrepresentation, be given actually greater rights beneath the surface of adjacent locators than the same claim legally and properly provided with a discovery vein crossing both side-lines? If such be the case the field is open for a vast amount of mining litigation and the dishonest locator will be aided by the law in despoiling his more conscientious neighbor. Moreover, the innocent man will be placed in a position where he cannot possibly protect himself. He has no way of adversing or protesting in the Land Office prior to patent; and subsequent to patent he is bound by a presumption to overthrow which he must trespass upon his neighbor's premises and then only to discover that he is seeking to develop the position of a vein which does not exist.

We shall look with much interest for decisions of the higher courts from which it may be possible to determine: (1) Is a patent conclusive proof not only of a valid discovery vein, but also as to the relation of its apex to the location boundaries of the claim? (2) Is it incumbent upon the party asserting extra-lateral rights to prove them clearly, or must the defendant do more than exhibit his own patent (senior in this case) or lose through no fault of his own?

Whichever way the matter is finally decided we have another beautiful example of the absurdities and inconsistencies of our mining law as it works out in actual practice. This situation is almost as involved as the Drum Lummon case in Montana, where there have already been decisions of the higher courts so learned and luminous that about a week's time was consumed in the hearing upon the third amended and supplemental complaint as to what these opinions actually do mean.

Cement v. Bone-Ash Cupels

Written for the Mining and Scientific Press
By J. W. Mcmurtry

The relatively high price of bone-ash and the fragility of bone-ash cupels used in assaying has led to the substitution in some places of portland cement. In a description of laboratory equipment and methods of the Provincial Assay Office printed in the twelfth report of the Bureau of Mines, Ontario, 1903, is to be found the following statement: "Cupels made of portland cement have been found by practice to be as satisfactory as bone-ash for the elimination of zinc, lead, copper, arsenic, etc., from gold and silver. The cement cupels have the advantage of hardness and durability and cost practically nothing, as cement is $2 per barrel." This led me to experiment with bone-ash and cement cupels under the same conditions in order to ascertain their relative merits.

Bone-ash cupels were made in hand-molds in the usual way and allowed to dry for three weeks. Cement cupels were made in five grades, varying in wetness from a shade less than that of bone-ash to a consistence which made the cupel stick to the plunger of the mold. These cupels were allowed to dry for five weeks, when they were found to be in the following condition: The driest were slightly harder than the bone-ash cupels. Those made the same as the bone-ash were found to be so hard that they would just break when allowed to fall five or six feet on a hardwood floor. Those made up wetter than the bone-ash were found to be too impervious and were undesirable. Two tests were made with these cupels, as follows:

First test: Ten cupels, five bone-ash and five cement, were arranged alternately in two rows across the muffle. When hot, the lead buttons were placed in them for cupellation. In each button was a weighed amount of silver (averaging a little over 10 mg.) plus the silver in the test lead. These buttons were obtained by scorifying test lead with a known amount of silver, and weighed about 15 grams. The muffle was kept at an orange heat. Cupellation progressed uniformly and all the cupels were withdrawn at the same time. The average loss of silver in the bone-ash cupel was 6.38%. For the cement cupel it was 6.64%.

Second test: The cupels were arranged as in test No. 1. The furnace was run with the muffle at light cherry heat. The silver was this time wrapped in sheet lead. Weights of silver were same as in test No. 1. The cupels were all ready to be withdrawn at the same time. The average loss for the bone-ash cupel was 4.62% and for the cement cupel was 4.91 per cent.

Two essential points of difference between the bead from the bone-ash cupel and that from the cement may be noted. First, the bead from the bone-ash cupel stood up good and round, on a small base, while that from the cement was flat and stood on a base which was as wide as the broadest diameter of the bead. Suspecting lead in the latter, it was tested, but no lead was found. Second, considerable cement clung to the lead after breaking, while very little bone-ash clung to the bead from the bone-ash cupel. The accompanying photomicrograph shows the bottoms of the two beads, magnified about 12 diameters. The larger, darker one is the bead taken from a cement cupel, and shows a large amount of cement clinging to the bead. These beads appear to be of different size, but this seeming difference is due to the fact that the bottom of one of the beads is smaller than that of the other, and only the bottom of each is in focus. The upper surface of the bead from the cement cupel appeared to be slightly rougher than that of the bead from the bone-ash, and of a duller color, but little sign of sprouting was apparent on either.

The advantages of the cement cupels are hardness and durability, convenience—in that the cement can be more easily obtained in the field than can bone-ash—and cheapness. Cement can be bought by the barrel at from 35c. to 40c. per 100 lb. Bone-ash can be bought at about $5 per 100 lb. If an assayer should use say 140 cupels per day, estimating that these cupels would run 14 to the pound with bone-ash at about the same weight as cement, he would use 50c. worth of bone-ash, or 4c. worth of cement per day. On the other hand, the difficulty of the cement clinging to the bead when weighing, and the fact that silica remains insoluble in gelatinous form while parting, which would vitiate the results on gold, balanced against the fact that little bone-ash clings to the bead and that only a very small percentage of the bone-ash is insoluble, makes the use of cement cupels unsafe in work where accuracy is desirable. For specimen assays, cement cupels might be used with profit. Cupels of cement, with a top coating of bone-ash, have been suggested, and experiments along this line would be interesting. The above tests were made in the Metallurgical Laboratory of Northwestern University, under the direction of W. H. Coghill.

Photomicrograph of Bottom of Assay Buttons.

An investigation of the Estancia valley, in the central part of New Mexico, was made last summer by O. E. Meinzer, of the United States Geological Survey, for the purpose of ascertaining the possibility of utilizing its ground water for irrigation. This broad valley, which contains extensive tracts of tillable land, is bordered by mountains, hills, and mesas and lies at the centre of an inclosed drainage basin that covers about 2000 square miles.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

The Engineer and His Report

The Editor:

Sir—Often the reputation of the engineer who signs a report is more valuable to the promoter who has mining stock to sell or the original mine owner who has a mine to sell, than the actual work performed in examining a mine or making a metallurgical test. In fact, the mining engineer who has spent perhaps 15 to 30 years in the business and has built up a reputation for honesty and ability, considers his reputation as so much capital which he naturally wants to protect. Anyone in business would want to protect his business and can do so, but not always the engineer his reputation. To illustrate, I will give some of my own personal experiences, and there may be similar cases which have never been brought to my attention.

About nine years ago I took an interest in the Val Verde smelter, near Prescott, Arizona. This plant was afterward sold to the Bradshaw Mountain Copper Mining & Smelting Co., and destroyed by fire. In addition to a salary under contract, our company had made a contract with the Standard Smelting & Refining Co. to smelt their ore and concentrate. There was nothing objectionable in this, if they had any ore to smelt, but a few months later a friend of mine in New York wrote me inquiring about the Standard Smelting & Refining Co. (one of the side companies of the Douglas-Lacy Co.), asking what I knew about it, as I was considered to be with the company. This I denied, when, in reply, one of Douglas Lacy's circular letters was sent to me, headed, 'Second Edition, September 16'. In it my name was used in such a way as to lead stockholders to believe that I would be one of the company, and partly responsible for its success. In addition to this letter, I understand there were others which I never saw. I immediately took the matter up with one of the best lawyers in Prescott, Arizona, who informed me that it would be useless to fight such a combination of people.

Later, since I came to California, a sample of oxidized ore was once sent me, low in silica, rich in bismuth and gold, and containing considerable lead and silver. The man sending this sample asked me to have it assayed, and stated that the owners were having a concentrating plant put in. He asked me what I thought about it. I sent him the assays and stated that I sincerely hoped, if the owners were friends of his, that they would not attempt wet-concentration of the ore. I did not charge a cent for the assays or my comments. This correspondence took place about three years ago. Last November, when I was in Sinaloa, Mexico, on other business, I found this property, the Amazon, shut down, and sold for taxes. There was a very nice little concentrating plant, and a few tons of concentrate on the ground. This was not much of a surprise to me, but the contents of a circular letter which was handed me was. I herewith quote that portion which refers to me, and which would lead people to believe that I was responsible for the process the Amazon company had adopted: "During the first visit of Mr. Craibs to the mine, he made a change in the management, employed an expert, Mr. Edwards, for consultation regarding the bismuth, and has also placed this problem before the Hendley people, the Allis-Chalmers people, and finally before Mr. S. E. Bretherton, one of the greatest smelter men in the world, now the general superintendent of the Great Western Gold Co., and together they have arrived at a method of treatment which all of these men pronounce successful."

My name may have helped to sell stock but using it in such a connection was certainly a great injury to me. Such language as the above may please boys, but not men of experience whom it injures and yet, what recourse have we?

S. E. BRETHERTON.

San Francisco, April 23.

Coal-land Prices

The Editor:

Sir—Your editorial defense of the new valuation of coal-lands by the United States Geological Survey, under date of April 2, 1910, has been read with interest, yet fails to convince me that there is anything in its favor except that the new price will ultimately net the Federal Government about $700,000,000 more for the coal lands yet in Federal control in the public lands States than the price heretofore charged for these lands. In defending this increase you have undertaken to weave in other and entirely extraneous matters by citing that under the new rates the Federal Government will not sell the land until there is a real demand for the coal, which has nothing to do with the new prices but is rather a matter of terms which will be decided by Congress and not by the Geological Survey. The confusing and wholly unwarranted statement that because the purchase is made long prior to the date of production the ultimate price for coal would be higher under the present prices than if the higher price prevails, is not a matter of fact when we consider that the higher first cost of the land will prevent small operators from engaging in the business, that if all the land is re-appraised at the same rate as that already gone over the purchase price will be 200% above what it is now, competition is destroyed by elimination of the small operator, title to a greater proportion of the land remains in the Federal Government, non-taxable, and the rate will be higher on the privately owned coal in consequence. The greatest danger to the consumer and the most certain result if the Government "holds the coal lands, parting with them only as the coal is actually needed," would be that mining companies would put a higher price on the coal. The safeguard against exorbitant prices in the East is the sharp competition between producers. The whole fabric of your argument favoring higher prices for the coal lands fails when the price of the land is considered independently, and all other features are as applicable to the lower as to

the higher per acre price. The proposed higher price is in the interest of monopoly, is the opposite of conservation, and has for its only excuse a desire to get better prices for the land. The members of the Spokane branch of the American Mining Congress are not opposed to State control, title to remain in the State, to the end that all revenues from leases may return indirectly to the people in the localities where the coal is, and the selling price can be controlled by the State.

Under the Constitution, the Federal Government is not empowered to rent or lease anything, and under section 8 of article 1 of the Constitution are these words: "The Congress shall have power to lay and collect taxes, duties, imposts and excises, to pay debts and provide for the common defense and general welfare of the United States; but all duties, imposts and excises shall be uniform throughout the United States." To which the United States court adds (157, U. S. 557), "Thus in the matter of taxation the Constitution recognizes the two great classes of direct and indirect taxes, and lays down two rules by which their imposition must be governed, namely, the rule of apportionment as to direct taxes and the rule of uniformity as to duties, imposts and excises." And the same court in another case (157 U. S. 429, 557) states: "Although there have been from time to time intimations that there might be some tax which was not a direct tax, nor included in the words 'duties, imposts and excises', such tax for more than 100 years of national existence has yet remained undiscovered, notwithstanding the stress of particular circumstances has invited thorough investigation into sources of revenue."

There seems in your article to be a confusion of law and suggestion as there is in many articles favoring changes in the method of disposal or non-disposal of our resources and utilities. In fact prices of coal lands have not yet been raised but it is suggested to raise them. Even much of the proposed legislation as to Federal control would not bear the analytical scrutiny of competent courts of law. The Spokane branch favors conservation which shall reduce the cost to the consumer, make waste places produce something, the power from our water ways take the load off the coal mines, where electric power can be used. This is not encouraged by Federal interference but by wise use under State regulation.

L. K. ARMSTRONG.

Spokane, Washington, April 15.

Cyanide Notes

The Editor:

Sir—In your issue of January 15, Bertram Hunt writes on 'Researches Upon Cripple Creek Telluride Ores', remarking that, "the use of cyanogen bromide ('bromo-cyanide') was strongly advocated at one time, but with the exception of a single mill in Western Australia one does not hear of its being in use." Evidently Mr. Hunt does not follow treatment in this State, or he would not write so. The original mill at Kalgoorlie using bromo, was the Hannans Star, but this is now shut down, as the company is about to consolidate with the Lake View Consols, which has 75 stamps and one No. 5 Krupp ball mill, wet crushing, concentrating, tube milling, agitation with BrCy, and filter-pressing at the vats of 11,200 tons per month, with about 90% extraction at a cost of $2.46 per ton. The Oroya Links company has 50 stamps, Wilfley tables, tube-mills, agitation of slime with BrCy, and filter-pressing at the rate of 11,500 tons monthly, with 92% costing $2.44 per ton. In connection with the milling results of these two mines, the former mine is dealing with a hard ore, and the ball mill has just started, so it must not be taken into account; while in case of the latter mine, the ore is fairly soft. Another mill using BrCy is that of the Golden Horseshoe. Here 150 stamps—soon to be 200—are at work, with Wilfley tables, tube-mills, and grinding pans in series, agitation with BrCy, and filter-pressing. An average of 24,500 tons is treated monthly, and of this quantity about 17,000 tons are treated by this chemical for 90% extraction, costing $2.80 per ton. Finally, we have the Ivanhoe mill with 100 stamps, tables, grinding-pans, sand, and slime treatment. Of the latter product, some 10,000 tons is treated by BrCy, the monthly output being over 19,000 tons. A little under 90% is extracted at a cost of $1.90 per ton. I am not by any means holding forth on the merits of the BrCy process, being firmly wedded to the dry-crushing, roasting, and plain cyaniding for the sulpho-telluride ores of this field; but I simply wish to point out that Mr. Hunt is slightly in error on this point. There is one thing certain about the wet-crushing process here, that, if BrCy were not used, the extraction would be very low. Certain minerals in our ores are soluble in BrCy, but not in plain KCy, that is, in raw treatment. Is not the BrCy process being used on some arsenical ores, with a high percentage of arsenic, at Deloro, in Canada?

In an editorial, in your issue of January 15, you had much to say about the Goldfield Consolidated of Nevada, which must be a wonderful mine. You said: "America can now boast of possessing the premier gold mine of the world, thus wresting first place from the Transvaal." Do you mean as regards the monthly or annual yields, or as to the value of the mine. Mr. Rickard once said that "The value of a mine depends on its present profits and its future development," or words to that effect. Now, a comparison between the Goldfield Consolidated, Homestake, Robinson, and Waihi mines present yield and future prospects, would be highly interesting. Which is the premier mine (gold) of the world? There is one laudable point about your Nevada mine, and that is its detailed monthly tonnage, costs, and mine development. Why don't all your American mines, whether working for precious or base metals, do likewise? We are compelled to in Australia.

M. W. VON BERNEWITZ.

Kalgoorlie, Western Australia, March 12.

[Our note about the Goldfield Consolidated had reference to present annual production. There are of course many bases for such comparisons, and each is, to some extent, unfair to some mine. The Goldfield Con. is setting an excellent example, as Mr. von Bernewitz notes, in the matter of fullness of monthly reports.—EDITOR.]

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Baguío is a term used in the Philippine Islands for the severe hurricanes which occasionally devastate the region. It is pronounced bah-geé-o.

Tropical wood is not generally good fuel and it requires large fireboxes in boilers to accomplish proper combustion and to keep up a steady steam pressure. It has been observed that it requires unusually large boiler capacity to do a given amount of work. This is in part explained by the great radiation that occurs in the humid atmosphere. For this and other reasons, it is wise to provide ample boiler capacity.

Concrete piles were first made in France by Hennebique in 1896, and were made of the cast and driven type. During the following decade this general type was developed by different engineers, and is now more generally used in Europe than any other. In the United States the Gilbreth (patented in 1908), Chenoweth (patented in 1904), and Raymond (patented in 1896), are the best known varieties of cast and driven piles.

Cast and driven piles require careful handling if made in long lengths, as cracks cannot be readily detected, and the piles should preferably be allowed to set several weeks before using. If made on the job this delays the work, while if made in distant yards, the exact lengths are hard to gauge, and the piles may be either too short or too long. As the operations of lengthening or shortening cause delay and expense, it is very desirable that the penetration be determined before the piles are brought to the site.

Waste in the woods, the mill, and the factory in the United States is so great that two-thirds of what was in the tree is lost on the way to the consumer. The heaviest part of this loss takes place in the sawmills. Much of this mill waste is unavoidable under present conditions, but the greater the demand for the product and the higher its value, the better will economy pay. Waste in manufacture is small compared with that at the sawmill. Study of the demands of the wood-using industries may be a means of finding out how the mill may profitably market a part of what now goes to the burner in sawdust, slabs, and trimmings.

Germany's greatest achievement in connection with navigation of the air is not the technical perfection of the air-going craft; she has learned how to use the air currents, as the birds do, in traveling. This is a science; the ship is only its instrument. Airships will double and treble their speed by acting in harmony with the forces of nature, the primal speedmaker. There is a working force only lately reckoned with, even by builders of air craft—and that is the wind. Airships will use the tradewind to reach this continent because it always blows one way. That is as simple a proposition as that a low-powered steamer should use the gulf stream. Air traffic, to compete with rail or water, must maintain as sure a schedule of travel. Germany has already mapped her airship routes to and from America.

Helium is a gas given out by radio-active bodies, and since, except in beryls, it is not found in minerals which do not contain radio-active elements, it is probable that all the helium in these minerals has come from these elements. In the case of a mineral containing uranium, the parent of radium in radio-active equilibrium, with radium and its products, helium will be produced at a definite rate. Helium, however, unlike the radio-active elements, is permanent and accumulates in the mineral; hence if the amount of helium in a sample of rock and the amount produced by the sample in one year be measured, the length of time the helium has been accumulating can be found, and hence the age of the rock.

Wild-catting does not mean in the oil business quite the same thing as in mining. In the latter case there is a stigma of which does not attach to the word when applied to the development of new oil territory. Indeed, among oil men the word 'wild cat' is used much as 'prospect' is among miners. A wild-cat well is one drilled in unproved territory. It may be in a region where every geological condition is favorable; indeed the term is even applied to a well sunk in improved territory between productive pools. Sinking wild-cat wells is an entirely legitimate business, and many men of the highest character are engaged in the business. It does not correspond at all to sinking money in a wild-cat company either for the development of oil, minerals, or transportation.

Prevention of corrosion in iron or steel is based on the use of a practically inhibitive pigment to prevent the inception of corrosion and a second coat to protect the first from atmospheric and temperature conditions and to fill thoroughly any voids. To meet these conditions the pigment should be practically inert and its particles extremely small. While red lead is not absolutely inhibitive, it has been demonstrated to be a first-class pigment for use in the preservative treatment of steel in almost any situation and its particles are extremely minute. It is heavy and settles quickly, necessitating the mixing of a new lot if it has stood any length of time. The settling may be retarded by the use of barytes or asbestine, and the use of the latter is to be recommended by reason of its permitting a firm hold on the pores of the steel. The oil should be pure, as the matter of vehicle is of large importance, and the raw oil is better than the boiled. A mixture of red lead, oil, and asbestine, in the proportions of at least 15 lb. of red lead and 2 lb. of asbestine to a gallon of oil, with sufficient japan dryer to work well, may be recommended. The use over this of a first-class graphite paint will serve thoroughly to protect the shop coat and to fill any voids; the particles of well ground graphite being extremely small.

Special Correspondence

JOHANNESBURG, TRANSVAAL

New System of Mine Returns — Profits per Square Fathom — Utopian Ideas — Flotation of Government Mining Areas — Ore Reserves and Gold Recovered

In a recent letter reference was made to the promised introduction of a new system of mine records based on some unit of square measurement as opposed to the normal basis of tonnage milled. Full particulars have been issued and have met with a mixed reception. The scheme is to be adopted forthwith upon the Eckstein mines, in connection with a new form of quarterly returns. To appreciate the purport of the innovation, and, at the same time, the weight of the opposition, some explanation of old methods must be made. Monthly records of operations have been made in detail and most companies have kept, and will, no doubt, continue to keep, precise data on the following points: (1) Development footages, and value of all new exposures. (2) Tonnage and value of ore developed thereby. (3) Ore stoped, with figures of fathomage, value, and stope width (measure and calculated) from each place. (4) Ore from development faces. (5) Tons packed underground. (6) Tons hoisted and sorted. (7) Tons milled, with all data relative to metallurgical operations and results.

Every item of cost reasonably required to be segregated is worked out, and for general guidance and for such purposes as the annual reports, the mining costs are shown 'per ton mined' and 'per ton milled', and the treatment cost 'per ton milled' and 'per ton treated'. Now, the argument is that (1) managers are forced owing to the publication of monthly reports to make uneconomical efforts to equalize monthly yields and profits, for fear of a drop or rise being given undue importance, and (2) that the close attention paid to costs per ton milled and the conclusions drawn therefrom as to managerial wastefulness or economy lead to the abuses of excessive stoping widths and inadequate sorting. The force of contention No. 1 is reduced by the fact that in the big mines of today the number of stope-faces kept in operation is necessarily so great as to ensure a fairly regular average, variations in which are met by the maintenance of a gold reserve. As for contention No. 2, it is as easy to attach too much importance to the significance of this as it is to overestimate the significance of a showing on the ton-milled basis. Because some Transvaal papers may proclaim with enthusiasm the reduction of costs on a certain mine to 13s. per ton, regardless of the fact that the company drew 30% of its mill ore from a dump of development rock accumulations, or because 3-ft. stoping with 25% sorting has cost 40% in excess of wide-reef mining, doing 10% sorting, and with its development complete, there is no cause for individual managers to receive unmerited censure or commendation from those whose opinions count. Every system is open to abuses, and no doubt the one of basing costs on the tonnage milled has been manipulated in some cases to serve visionary ends and to gain popular applause. But it would be erroneous to conclude that the great reduction in working costs recorded during the past three years has been the result of manipulation of figures in any but a small degree. When we hear the shriek against the 'bogey of low costs per ton milled', we may generally conclude that somebody has yet to learn the art of economical mine administration, of making good miners, and of keeping them. The new quarterly returns call for the following items, the last being considered to be the crux of the whole scheme and unerring criterion of progress:

1. Area developed on plane of reef in square feet, (a) South Reef, (b) Main Reef Leader, and (c) Main Reef.

1a. Total area in square fathoms.

2. Areas stoped out on plane of reef in square feet, (a) South Reef, (b) Main Reef Leader, and (c) Main Reef.

2a. Total area in square fathoms.

3. Resultant average stoping widths by actual measurement, (a) South Reef, (b) Main Reef Leader, (c) Main Reef, and (d) total.

4. Value of total gold content of ore developed as disclosed by sheet or by plan of ore reserves in sight.

5. Average gold content per square fathom stoped. 4 ÷ 2a

6. Value of total gold won.

7. Average amount of gold won per square fathom. 6 ÷ 2a

8. Percentage of recovery (100 by 6 ÷ 4).

9. Mine working costs per square fathom over areas stoped on all reefs, in pounds sterling.

10. Proportion of necessary costs chargeable against annual profits per square fathom, including maintenance, profits tax, head office, and everything except increase of capacity of plant.

11. Average working costs per square fathom = 9 + 10.

11a. Total working costs = 11 by 2a.

12. Total distributable profit obtained 6 − 11a.

13. Distributable profit per square fathom stoped 12 ÷ 2a.

There are several commendable principles involved in this scheme, provided the return is solely used for internal use and not issued as a Chinese puzzle for the amusement of shareholders. The dominant influence that it is intended to convey is that of checking careless mining and forcing managers to aim for the maximum profit per unit of area. The best way to ascertain whether unnecessary waste is being sent to the mill for the sake of appearances under the head of 'expenditure per ton milled' is not through the medium of such general returns, however ingenious; for no statistics of so meagre a range as those reproduced above will indicate the measure of increasing or decreasing efficiency. The bare total of profit, not per ton, but per month, is as valuable a guide. It must not be imagined that the manager who, for a couple of years, obtains a good showing in profit per fathom is necessarily doing the best for the whole mine—to be measured in hundreds of acres. Gaining the maximum total ultimate profit should be the aim, and not the greatest profit per claim for a given period; the latter perhaps gained by the operation of the high-grade blocks in a number of scattered workings on an excessive number of levels, or by drawing uneconomical proportions of the ore from each reef. These matters, it may be said, can be regulated by supervision, but so can the abuses of the tonnage-milled system that are declared to necessitate its displacement by something more scientific. If managers are working uneconomically to gain credit under an improper system, it is better for the directors and their technical advisers to get at the actual facts and details of bad practice than to seek cognizance of its influence by inferences from a series of belated and unreliable returns.

The issue of 175,000 shares out of a total capital of 1,400,000 shares, at par value of £1, in the newly floated Government Gold Mining Areas (Modderfontein) Consolidated, Ltd., has proved highly attractive. Barnato Brothers, who have been the successful tenderers for the Government ground, were obliged to offer these shares to the residents of the Transvaal. The applications for shares, limited to a maximum of 400, totaled 6000, equivalent to an amount exceeding £600,000. It has been taken as a foregone conclusion that all shares allotted will bring a certain profit, so that this original scheme by which the Government has presented a bonus to the speculating public has earned high favor. Although regarded as a socialistic precedent, this method of compensating the public for depriving it of rights impossible to grant by pegging, lacks many features of popularity. It has been necessary to accompany all applications for shares with cash in full, which immediately gave favor to the rich man in command of several 'dummies'. Work upon the Modder Consols has already been commenced, thus constituting another centre of activity to call for 6000 natives in the course of a few years. In three years' time, these Far East Rand mines will be requiring 20,000 to 30,000 more boys than they employ today. Labor is a factor in calculations of prospective value with which a doubt as to grade, even of 10 to 20%, appears of minor importance.

The meeting of the Aurora West—a small mine of small interest—was remarkable for the confession or explanation

from the chair that the gold called for by ore reserve valuation was not accounted for by actual operations. There is nearly always a discrepancy upon the Rand between the mine grade as calculated from screen value and from face sampling returns, that averages 10%. The Aurora West discrepancy has been much more serious, and although the payable ore reserve valuation at December 31, 1908, was 8.1 dwt., the yield for 1909 was only 26s. per ton after sorting. The payable ore reserve is now shown at 5.7 dwt. The difference cannot be explained without further details, but the gold occurs in this district largely in a stringer of 'reef' (often only an inch wide), whose true value sampling results are liable to exceed. However, it was most satisfactory to find the chairman of the company enunciating the sound principle that an effort was made to "work the mine on the basis of the average yield to be expected from available data as representing the grade of the property." There appear to be many today who, in the happy pursuit of theoretical gains, are apt to forget this honest principle, upon which the credit of the Rand has been so largely based. The practice of straight driving, below the 'reef', in a mine of such a character as to prevent the reliable valuation and location of stoping blocks without much cross-cutting, has been previously criticised. It is being followed by the Rand Collieries gold mine, which claims the following advantages, while admitting the defect of comparatively inadequate reef disclosures. (a) Cheaper developing costs. (b) The underlying or foot-wall 'reef' is more accessible and may even be exposed. (c) Cheaper mining costs for these reasons, (1) after stoping operations have been commenced it will be an easy matter to keep these levels open, but drive pillars will be unnecessary; (2) less labor required and cheaper and quicker shoveling and tramming; (3) greater facilities for using long-wall system of mining. The question is, whether the company will be able to work conveniently without auxiliary driving along the 'reef'.

LONDON

Globe & Phoenix Attracts Attention. — Salt Union Building New Works at Manchester.—Rio Tinto Annual Report.

Globe & Phoenix, a Rhodesian gold mining company, has been much to the fore in London recently owing to the great increase in the reserve and the content of the ore. The ore reserve at the end of December, 1909, is reported to be 171,507 tons, averaging 31¼ dwt. per ton, with a gross value of £1,124,878, as compared with 144,348 tons, with an average of 16 dwt. and gross value of £485,020 a year ago. The profitable ore extends to a greater length on the fifteenth level than on the fourteenth and thirteenth, the actual lengths being 1923, 1315, and 1230 ft., respectively. Work on the sixteenth level, below the dike, disclosed remarkably rich ore; the south drift is 208 ft. long and assays 37.7 dwt. over 31½ in., and the north 212 ft., assaying 157 dwt. over 32 in. The average of the orebody on the sixteenth level is 64.6 dwt. over 31.8 in., as compared with 28.9 dwt. over 37.9 in. on the fifteenth level. The seventeenth level is opening well, for on the south drift which is in 102 ft. so far, the orebody assays 28.6 dwt. over 30 in. The north drift has not yet been commenced. During the latter half of the year 1909 some of the high-grade ore was sent to the mill, so that the output and profit have been substantially increased. The amount of ore crushed in the 40-stamp mill during 1909 was 74,492 tons and the yield was 59,306 oz. The sand-plant treated 44,268 tons and recovered 4357 oz. while 23,861 tons of accumulated and 4950 tons of current slime yielded 2840 oz. The total production was, therefore, 66,503 oz., or 17.85 dwt. per ton. The working cost, including mine development, was 28s. 2d. per ton, which is an increase of 2s. over 1908, chiefly due to the fact that the machinery is old and has required much expenditure to improve its condition. The total revenue was £283,882, and the expenses and allowance for depreciation £133,236 leaving a profit of £150,646. The year commenced with a balance in hand of £47,802 so that the amount available for distribution was £198,448; out of this £160,000 has been distributed as dividend for 1909, being at the rate of 80% on the capital. The £1 shares now stand in the market at £8. I referred in this column some six months ago to the difficulty of treating this ore by cyanidation owing to the presence of antimony. It is now stated that the new plant for the improved treatment designed by H. T. Brett is being erected and should be at work in May. In the above figures relating to the extraction by the sand-plant it will be seen that the yield was only 2.33 dwt. The assay-value of the charge was 7 dwt. so that 4.67 dwt. was left in the residue. The new plant will not only treat current sand and slime but also the old residue and accumulated slime. At the present time some of the rich reserve is being milled in order to provide funds necessary for the thorough overhauling of the plant.

The Salt Union is by far the largest producer of salt in England. It owns extensive tracts of salt land in Cheshire and is managed in Liverpool. It was formed as an amalgamation of many owners in 1889 at a period when German and American production threatened competition not only in the chemical trade but in the export trade to foreign countries for household uses. The first year of its existence the production of salt was approximately 1⅔ million tons and the net profit was £320,400, out of which debenture interest, 7% on the preference shares and 10% on the ordinary shares, was paid, besides £40,000 being placed to reserve. How the production and profits dropped subsequently may be seen by the gradual fall in the ordinary and preference dividend. The ordinary dividend dropped to 1% in 1896, since which time the only distribution in this class of shares was 1¼% in 1907. The preference shares received their full 7% until 1896, but since then 13 years have provided only 35½%. With regard to the capitalization of the company it must be remembered that some years ago an effort was made to bring it more into line with the decreased value of the properties. Originally there were 200,000 ordinary shares of £10 each and 100,000 preference shares of similar denomination, as well as £1,200,000 in 4½% debentures. The preference were cut down to £6 each and the ordinary to £4 each, and the rate of distribution of late years on the preference shares has been on the reduced capital. The report for the year 1909 shows a production of 774,000 tons as compared with 781,000 in 1908. The net profit was £100,438, out of which £54,000 was paid as debenture interest, £25,000 as a dividend on the preference shares at the rate of 4⅙% and £20,000 placed to reserve. It is stated that there has been a further shrinkage in the amount bought by chemical manufactures, and that the bad fishing season has caused a decrease of the demand from this source. Also competition in the Indian markets has tended to reduce the export price. In order to keep pace with competition, the company is erecting a modern plant at Weston Point on the Manchester Ship Canal, near the present works, the money being provided by the recent sale of surplus lands. This plant will be of the multiple-vacuum type and it will be operated electrically. Improvements have been introduced into the system of purifying the brine for the purpose of producing a better quality of salt that will command a higher price. But with the present economics of the world's industry in salt it cannot be expected that even the best business management and the most modern technical skill can place the Salt Union again in the position it occupied in 1889.

The report for 1909 of the Rio Tinto shows that the great Spanish mine produced during the year 1,788,987 tons of ore, with an average content of 2.349% copper. Of the total 604,799 tons was ore suitable for shipment to chemical manufacturers, and 1,184,188 tons was treated locally in the blast-furnaces and by leaching. The amount of cupriferous ore shipped during the year was 600,946 tons, in addition to which 619,814 tons of washed ore was shipped for its sulphur value only. The copper production at the mine was 24,364 tons, and the content in the shipped ore was 11,008 tons, making a total output of copper during the year of 35,372 tons. The actual sales appearing in the accounts were 35,496 tons. The income and expenditure are not published but the gross profit for 1909 was £1,515,623. After deducting £122,999 for taxes, £81,123 for expenses of administration, allowing £85,269 for depreciation and bring-

ing forward the undistributed balance from last year a sum of £1,273,995 remains. Out of this £81,250 has been distributed as dividend on the 7% preference shares and £1,125,000 as dividend on the ordinary shares at the rate of 60%. The par value of the ordinary shares is £5 and on the day when this report was issued they stood at £76 in the market, which means that investors are at present content with 4%. The extensive work in connection with the removal of the overburden from the western portion of the San Dionisio orebody has been prosecuted actively during the year and the amount excavated has been over one million cubic metres. During the current year the top of the orebody should be reached and mining by open-cut commenced. In addition 1,200,000 cubic metres of overburden has been removed from the South Lode, and much more work has to be done here before the normal output is once more reached. Thus operations for open-cast work and the necessary equipment have entailed considerable expenditure, and £300,000 has been allocated for the purpose during 1909. The sums employed in this way are charged to a suspense account, which will be liquidated when the ore is mined. The funds required in the meantime are provided out of the reserve fund. The water supply has given no trouble and the reservoirs, including that recently built, are now full.

BRITISH COLUMBIA

Spring Resumption of Work. — Nelson, Rossland, Ainsworth, Slocan Mines Busy. — Granby.

With the return of spring preparations are being made for a resumption of placer mining. John Hopp, the largest hydraulic operator in Cariboo district, who during the winter has constructed additional dams and other works to increase his water supply, will commence hydraulicking in the vicinity of Barkerville as early as local conditions will allow. John B. Hobson purposes leaving Victoria for Quesnel Forks early in May to resume hydraulicking near Bullion. Howard W. Du Bois, of Philadelphia, is pushing on important work in dam and ditch construction preparatory to placer mining on a large scale in the Quesnel Forks district. J. M. Tuffner, manager for the North Columbia Gold Mining Co., after wintering in Cincinnati, Ohio, has returned to Pine creek, Atlin, where his company has extensive placer properties. Lode mining is being carried on chiefly at Hedley, Similkameen district, and near Nelson. The Hedley Gold Mining Co. is adding plant and machinery at both mines and mill, and is steadily developing. This company made a net profit here of $68,813 from August 13 to December 31, 1909. In Nelson division, the Granite-Poorman mines and mill are being regularly operated. Another gold-milling operation in Nelson division that has attracted attention is the Nugget Gold Mines, Ltd. Last year's profit was $49,698, which brought the credit balance up to $66,349. A large permanent stamp-mill and plant is contemplated. Several other companies in Ymir, Salmo, and Erie camps of Nelson division are also producers, the most important being the Yankee Girl, near Ymir. The Silver King mine, near Nelson, has this year shipped in excess of 1000 tons of silver-copper ore, running about 20 oz. silver per ton and 4% copper, while the Emerald, in Salmo camp, has sent out a similar quantity of ore containing 40 to 50% lead and a little silver. At Rossland the only important recent development is the discovery in the Consolidated M. & S. Co.'s War Eagle of another large shoot of ore containing a much higher average amount of gold than is general. Diamond-drilling is being continued in the Le Roi, but without favorable results. Le Roi No. 2, Ltd., during the four months of the present year has shipped to Trail rather more than 10,000 tons and milled approximately 5000 tons.

Ainsworth and Slocan districts are making good showings The recent suspension at the Blue Bell, in Ainsworth division, is a set-back especially since there is a large quantity of lead-zinc ore available. It is stated that hoisting and pumping machinery must be provided before the large reserves of ore can be utilized. Melting snow will for several weeks interfere with shipment of ores from Ainsworth and Slocan mines, but several are in better condition for the production of ore than for some time past. The return of summer will see the Cork, on south fork of Kaslo creek, and the Whitewater group, also in Ainsworth division, resume production. The Lucky Jim mine is again shipping ore, much of which assays about 32% zinc. Its production during seven months of last year was more than 5000 tons. At no previous time for several years has the outlook for the Slocan been so promising as at present. In addition to the Rambler-Cariboo, Ruth Hope group, Slocan Star, Richmond-Eureka, Standard, and Van Roy, production may be expected from the Surprise and Sunset, near Cody, the Mollie Hughes, at New Denver, and the Eastmont (Ellis Silver Mines, Ltd.), also near Slocan lake. Large orebodies are being developed at the Hewitt-Lorna Doone group, operated by the Silverton Mines, Ltd., of London, but no arrangements have yet been made to stope and ship. Boundary district mines continue productive, ore shipments for this year aggregating about 630,000 tons. Granby is mining and smelting about 25,000 tons per week. Jay P. Graves, vice-president and general manager, visited the company's mines and smelter during the latter part of April. The matter of reserves of ore is still under discussion. The engineer who reported them to be much smaller than previously stated by the management, 12 years ago was stated to have 'turned down' the Boundary when reporting to a railway company contemplating building into the district. The railway was built, nevertheless, and approximately $46,000,000 worth of ore, reckoning its metal content at New York prices, has been taken from Boundary mines and smelted. An examination by independent engineers would appear to be needed and has been proposed.

Smelter at Trail, British Columbia.

SALT LAKE, UTAH

Utah Con. Mine and Mill. — Utah-Apex. — Bingham & New Haven.—Yampa Smelter.

The Utah Consolidated Copper Co. is still shipping ore from its Highland Boy mine, in Bingham district, to the Garfield plant of the American Smelting & Refining Co., under the terms of an old contract. As is well understood, all Highland Boy ore is to be sent to the International S. & R. Co. as soon as the latter's plant at Tooele is ready for business, and by that time it is anticipated that the Utah Con. will have supplied the Garfield plant with the tonnage of ore specified in the contract. Highland Boy ore, being taken mostly from stopes between the fourth and ninth levels, carries approximately 29% iron, 25 silica, 32 sulphur, 2.8 copper, $1.60 gold, and $0.75 silver per ton. The highest and shortest adit-level is No. 3. The lowest and longest is No. 7, which is in 2600 ft. No. 3 is connected with No. 4 by an incline, No. 4, 5, 6, and 7 being connected by verticals containing ore-chutes and ladder-ways. These adits, which are 100 to 150 ft. apart, vertically, were driven westerly along the limestone which dips north 25 to 45°, and lies between walls of quartzite. The orebodies occur within the limestone, in well defined shoots which have a north dip, an east-west strike, and a northeast pitch. One shoot, as shown by partly stoped-out chambers between No. 6 and No. 7, is 350 ft. long and 250 ft. wide, except that there

are small bodies of waste. The same shoot was opened on the higher levels. Between the sixth and seventh as an example, the worked-out ground, after being timbered with square sets, 7 ft. 4 in. from floor to floor, has been filled with waste derived mostly from outside of the mineral zone. No. 7 adit, which is the main haulage level of the mine, strikes the orebody at a place 300 ft. from the portal and then passes along the quartzite foot-wall. The drifts and cross-cuts from this adit have opened an ore-shoot 600 ft. long, and 200 ft. wide, which shows a decidedly clean chalcopyrite ore in massive bodies. Some of the most interesting work in the mine consists of the workings below No. 7 haulage level. A 250-ft. incline has been sunk on the foot-wall at a point on No. 7 level, 500 ft. in from the portal, attaining a vertical depth of 200 ft. on the ore zone. A skip is operated by an electric hoist in this incline, whereby levels No. 8, 8½, and 9 are established, and from which extensive development has been accomplished and many stopes opened. Development below the haulage level has been further expedited by the sinking of a 200-ft. vertical winze on the hanging wall side, affording two passage ways from levels 8 and 9 to the haulage level. This winze was sunk at a point 400 ft. off No. 7 level, on a short-cut or branch drift. One shoot, as displayed by open stopes between the eighth and ninth levels, appears to be about 350 ft. long and 80 ft. wide. The 18 air-drills employed in the mine permit the breaking of about 800 tons of ore in 24 hours. Present operations in the mine extend through a vertical depth of 500 ft. and on the strike a distance of about 2000 ft. The dimensions of the ore-shoots given are based on fragmentary information, but intended to convey some idea of the orebodies. No. 7 level is equipped with electric haulage facilities by which the ore is taken out in cars and dumped into bins, chutes from which fill the tramway buckets by which the ore is conveyed to the railroad shipping bins. A new track has been built from the portal of No. 7 adit, however, to the new bins at the terminal of the new tramway line over which the ore is to be carried to the smelting plant on the Tooele side of the Oquirrh range.

The mine of the Utah-Apex Mining Co. is entered by a 4000-ft. cross-cut from Car Fork canyon. At the breast of the cross-cut is a 350-ft. vertical 3-compartment raise. Two compartments are for cages. The raise connects with a 600-ft. incline, at 45°, five levels from this go in on the orebody, which lies between limestone and quartzite. Ore from these drifts is dumped into skips which are operated in the incline, and discharge their loads into an ore-pocket at the top of the raise. From this point the ore is lowered to the main cross-cut in cars, and hauled to the portal, where it is dumped into a hopper. The latter discharges into a skip which is drawn up a 200-ft. incline to the mill bin. The ore, which consists mainly of lead and silver in a silicious gangue, undergoes crushing, pulverizing by rolls, sizing by trommels and Callow screens, is passed through jigs and over Wilfley tables. The slime material obtained from these processes is classified in Callow tanks, the coarse from the latter being then re-concentrated over Isbell vanners, a new belt machine put on the market by the Gallgher Machinery Co., of Salt Lake. The concentrate produced on the tables and vanners falls into a launder having a conveyor by which it is taken to the foot of an elevator and discharged into a set of tanks where it is de-watered and dropped into cars. The concentration is in the ratio of 3½ tons into 1, and the plant handles 165 tons in 24 hours. A considerable amount of the higher grade ore is shipped without milling it. The superintendency of the mine and mill is in the hands of R. S. Oliver, who has been in that position several years.

At the Bingham and New Haven mine, situated a little farther up Car Fork from the Highland Boy, the main entrance is through No. 3 adit, 3000 ft. long, which receives all the ore from various higher levels. It cuts the first orebody at 500 ft., the second at 900, and the third at 1500 ft. from the portal. No. 3 level is 480 ft. below the old adit that was formerly used. The distance, vertically, between the highest and lowest level is 1800 ft. on the dip of the beds that contain the ore. The workings have opened several shoots of ore. The ore contains copper, gold, and silver. H. J. Turley, superintendent, states that it will assay 4% copper, and contains enough gold and silver to pay treatment charges at the smelting plants. The concentrating mill is undergoing some repairs and it is said the jigs will be discarded. The larger proportion of the ore, according to Mr. Turley, can be shipped. The management of the property devolves upon C. H. Doolittle, of Salt Lake.

The plant of the Yampa Smelting Co., in the lower part of Bingham canyon, is treating 750 tons of ore per day, the major part of which comes from the Yampa mine, about 300 tons per month coming to the plant from custom mines. Frank J. Murphy, superintendent, states that the Yampa ore contains 1.9% copper, 28 iron, 30 silica, 28 sulphur, 3½ lime, 6 alumina. As the ore is received at the plant it is screened, the undersize, which amounts to 425 tons per day, is roasted in nine McDougall roasters, then smelted in two reverberatory furnaces; the oversize from the screens, amounting to 325 tons in 24 hours, is smelted in the blast-furnace. The reverberatory matte contains about 30% copper; that turned out by the blast-furnace about 14. The matte is shipped to another plant for converting into blister copper. The custom ore of the Yampa plant comes principally from the Commercial mine of the Bingham Mines Company.

BUTTE, MONTANA

April Output.—Curtailment Inevitable.—Clark in Merger.

The Butte mines produced 25,087,200 lb. of copper in April. It is likely that the May output will show that the Butte production is again normal, the curtailment agreement apparently being off. The daily output, together with the estimated yield of copper per ton of ore, were as follows:

Company.	Daily Tons.	Lb. per Ton.	Daily Lb.
Boston & Montana	3500	70	245,000
Anaconda	3800	61	231,800
Butte & Boston	500	62	31,000
Washoe	350	60	21,000
Parrot	150	60	9,000
Trenton	400	62	24,500
North Butte	1200	64	76,800
Butte Coalition	1500	65	97,500
East Butte	280	68	19,040
Original	600	63	37,800
Miscellaneous	500	85	42,500
	12,780		836,240

Curtailment is regarded here as highly probable in the near future. The mines in this district at the present time are not running within 25% of their possible output, but the supply is increasing to such an extent as to necessitate further curtailment.

The report persists that the Clark mines are to form part of the merger although nothing can be learned here. It is said that negotiations are proceeding in New York with every prospect of an ultimate agreement. While it is stated that Mr. Clark is willing to accept the terms offered so far as the mines are concerned, he insists that other properties in this city be included, especially the street railway and Columbia gardens. The railway has not made big money and he does not want to sell his paying mines, and still maintain the non-paying properties. A working agreement already exists between Clark and the Amalgamated as to the curtailment of output. When the merger goes into effect the mines of the district will be divided into three operating sections. The Jack O'Neill, who has fought the fire in the Anaconda mine for years, will superintend the mines of the first district, including the Anaconda group and one or two others. William B. Daly, recently named to take charge of the Diamond, Bell, Modoc, Buffalo, Mountain Consolidated, and the Gray Rock, will have charge of the second. The third superintendent has not yet been named. Mr. Daly has been in the employ of the Amalgamated company for several years and is well regarded.

NEW YORK

Copper Producers' Figures May be Abandoned — Ray Central Bonds —North Butte Report — Ray Con and Gila — Coeur d'Alene News —Camp Bird —Wyoming Copper

It will take time to heal the sore spots left in the mining market by the shrinkage in some of the copper stocks. There is still much discussion of the threatened abandonment of the work of the Copper Producers Association. The value of the figures has been demonstrated by the intense interest displayed everywhere in the analysis of the copper situation afforded by the monthly statistics and this ought to be a sufficient reason for their continuance. It has been for many years the custom abroad to publish fortnightly figures covering the visible supply of copper, and, instead of fostering undue speculation the custom has proved a steadying market factor. No small part of the enthusiasm displayed for copper mining during the past eighteen months was builded upon the belief that the leading interests were big enough to warrant good faith. Any withdrawal of confidence now, such as would result from discontinuing the monthly reports, would bring grave results. The sufferers would be not the public but the copper producers. One of the reasons for the present condition is the endless conflicting relations of the orebodies. Illustrative very fairly the absurd complexities of apex litigation. If any contest is to be based on them some fine questions as to primary and secondary mineralization will be raised. A special meeting of the stockholders of the Ray Consolidated has been called to take action on a proposed authorization of an increase in the capital stock of 200,000 shares, the additional stock to be offered to shareholders of the Gila Copper Co. on the basis of one share of Ray for three shares of Gila. It is said that two-thirds of the Gila stock has already been pledged to go into the exchange. At present each company has a capital of 1,000,000 shares, par $10, as Ray Consolidated is selling at $18 and Gila at $6, the exchange is exactly on a parity with the present market. Both companies are controlled by the dominant interests in Utah Copper.

The starting of production by the Stewart Mining Co., the Coeur d'Alene mine controlled by F. Augustus Heinze, and the payment of a dividend by the Caledonia, have brought the Idaho lead-silver camp into renewed public notice. Stewart stock is largely held throughout the East and shareholders have always looked for some real returns from the property. Some two years ago Mr. Heinze had a mill erected for the Stewart upon some adjoining ground upon which he held an option; the mill being erected by a separate company called the Coeur d'Alene Development Co. Later the Stewart failed to make good its agreement to purchase the claims upon which the mill was built and an injunction was obtained preventing its operation with the result that for the past two years a new mill which was built to care for the Stewart ores has stood idle and the company has made no progress whatever. This seems to be a fair sample of Mr. Heinze's way of going into things blindly and winding up in endless snarls of litigation. At the present moment the one time 'Copper King' is on the firing line defending his banking methods and all of the mining properties in which he is interested are suffering from his administration. The settlement of the troubles between the Bunker Hill & Sullivan and the Federal Mining & Smelting Co., together with the recent purchase of control of the Hecla, one of the most spectacular of the recently developed mines of the Coeur d'Alene, has revived discussion of the possible absorption of the Bunker Hill by the Federal. This is a step long desired by the Guggenheim interests in the Federal, but it was strongly opposed by the late D. O. Mills and his interest was large enough to dominate the situation in this regard.

Utah Copper Company's Arthur Mill at Garfield, Utah.

the belief that in order to continue the payment of dividends the low-cost producers will have to take practical command of the copper market. These companies have been paying out practically all of their earnings in dividends and are making preparations for record production. If the copper market should decline another point, to 12c. say, it would mean that the new Anaconda at Butte could not show a safe margin of profit, and while dividends could be continued out of the present large surplus, actual operations might for a time show a deficit. Utah Copper costs are expected to run not more than 7c. per lb., when the enlargements of the Arthur mill of the Boston Consolidated and the Magna mill of the Utah are completed. The two mills will have a capacity of 19,000 tons per day. The Boston has heretofore been worked as an underground mine, but stripping of overburden has already begun and eventually the whole will be operated by the open-cast system. The Ray Central Copper Co. has strengthened its treasury by the issuance of $100,000 of its $2,000,000 bond issue. The balance of the bonds are to be put out only as needed in the course of the development which is progressing under the direction of J. Parke Channing. Attention is being directed to the Tuolumne mine at Butte, owing to the fact that the North Butte M. Co. is just making its annual report. While the report itself has not, at this writing, yet come from the press, it is stated that ownership of the Tuolumne orebody is claimed therein by the North Butte and various dispatches have stated that a compromise agreement has been made between the two concerns. The variety of

The management of the Camp Bird, Ltd., announces that the last of the payments due to Thomas F. Walsh have been paid. The final payment was made about the time of Mr. Walsh's death, and completed the sum of $2,000,000 which he was to receive in addition to the $3,250,000 cash payment made at the time the mine was sold, the balance being payable as 25% of the net earnings until such payments

aggregated $2,000,000. Camp Bird's earnings are running far above dividend requirements and a nice surplus will soon be available to take care of the development of the recently purchased Santa Gertrúdis or for the purchase of additional property. The long and dizzily crooked path of the Rudefeha-Ferris Haggerty-North American-Penn Wyoming-United Smelters-Railway & Copper Co., has ended in a suit in the Federal court brought by the Penn Wyoming Investors' Association. The name of the protective committee is something of a misnomer, there never were any 'investors' in Penn Wyoming, its predecessors or successors. The shareholders were merely dupes from whom, first and last, a large amount of money was extracted. Some of this was spent on the various properties at Encampment, Wyoming, but, for the most part the promotions and re-organizations of the various companies have been as crooked as Davy Crockett's log—which could not lie still.

WASHINGTON, D. C.

Bureau of Mines Bill Passes Senate. — Land Withdrawal Bill Passes House.—Proposed Seismological Laboratory.

Progress is being made. The Senate has passed the Bureau of Mines bill and it will now go to conference. No serious difficulty is anticipated at this point and the new Bureau, which will mean much to the West, is likely to be promptly organized. In the House after a prolonged and spirited debate, in which much misinformation was bandied about, a bill has been passed authorizing the President to make withdrawals of public lands. This started as one of the nine conservation bills advocated by the administration, but its present appearance would indicate that it were an orphan. The bill as it passed the House is as follows: That the President be, and he hereby is, authorized to withdraw from location, settlement, filing, and entry areas of public land in the United States, including the District of Alaska, for public uses or for examination and classification to determine their character and value; and the President is further authorized when in his judgment public interest requires it, to withdraw from location, settlement, filing, and entry areas of public land in the United States, including the District of Alaska, whether classified or not, and submit to Congress recommendations as to legislation respecting the lands so withdrawn. Section 2. That the Secretary of the Interior shall report all withdrawals made under the provisions of this act to Congress at the beginning of its next regular session after date of the withdrawals, specifying the purpose of each thereof. All withdrawals heretofore made and now existing are hereby ratified and confirmed as originally made under this act. All withdrawals shall remain in force until revoked by the President or by Congress.

The bill as reported by the Public Lands Committee contained amendments which provided that the withdrawals should not affect the legal rights of any settler or entryman initiated prior to such withdrawal, and that upon "restoration of any such lands in the United States the equitable rights shall attach of any bona fide claimant who prior to such withdrawal initiated a claim thereto and made valuable improvements thereon." These were defeated. These amendments precipitated a perfect maze of parliamentary tangles. Speaking upon the amendments proposed by the committee, Scott Ferris, from Lawton, Oklahoma, said that this committee amendment if adopted would undo everything that the bill proposed. It would clear list and pass to patent every claim and entryman's right that has been initiated throughout the United States and Alaska. He charged that the amendment was formulated in the committee by hands unfriendly to conservation. Frank Mondell, of Wyoming, chairman of the committee, retorted that the Democrats were trying to make this bill so objectionable and so drastic that it would turn the tide in their direction, because of the fact that a Republican Congress denies the rights of honest, bona fide entrymen.

William F. Englebright, Nevada City, California, representative, suggested the following amendment: "Provided, however, that all lands withdrawn under the provisions of this act shall be open to exploration, discovery, occupation, and purchase, under the mining laws of the United States, so far as the same apply to metalliferous minerals." He said the object of his amendment was to protect the prospectors engaged in prospecting for the precious and other metals. In spite of similar pleas, the amendment was defeated. Mr. Mondell told the members of the House that there was no fear of the rapid depletion of the coal supply of the country; that but one-half of one per cent of the total supply had been used up to date. He declared that at the present consumption, his State alone, Wyoming, had sufficient coal to supply the country for 3000 years. It is evident that the bill, as it passed the House, will be changed materially before it passes the Senate. Reed Smoot, Senator from Utah, has already introduced a new bill in the Senate, covering the withdrawal of public lands and providing that all lands withdrawn shall be open to exploration, discovery, occupation, and purchase, under the mining laws of the United States, so far as the same apply to minerals other than coal, oil, gas, and phosphates. His bill also contains the provision that such withdrawals shall not affect the legal rights of any settler or entryman initiated prior to such withdrawal.

The indications are that the Federal Government will soon take up a thorough study of seismologic disturbances. The committee on the Geological Survey has recommended that $20,000 be appropriated for a seismological laboratory under the direction of the Smithsonian Institution. This will be added to the Sundry civil appropriation bill as an amendment. The committee in its report states that the Smithsonian Institution is the proper organization to have charge of the laboratory. Before making its recommendations, the committee requested information from Charles D. Walcott, Secretary of the Smithsonian Institution; George Otis Smith, Director of the Geological Survey; and Willis L. Moore, chief of the United States Weather Bureau. The committee called particular attention to the memorandum submitted by Mr. Walcott. His views are as follows: "The immense destruction of life and property by certain large earthquakes emphasizes the importance of investigations which may lead to a reduction of the damage of future earthquakes. The science of seismology is in its infancy, and it is not always evident what lines of investigation will yield the most important results, hence the importance of developing larger knowledge of seismology in all directions. As an example: It was not at all realized that the accurate surveys of the coast and geodetic survey in California would demonstrate that the great earthquake there in 1906 was due to forces set up by slow movements of the lands which have probably been going on for a hundred years. We have learned that slow movements of the land must precede many large earthquakes, and monuments are now being set up in California to enable us to discover future movements of the land and thus to anticipate future earthquakes. This, I think, is the most important step so far taken toward the prediction of earthquakes. Seismological work is too large to be prosecuted successfully by the universities, but requires some central office under Government supervision to encourage theoretical and observational studies and to collect and to study information from all available sources. The various departments of the Government could offer material help. The Weather Bureau could furnish information regarding shocks and could maintain seismographs at some of their stations. Postmasters throughout the country could also report earthquakes. The Coast and Geodetic Survey could maintain instruments and adapt their surveys and tidal observations to the detection of slow earth movements. The army could give information regarding earthquakes felt at their outlying posts; the navy, regarding earthquakes felt at sea. The Geological Survey could furnish information regarding the geological structure of earthquake regions. The seismological laboratory would collect and study all this information. It would serve as a clearing house for the whole country. It would also be the link to connect seismological work in this country with the work done in other parts of the world. Its director should represent the United States in the international seismological association, which this country has joined through the Department of State."

General Mining News

ARIZONA

COCHISE COUNTY

The case of H. F. Gilbane, representing the Copper King Mining Co., against Hoval A. Smith, C. M. Henkle, and R. E. Bretherton, to regain title to mining ground in the Warren district, alleged to have belonged to the former company has been decided in favor of the defendants by Judge Doan of Tombstone. The group comprises 10 claims adjoining the Copper Queen, the C. & A., and Denn Mining companies. There is a 600-ft. shaft and considerable driving has been done on the property opening good ore. The mine has been closed down for the past three years, but it is thought that within the near future steps will be taken to re-open it for further development.

GILA COUNTY

(Special Correspondence).—Sinking continues in the McGaw shaft and Great Eastern winze of the McGaw workings of the Superior & Boston mine, near Globe, and regular shipments of 80 tons of ore per day are made to the Old

Map of Arizona.

Dominion smelter. Two winzes, sunk from the 400-ft. level of the Gardner shaft, are 125 ft. apart and have opened the vein which assays 8% copper to depths of 40 and 55 ft. below the level.——The cross-cut on the 660-ft. level of the Williams shaft of the National Mining Exploration property is now 64 ft. long, and has intersected a small vein of copper ore assaying 39% copper.——At the 420-ft. level of the Miami mine ore-pockets are being cut at the station and the development work started for the second haulage level 150 ft. below the first one.

Globe, April 29.

YAVAPAI COUNTY

Operations have been resumed at the Spar mine of the Pocahontas Mining Co. three miles southwest of Mayer and grading for the new mill completed. There have been two shafts sunk on the property to a depth of 100 and 200 ft. The 100-ft. shaft is near the mill-site and it is here that the company intends to do its most active work.——The Mount Elliott Mines Co. is sinking the two main shafts at the Dividend and Ticonderoga mines and running the mill one shift. As soon as the power line is completed from Poland Junction the company will increase the amount of ore taken from the mine and operate the mill continuously.——The shaft of the Grand Mountain Mining Co. a few miles east of McCabe is down 150 ft. and the company is installing a new hoist. New living quarters, a blacksmith shop, and assay office are also being erected. F. L. Dwight is manager.

YUMA COUNTY

At the Clara Consolidated, at Swansea, operations are being confined to development and at present five shafts are being sunk and drifts from each of these have opened ore. Practically all the machinery for the smelter has been delivered and it is expected that the plant will be ready for operation in a short time.

CALIFORNIA

INYO COUNTY

C. A. Fohrman, manager for the Casa Diablo Gold Mining Co., operating the Casa Diablo mine 20 miles north of Bishop has returned from the East and is now at the property. At present the ore is being mined from the Dry Bone vein and the mill in which a new 40-hp. motor has been installed is kept running night and day. It is the intention of the manager to sink to the 500-ft. level and explore the vein at that depth.

MARIPOSA COUNTY

A tramway, bunkers, and spur connecting with the railroad have been completed at the Baryta mine of F. M. Smith a few miles below El Portal on the Merced river and shipping will be started in a short time. The material, of which there is a large amount opened in the mine, will be shipped to Oakland to be used in the manufacture of paint.

NEVADA COUNTY

Machinery for a new 5-stamp mill at the Montana mine has been hauled from the foundry at Grass Valley to the property in Willow valley and is now being erected. A considerable supply of ore has been blocked out at the mine and it is expected that the ore reserves can be kept well ahead of the stamps.——The Champion Gold Mining Co. has failed to make the payments due on the bond under which it took over the Champion mines, near Nevada City, and the Champion Mines Co. has resumed work in the properties. The men employed by the former company have attached the ore broken in the stopes for back wages.

PLACER COUNTY

Two parties working for W. P. Hammon are testing the ground in Auburn ravine to determine its value for dredging. It is reported that the holes sunk so far have been successful in opening gravel containing enough gold to warrant the installation of a dredge.——The El Dorado & Placer Counties Gold Mining & Power Co. has purchased four miles along the middle fork of the American river embracing some 6,000,000 yd. of gravel, and will install complete equipment to work the claims. Power for steam-shovels will be obtained from Clipper Gap.——At the Dewey the adit is in hard rock and is expected to tap the shaft in a few days.——The Red Sea channel has been opened at Forest and excellent gravel is being taken out.——S. A. Hendren, who has been operating the extension of the Black Oak mine east of Weimar, has opened a 28-in. vein that assays from $25 to $75 per ton.

SHASTA COUNTY

All the electrical appliances and most of the steel for the Balaklala company's smoke-consuming plant have been ordered and work on the foundation started. Construction will be rushed and the company will have the plant ready for operation by July 1, which was the time agreed on by the Farmers' Association.——It is reported that Chicago capitalists are arranging to resume work on the Friday-Lowden copper group, and that arrangements have been made whereby the ore will be treated at the Mammoth and Balaklala smelters.——The U. S. Gold Dredging Co. is arranging for more extensive work on its holdings along Clear creek.——The Consolidated Gold Dredging Co. reports that activity will soon commence on the ground recently secured.

SIERRA COUNTY

Operations have been started at the Lookout property in

the Alleghany district and an adit is being driven to tap the vein. The property is on Kanaka creek and adjoins claims that have been good producers.——The old Joel Bean mine at Scales is being operated with a small crew. The company last year completed a large concrete dam that will be capable of restraining the débris for several years.——The Poker Flat Mining Co. has resumed work in the shaft of the property on Poker flat.——The machinery at the Gibraltar mine is being overhauled and work will be started as soon as the snow melts.——A shoot of rich sulphides has been opened near the surface of the vein at the High Commission group east of Downieville and an adit started to cut the ore at greater depth.——Camp & Ish have lately obtained a number of good assays from the Tippecanoe and Jumper claims near the head of Slate Castle ravine which they are operating under bond.——The raise which is to be used for an air-shaft at the Bunker Hill mine has been completed. The gravel that was worked on a bench about a month ago paid well, but the bedrock pitched away, and after following it for 20 ft. with a winze bad air made operations difficult, so the raise was started.——F. O. Richardson and Chris Davis of Monterey have obtained a bond on the Black Warrior and Etta G. claims in Sailor ravine.——The cross-cut in the hanging wall at the Gray Eagle mine opened a new vein, and drifts have been started to develop it.

SISKIYOU COUNTY

Work has been started for the season at the Homestake mine on Taylor creek.——The Siskiyou Syndicate is preparing to resume work on the Bordman group in China gulch.——A 20-in. vein assaying $40 per ton has been cut at the Frietas-Lynn mine by the lower adit.——After a temporary shut-down of three weeks the Golden Indian on Indian creek has resumed operations under different management.——Twenty-five tons of high-grade ore have been taken from the Old Turk mine and will be crushed in an arrastre near the property.——A new bridge has been completed across Punch creek and ore is being hauled from the Red Ant mine to the quartz mill at Yreka. R. M. Brown, the superintendent, reports that a 3-ft. body of good milling ore has been opened recently.

TRINITY COUNTY

George Lewman, in charge of six or eight men, is working on the old Poker Bar hydraulic mine, below Lewiston. Machinery is being removed from the old dredge and an elevator is being put in to prospect the ground. The old Poker Bar dredge was operated several years ago, but not with much success. The company that has now taken hold will erect a modern dredge and develop the property if the prospecting turns out as well as expected.

TUOLUMNE COUNTY

(Special Correspondence.)—The company which has taken the Duffield mine, near Arastraville, is preparing to commence development work. Machinery and a large quantity of pipe are being taken to the property and a 75-hp. motor is expected to arrive soon.——The remodeling of the mill at the Draper mine has been completed and the 10 stamps will be started at once. The property, since passing into the hands of E. J. Cotton and Andrew McCormick, has been extensively developed and the owners are more than pleased with the outlook. The shaft is now 600 ft. deep, and the several drifts show large quantities of high-grade ore. R. A. Nicholls is superintendent.——It is expected that the new shaft being sunk at the Eagle-Shawmut mine will be connected with the old shaft, 400 ft. below the surface, by May 15, when complete operations will be resumed with the usual force of more than 200 men.——Operations will be resumed immediately at the Keltz mine, of which H. L. Houston is superintendent and part owner. Additional machinery will be installed.——Everything will soon be in readiness for beginning hydraulic operations at the Red Gravel mine.——A well defined vein has been cut 190 ft. from the surface at the Gold Crater mine.

Tuolumne, May 2.

McRae & Baum have cut the vein on the 100-ft. level of the Ida Klein mine in Yorktown gulch and obtained a number of good assays.——At the Yrma the shaft is down 90 ft. on the vein, showing a width of 6 ft. at the bottom. Sinking will be continued to the 150-ft. level before any drifts are started.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence).—From this time forward it is expected that the Central adit on Bellevue mountain will be advanced at the rate of 200 ft. per month. For the past year 90 to 100 ft. of ground has been broken monthly.——The Roberts concentrating plant at the Lamartine mine was put in operation on material from the dumps a few days ago and steady shipments will be maintained.——Work has been put under way in the sinking of a new shaft on the Chicago Belle mine on Chicago mountain. At a depth of 30 ft. an 18-in. streak of $21 ore has been cut.——The switch to connect the railroad tracks with the Malm chemical-electro plant was completed the first of this week. Since then five carloads of machinery have been shipped from Denver. W. E. Malm, in charge of construction work and installation of machinery, states that the plant will be ready to begin operation July 1.——Construction work on the new 100-ton mill building for the Conqueror Mining & Milling Co., operating the Conqueror mine on Covode mountain, was started last week. The grading has all been completed. This mill will be in operation by July 15. J. C. Sturdevant of Empire is manager.——Machinery for the 10-stamp mill in course of construction for the Mint mine being operated by the New System G. M. Co. is arriving and a force of men is being employed in placing the same in position.

Georgetown, April 28.

GILPIN COUNTY

(Special Correspondence).—N. McKay, leasing on the War Dance mine in Russell district, sent out a shipment of three tons of ore last week that milled 26 oz. gold and 28 oz. silver per ton. At the same time three tons of second-class ore was marketed that brought a settlement of 7 oz. gold and 27 oz. silver per ton.——Active development is in progress at the Gold Collar mine in Eureka district. Work is being centered in the east drift from the 350-ft. level of the shaft. The management is considering erecting a new mill. A. Skeels is manager.——The Hubert mine in the Nevada district is the scene of a discovery on the 500-ft. level west. The streak is from 6 to 10 in. wide and will mill better than $35 per ton in gold and silver.

Central City, April 30.

LAKE COUNTY

Work is to be started at once at the Big Four property on Breece hill in the Leadville district by the Crawford Mining Co., a corporation composed of Boston and Chicago capitalists. The company will work the Big Four south shaft and will not extend its workings to the Gold Basin mine, which was formerly a portion of the property.——The winze in the St. Louis adit has been completed and lateral work started to further open the mine.——The Curan adit has been started from the south side of Big Evans gulch and will be driven to cut under the Highland Mary and adjoining claims.——It is reported that new pumps are to be installed in the Pyrenees property on Carbonate hill and work resumed in the mine. Operations have been suspended three times at the property on account of insufficient pumping capacity.——Arrangements are being made for the resumption of activities at the Anona mine on Long & Derry hill. The property has been idle for the past year, though two years ago the plant was connected to the wires of the Leadville Light & Power Company.

TELLER COUNTY

Sub-lessees from the Western Investment Co. on the Empire State mine of the Isabella Mines Co. in the Cripple Creek district are mining high-grade ore, and recently settled for a 30-ton lot at a rate exceeding 6 oz. gold per ton. The net amount to the lessees, after deducting freight and treatment charges and royalty to the owning company, was approximately $2000. The Western Investment Co. is also mining a good average grade of ore, and during April shipped the largest tonnage since acquiring the lease.——An

[illegible] body of low-grade milling ore has been exposed by [illegible]ent on the Nellie V., a fractional claim on Gold Hill, owned by the Lexington Gold Mining Co. and operated by Ivey Weston and associate lessees. The ore assays from $3 to $7 per ton, but the present freight rates prohibit shipping ore of this value, so a small lot is being tested to ascertain if it will be profitable to build a mill at the property.——Shareholders of the Elkton Consolidated Gold Mining Co. are receiving checks to the amount of $37,500, mailed from the home office in Colorado Springs. The Elkton company has paid its shareholders two bi-monthly dividends of this amount this year, a total to date of $2,554,460. The main shaft on the Walter claim in the town of Elkton is producing ore of the gross bullion value of approximately $35,000 per month, and only one shift with about 75 miners is employed.

IDAHO

IDAHO COUNTY

The Elk City Mines Corporation, which recently acquired the South Fork, formerly the Espey mine, in the Elk City district, from the Adams brothers of Atlantic City, New Jersey, has been incorporated under the laws of Washington with a stated capitalization of $1,000,000 by W. H. Stowell, Robert A. Koontz, W. D. Greenough, and J. T. Omo, of Spokane, and William Hare, of Tekoa. The chief development will be the extension of the main adit and the advance of deeper workings. More than $2000 per month in bullion bars has been received by banks in the district from the South Fork mill, and it is expected that the improved machinery and cyanide tanks to be installed will increase the output. The prospective sources of additional profit are ore on the dump valued at $50,000 and $100,000 worth of tailing in the creek.

SHOSHONE COUNTY

M. W. Bacon, secretary and general manager of the Stewart Mining Co., announces that the Mammoth mill at Wallace, owned by the Federal Mining & Smelting Co., has been leased by the Stewart company and will be put to work on the Stewart ores immediately. The Mammoth mill is a 354-ton plant and is in good condition. The Stewart has 10,000 tons of ore on the dump and enough more blocked out to insure the steady running of the mill. The mine is situated near Wardner. It was sold to F. Augustus Heinze by H. F. Samuels and associates for $400,000 in 1905. The Mammoth mill is about 14 miles up the North Fork of the Coeur d'Alene river and within a mile of Wallace.——It is reported that a 12-ft. vein of high-grade concentrating lead-silver ore has been cut on the 300-ft. level of the Alice mine. The mine has been developed extensively and bodies of galena ore have been opened on several levels, but the present find is the richest. The 200-ton concentrator recently installed is working perfectly and is said to be one of the best plants in the district.

KANSAS

CHEROKEE COUNTY

(Special Correspondence).—At Galena camp, as throughout the Joplin field, shallow mining is reviving. Several companies are opening old tracts southwest of town, making in all about 600 acres open to small investors. Two famous producing tracts, the Battlefield 40 and the Luscombe & McElroy 40 have just been opened the last week. Both were extensively mined in the early days and both are filled with old drifts and shallow shafts which have been filled to the surface with water. The present company has installed heavy pumping machinery and will easily drain the ground. It will not be necessary to do a great deal of prospecting before beginning active operations, as the old works show rich deposits. The lower levels have never been touched and these as well as a large amount of shallow ore are available. Part of the ground will be sub-leased, while the deeper ore will be worked by the owners.——The Boston company, too, has taken 400 acres southwest of Galena which is also being developed. Much of the shallow ore will be worked through the open-cut method, while the deeper will be through shafts and drifts. The open-cut work will be done by the company, while the remainder will be leased. A portion of the land is or before worked will be drained and made ready for leasing.——The Eureka mill, one of the largest in this camp on the Plug & Robertson land, has at last been started after a long wait for sufficient water to accumulate in the pond. The mill is new and its starting marks an innovation in the way of deep mining, only the Herald company in this district being at work in the deep levels. Hitherto all mining in the Kansas field has been confined to the shallow but rich pockety deposits, which are not generally so extensive or long lived as the deeper levels.——The mill belonging to Stone, Pinson & Hallam on the Black Hills 40 has been started and will be run on custom ore for the present until the ground is sufficiently opened to operate on the company's own ore exclusively. The plant is run by electric power.

Galena, April 22.

MISSOURI

JASPER COUNTY

(Special Correspondence).—In the entire district shallow ore mining is reviving in various camps, reminding one of the early days of the mining industry in this field. At Tuckahoe, northwest of Joplin, the latest discovery has been made by J. M. Short, where the drill penetrated a 14-ft. vein of ore assaying 20% zinc. The ore was struck at 118 ft. and again later at 152 ft. It is thought to be a continuation of the rich old ore deposits worked in the Tuckahoe camp which made that part of the field famous several years ago. The latest find was made on the Brinkerhoff land. Other drill-holes will be sunk and the deposit thoroughly developed.——On the Rex land southwest of Joplin the Elizabeth Mining Co. has six shafts in ore at the 100-ft. level in ore said to run high in both lead and zinc. Much of the ore can be hand-jigged and no mill will be built for the present.——Several shallow mines have been developed on the Anderson farm at Carl Junction as a result of a find made there several months ago. The most favorable is that of McFaren & Co., who have drifts at 37 ft. which is not the bottom of the run. There is a considerable quantity of both lead and zinc in the bins which have been cleaned with hand-jigs. In some of the shafts the ore was found at as shallow depth as five feet, which, though thin, led downward to a much better grade of ore. These developments are on virgin ground far from other operating mines.——Another body of ore has been cut in the vicinity of Toms Station in new drill-holes put down by Wells Brothers. In each hole ore was struck at 142 ft.,

Mill in Joplin District.

passing through 11 ft. of lead ore when zinc was entered continuing to 184 ft. This made in all an ore face of 42 ft., part of which assays as high as 17%. The new find is near the Katherine and Freeman mines.

Joplin, April 23.

MONTANA

JEFFERSON COUNTY

In the Corbin district the Montana Corbin Copper Co., which is developing the Hidden Treasure property, is making occasional shipments of high-grade ore. The vein is being stoped on the 400-ft. level, where 2 ft. of chalcopyrite ore has been opened.——The Boston & Corbin has opened a good body of bornite on the 700-ft. level and has considerable first-class ore in the bins which it expects to ship at an early date.——A winze is being sunk in the adit level of the Butte & Corbin Consolidated and some good ore opened.——At the London-Corbin Exploration Co.'s property the showing in the adit is improving and the company has started a double compartment shaft that will be sunk to the 200-ft. level before cross-cutting is commenced.——The shaft at the Corbin Metal is down nearly 400 ft. It is the intention of the company to sink to the 700-ft. level before doing any extensive exploratory work.

NEVADA

CLARK COUNTY

The pipe-line from Tule springs to the Capital mine in Eldorado canyon has been completed and the camp is now supplied with a good flow of water. In the mine cross-cutting from the 200-ft. station has been started to open the vein on that level. Two carloads of ore are to be forwarded to the Needles smelter in a few days.——The south cross-cut on the 300-ft. level of the New York Searchlight opened a 20-ft. vein when out 100 ft. from the shaft. The ore is an oxidized quartz considerably copper stained and shows some free gold when panned.——At the Good Hope mine lessees have opened a vein on the 85-ft. level that is about a foot wide and assays $30 per ton. The ore is being stored near the shaft and will be crushed in the Knight mill within the next few days.

ESMERALDA COUNTY

The Goldfield Consolidated Mining Co. will soon erect a new 2000-hp. transformer station near the old Combination mill. At the present time the Consolidated company is using something over 1000 hp.——The Lind lease on the Booth continues to show steady improvement since what is believed to be the northeasterly extension of the Red Top vein was cut by the east cross-cut on the 360-ft. level some days ago. Drifts have been started along this vein, which is more than 10 ft. in width, to the north and south from the point of intersection, and each drift is now out some 35 ft. from the cross-cut.——The Florence mill is steadily handling an average of 160 tons of ore per day. In the mine 24 to 26 drills are being steadily used in development work alone. On the seventh level of the main workings extensive driving is in progress, as on this level the downward extensions of orebodies opened in the upper levels are being rapidly picked up and preparations made for extracting the ore when it is needed. Bulkheads and ore-chutes are being put in as rapidly as stoping ground is opened. On this level the Florence vein system will soon be opened from the old Reilly lease workings through to the Little-Florence.——The mines of the State of Nevada produced, during the year 1909, $25,000,000, according to the official report of James F. Haley, State Bullion Tax Agent, which report has just been submitted to Governor Dickerson. The above figures apply to the production as officially reported to the Bullion Tax Agent, and upon which production bullion taxes were paid to the State. The figures show that Esmeralda county, of which Goldfield is the county-seat and centre, led the counties of the State in value of mineral produced, with an output of $9,587,831. White Pine county, of which Ely is the county-seat, was second with a production of $7,114,354, and Nye county, of which Tonopah is the county-seat and mining centre, is third with $5,740,581. Eureka is fourth with a production of $815,088. On the other hand, the copper properties of White Pine county led in the point of tonnage of ore handled, as it shows 1,678,895 tons of ore produced, as against the 509,801 tons produced by Esmeralda county, with its gold, silver, and lead properties. Nye county comes third with 374,827 tons of ore produced during the year.

LANDER COUNTY

(Special Correspondence).—The Austin-Manhattan Co. is arranging to re-timber the Ophir shaft and is sinking from the 380-ft. level an additional 100 ft. The surface plant will be removed to this point from the Frost shaft and the first unit of the mill be installed at once. Walter W. Wishon is general manager.——The Kimberly Mining & Reduction Co. has been formed with a capital stock of $3,000,000 to erect a custom mill at Kimberly. It is stated that the plant will have a capacity of 200 tons per day.——The owners of the Yellow Jacket mine in the Reveille district report the uncovering of 40 ft. of silver ore. A small amount of gold also occurs. About two feet is said to assay over 300 oz. per ton.——The Shoshone Quicksilver Co. is opening a large body of ore containing a high percentage of mercury. The Nevada Central railroad management announces that regular trains will be in operation about the middle of May. The washouts are being repaired as rapidly as material can be delivered. A number of mines in this district are idle because of lack of supplies and working materials, caused by the blocking of the railroad.

Austin, April 28.

NYE COUNTY

The report of the Tonopah Mining Co. for the year ended February 28 has just been issued, showing the total net earnings for the year were $1,639,602, of which $1,400,000 was paid in dividends. The average gross value of the ore was $20.93, the extraction amounting to 91.7%.——The survey from the main spur of the railroad to the new Belmont shaft at the Belmont mine has been completed and the site for the new ore-bins will be 240 ft. northeast of the shaft. A new compressor and steel head-frame have been ordered and will be installed in a short time. At Millers the mill has been overhauled and all the stamps will be dropping by the middle of the month.——The Midway Mining Co. continues work on the big vein intersected by the winze from the 535-ft. level. The vein is inclined to be pockety, with the best value in a streak near the hanging wall.

STOREY COUNTY

At the iron properties being developed 14 miles northeast of Virginia City the shafts are down 100 ft. and cross-cuts have been started to prospect the ground between them. At the present time there are 30 men working at the property. The outcrop has been traced for several miles, showing a width of 2000 ft. in some places.——Two 4-horse teams are now hauling ore from the Dietrich lease on the Best & Belcher surface workings to the Fisher mill in Sixmile canyon.——A drift on the north line of the Gould & Curry claims is being run near the surface and some good ore is being opened.——The Consolidated Virginia is extracting low-grade ore for the mill from the 1750 and 1800-ft. levels, and it is stated that a west cross-cut will soon be under way from the eighth floor of the raise on the 1750-ft. level. The raise is now up over 60 ft. and has passed through favorable formations.——There is greater activity in the Gold Hill mines at present than at any time during the past fourteen years. More men have employment and large areas of new ground are being opened that are giving immediate good results. With the unwatering of Gold Hill to the 1800-ft. level through the Ward shaft still greater activity may be expected from this group.

WHITE PINE COUNTY

A new ore-bin has been erected at the Millard lease north of Lane and another load of ore is ready to be forwarded to the smelter.——McGill & Willoughby have cut the Southern Cross vein at the Chainman property and have started the mill on the ore.——In the Ely district 2 ft. of good lead-silver ore has been struck in the raise from the east drift of the American mine on the Ely Consolidated, which promises to afford much good stoping ground. The Brilliant mine of the Ely Consolidated is looking comparatively

well and the south drift of the Zack mine is all in low grade ore at the present time. It is expected that the Nevada Consolidated will commence operating its new steam shovel pit on the Liberty claim within a week or ten days. The company has three steam shovels on the road and five donkey engines, all of which will be used in the removal of the overburden. At this point the sulphide zone comes very near the surface. The winze from the 1100 ft. level of the Boston Ely is now down 80 ft. and is bottomed in sulphide ore, which is just coming in. The ground is much harder than it has been above, hence the winze is going down at about 2½ ft. per day.

NEW MEXICO

SOCORRO COUNTY

(Special Correspondence.) The Socorro Mines Co. has made good progress during the week in changing the Burt filter-press operations from the power to the gravity system. Development was advanced 150 ft. and 700 tons of ore milled averaging $18 per ton. Five bars of bullion and 100 sacks of concentrate were produced. The high grade ore continues in the 300 ft. level west, all of which is being sacked as mined. —The Ernestine Mining Co. produced 6710 oz. of bullion, 61 sacks of concentrate, and milled 715 tons of ore during the week. This company has also opened a good body of sulphide ore on its 300 ft. level west. —Good progress is being made installing the pipe line by the Helen Mining Co., completion of which is expected within 90 days. Practically all the required material has been delivered at the plant at Graham.——For the past week the drift in the Crescent adit of the Alberta Mining Co. has shown a decided improvement, with the vein measuring about 13 ft., although the andesite in the hanging wall is still full of quartz seams.

Alma, April 28.

OKLAHOMA

L. L. Hutchison, Assistant Director of the Oklahoma Geological Survey, has just sent to press a special State report on the asphalt, oil, and gas deposits of Oklahoma. This report is divided into two parts. In part one, Mr. Hutchison gives a general map which shows that portion of the State in which asphalt occurs and the region where it is likely to be found. It also contains a geological map of the asphalt bearing district, and one showing the exact location of nearly one hundred known deposits, all of which have been visited by the author or his field assistants. This part of the report is closed with a chapter on asphalt paving that contains suggestions to cities and towns which contemplate paving. Part two is devoted to oil and gas and reviews the history of the industry and discusses the various theories of origin and accumulation of petroleum and natural gas. This section of the report is illustrated by a general map showing the present developed areas, probable territory yet undeveloped, and those parts of the State where it seems possible that oil and gas may be found, and by a geologic map of the oilfields and detailed maps, which give the exact location of every well drilled in the various important fields prior to 1910.

UTAH

BEAVER COUNTY

(Special Correspondence).—The Moscow Mining Co. is shipping two cars of ore per week, and this probably will be increased. The ore consists of a lead-carbonate containing silver. The orebody is said to have been opened a distance of 350 ft. on the vein. A 70-ft. raise and a 90-ft. winze are in ore.

Newhouse, April 30.

SALT LAKE COUNTY

(Special Correspondence).—The Utah Leasing Co., composed of J. C. Dick and associates of Salt Lake, is operating the Old Telegraph mine, in upper Bingham, under a three years' lease from the United States Smelting, Refining & Mining Co. The property had been idle for some time prior to the time this lessee began work last June. At present the ore shipments consist of 600 tons per month of siliceous ore to the Garfield smelting plant for converter lining; 200 tons of copper ore per month to the plant of the Yampa Smelting Co. and 200 tons per month of lead ore to the U. S. company at Midvale. The siliceous ore carries some gold and silver and runs 85% silica. The copper ore contains 5 to 6% of that metal, with gold and silver aggregating $5 per ton. The mine is entered through an 800-ft. adit, all ore that is mined being taken from stopes above this adit. The orebody occurs as a deposit overlying a bedding of quartzite, the three kinds of ore being definitely separated from each other. The work is under the superintendency of N. M. Muir, who states that there is a considerable tonnage of the siliceous ore accessible. The Old Jordan mine, of the U. S. Smelting, Refining & Mining Co., is producing 250 tons of lead ore per day; this is conveyed to the shipping bins at the railroad over the company's four mile aerial tramway. J. F. Barnard has charge of this property as superintendent. The North Utah Mining Co., owner of the Butler Liberal mine and other mineral ground in Markham gulch, Bingham district, has shipped 20,000 tons of lead-silver ore to mills and smelting plants within the last year, this production having been incidental to development. W. D. Bohm, the company's manager, states that a 163 ft. shaft has been sunk from the main adit level on the Butler Liberal and that 900 ft. of horizontal development has been done from the bottom station of this shaft. The ore-channels sought have been found and further development will doubtless be most interesting.

Salt Lake, April 30.

SUMMIT COUNTY

(Special Correspondence).—The New York Bonanza Mining Co., whose development work is in charge of M. J. McGill, has sunk a 2-compartment shaft to a depth of 1000 ft. in limestone, and driven a number of cross-cuts to a quartz fissure. The property is in Ontario canyon, 3500 ft. south of the Ontario shaft, and three miles from Park City. Since beginning they have shipped ore that sold at $72,000, some of which was taken from stopes between the 600 and 800-ft. levels, and the rest from a winze on the 400. Present work is confined to the 800-ft. level, but the company will resume on the 1000-ft. level as soon as the spring flow of water has had time to drain out of the lower workings. The average of the ore shipped ran 100 oz. silver per ton, and 10% lead; some, however, contained 176 oz. silver, 20% lead, $2.50 per ton gold, and 2% copper. The ore carries 60% silica and all below the 850-ft. level is sulphide. The old Daly dumps, which resulted mainly from operations twelve to twenty years ago, have been leased to A. W. Davidson and Ole Johnson, who are working over portions by hand-jigging.

Park City, April 30.

CANADA

ONTARIO

The annual report of the Nipissing Mines Co. recently issued shows that dividends aggregating $1,500,000 were paid during the year, that ore in transit and at the mine amounted to $400,000, that net earnings for the year had increased $775,000, that the ore reserves were estimated at $3,269,000, and that the company had over $100,000 surplus in the treasury.——The Agaunico, on the shore of Lake Temiskaming, has cut the Huronian slates at a depth of 250 ft. The company is working 30 men and a 5-drill compressor is operating two large machines. At the 200-ft. level a cross-cut opened the big smaltite vein where it showed a width of 30 in. It assayed high in cobalt but low in silver. The shaft at the present time is down 255 ft. and will be sunk to the 300-ft. level where the vein will again be picked up in a cross-cut.——There are now two plants running in the Porcupine camp. One is the Crown Chartered, in the neighborhood of the Bannerman and Davidson claims, in the northern end of the camp, and the other is the Timmins in Tisdale, near Pearl lake. The Wilson has a small stamp-mill. The Timmins are now probably the largest holders of valuable property in Porcupine. They have the Hollinger, the McMahon, the Gillies, the Miller, two Bruce claims, and five Armstrong and Booth claims all in one block. Upon all of these claims valuable discoveries have been made, so that the need for a large equipment such as they have now installed is apparent.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

MECHANIC'S LIEN ON MINING PROPERTY.

The mechanic's lien statute of Utah is intended to apply to all persons who shall work or furnish materials for the working, preservation, or development of any mine, lode, mining claim, or deposit yielding metals or minerals of any kind, or for the working, preservation, or development of any such mine, lode, or deposit, in search of such metals or minerals and to all persons who shall do work or furnish materials upon any shaft, tunnel, incline, adit, drift, drain, or other excavation of any such mine, lode, or deposit. The statute also provides that when two or more such lodes or deposits, owned or claimed by the same person or persons or where the owners are different persons, and the same with the consent of all shall be worked through a common shaft, tunnel, incline, adit, drift, or other excavation, then all the mines, lodes, or deposits so worked shall, for the purposes of the statute, be deemed one mine. In an action to enforce a mechanic's lien against mining property, the Supreme Court of Utah held that the proviso was not such in fact, as it did not restrict or modify what was previously said in the section, but was intended to apply to the whole chapter and that for the purpose of arriving at the true intention, the proviso should be considered as a separate section of the statute; and that for the purpose of acquiring a mechanic's lien under this proviso against mining claims which are operated as a mine, the claims constituting the mine and all the property necessarily used and connected with the mine and mining claims, including an easement in adjoining lands, used as dumping grounds as a necessary appurtenance to the mine, must all be regarded as a unit and to all of which the lien would attach. It was also held by the court that a notice of intention to claim a lien for work on the mine or several mining claims operated as a mine, need only describe the mine as a whole or refer to the claims by name or number, without referring to an easement in adjoining lands where such easement was a necessary appurtenant to the mine.

Park City Meat Co. *v.* Comstock Silver Min. Co., (Utah) 103 Pac. 254, June '09.

MINING—RELATIVE RIGHTS OF MINE AND SURFACE OWNERS.

The right of a mine owner to take minerals underneath the surface is subordinate to the right of the owner of the soil or of the surface to have it supported in its natural position; this right is a part of the freehold, and the mining must be exercised in such a way as not to deprive the owner of the soil of his existing rights. Under such circumstances the mine owner cannot establish a custom of allowing miners to destroy the surface support by removing the pillars.

Southwest Missouri R. Co. *v.* Big Three Min. Co., (Mo.) 119 S. W. 982, June '09.

ASSIGNMENT OF MINING LEASE.

The Alaska statute provides that an assignment of a lease of mining property shall be executed with the usual formalities of a deed; but such a lease was not invalid because the subscribing witnesses thereto were members of the partnership which was the assignee of the lease.

Halla *v.* Cowden, 170 Fed. 559, May '09.

COMPANY REPORTS.

LUCKY TIGER

The Lucky Tiger-Combination G. M. Co., with offices at Kansas City, is owner of the Tiger Mining Co., S. A., having properties in Sonora, Mexico. J. W. Malcolmson, consulting engineer, reports that during 1909, 47,130 tons of ore were broken, of which 1911 were shipped to the smelters and 37,721 milled, 2235 tons of concentrate being produced. The ore milled averaged $24.65 per ton. Receipts from ore sales amounted to $1,087,278, of which $586,598 was net profit after deducting operating charges, freight and treatment, interest on bonds, taxes, and some other items. This is $200,000 better than the previous year. Dividends to the amount of $409,500 were paid. Development amounted to 8161 ft., increasing ore reserves 79,445 tons. The total ore in reserve is now 258,891 tons of which 90% is exposed on four sides and the remainder on three. There is 150,000 tons additional of probable ore and 48,000 tons of tailing. The latter has a gross value of $9.96 per ton and may be treated at a profit of $5.94 per ton. The profit from treatment of the tailing will be enough to pay for the proposed new plant. Within the year a drainage and development tunnel 2250 ft. long was started. It will intersect the vein 300 ft. below the lowest workings. A new contract has been made with the A. S. & R. that will effect a saving of $6 per ton in treatment of high-grade ore and concentrate. The company has contracted to purchase 50,000 acres of adjacent land. Plans are under way for increased power and milling plant. In the report no details as to costs are given.

ROUND MOUNTAIN

The Round Mountain M. Co. owns a rich mine of free-milling gold ore in Nye county, Nevada. For the year ended March 31, J. R. Davis, general manager, reported 8098 ft. of development and an increase of 5458 tons in ore reserves, making a present total of 45,360. The value of this ore is placed at '$9 to $10 per ton', slightly below the previous average net return of $11.63. The following figures of costs for the year are of interest:

	Cost.	Cost per ton.
Development	$58,844	$1.738
Ore extraction	78,821	2.318
Milling	51,150	1.510
General expense	11,985	0.353
Total		$5.919

The above figures include a fixed charge for deterioration on all mine and mill machinery, building, and equipment. During the year, the company mined and milled 33,860 tons of ore of an average value of $11.63, with a gross value of $393,865, and a net of $192,805. Miscellaneous earnings were $1244. The total net profit for the year was $194,049. This shows a net increase over the earnings of the year previous of $16,960. The cost per ton was $5.919 as compared with $6.07 the preceding year. Besides paying four quarterly dividends of 4c. per share on the issued stock, amounting to $131,181, the company purchased 531,800 shares of the Round Mountain Combination M. Co. stock at a cost of $16,035; and purchased for 60,000 shares of treasury stock, the Black Hawk lode and three fractional claims. This gives to the company a total of 222 acres of patented ground, and a total of 121 unpatented. During the year the company has added to its mine and mill equipment, new machinery at a cost of $34,188. The total tonnage mined and milled since beginning operations has been 77,500; total mint returns, $916,123; total dividends, $259,082.

CALUMET & ARIZONA

The report of the Calumet & Arizona Mining Co., just issued, shows a healthy financial condition, with assets of $3,428,680. These consist of cash, $813,360; bullion on hand, $1,045,835; ore in stock, $91,000; supplies on hand, $549,777; accounts receivable, $215,146; stock in other companies, $167,500. It will be noted that mine properties and equipment do not figure in this list of assets. The balance sheets shows receipts for 1909 of $5,054,864, and expenditures of $4,241,303. Dividends of $800,000 were declared during the year. The Superior & Pittsburg Copper Co. shows for the year 1909 receipts of $3,454,956, and an outgo of $3,447,650; with assets, estimated similarly to those of the Calumet & Arizona, of $1,069,940. In calculating the value of bullion in both cases the price of copper was assumed at 12½ cents.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

M. A. Newman is here.

G. B. Street was in San Francisco.

James Brown is at Douglas, Arizona.

Edgar Newhouse has been in San Francisco.

S. F. Shaw is making examinations in Arizona.

Clarence Woods is now at Tuolumne, California.

P. C. Stoess, of Seattle, was at Salt Lake last week.

Edwin E. Chase is at Butte examining copper properties.

Ernest A. Haggott will be in Arizona and Sonora during May.

Walter Harvey Weed was in Bisbee, Arizona, again this week.

T. Lane Carter will make headquarters at Chicago hereafter.

Bryan K. Morse, of the Constant Herzig staff, is at Salt Lake.

Edwin M. Clark is spending a month near Nacozari, Mexico.

Masutomo Mayekawa sailed for Japan this week on the *Chiyo Maru*.

E. R. Abadie has moved his office from Los Angeles to Bakersfield, California.

Forbes Rickard has returned to Denver from New Mexico but will be in Arizona soon.

Alex. Imhoff has been appointed superintendent at the San Juan mine, Taviche, Mexico.

William H. Radford has gone to Siberia by way of London, to examine dredging ground.

E. P. Butts has returned from Sonora, Mexico, and has gone to Tuolumne county, California.

C. H. Jones has returned to the Monte Cristo mine, Moctezuma, Sonora, from Douglas, Arizona.

John B. Farish has returned to Denver from San Francisco. He will be in New York soon.

Charles S. Howe will deliver the Commencement Day address at the Missouri School of Mines.

J. D. Hubbard has resigned as metallurgist for the Oriental Con. M. Co., in Korea, and will return to California.

H. C. Parmelee, Western editor of *Metallurgical & Chemical Engineering*, New York, is spending a week in Utah.

W. F. Ferrier, who has been in Washington and Philadelphia recently, attended the Raymond dinner in New York last week.

Arthur W. Jenks is examining a copper property in Ontario, Canada. He will return to Berkeley, California, in a few days.

Weed & Probert have been examining the Shattuck-Arizona mine at Bisbee preparatory to the listing of the stock at Boston.

C. W. Purington has been in New York contracting for machinery to be sent to Siberia. He will be in San Francisco about May 15.

Jules Labarthe, of the Consolidated M. & S. Co., Ltd., Rossland, B. C., has resigned and will go to Yerington, Nevada, where he will have charge of the new smelter of the Mason Valley Mines Co. at Wabuska.

R. B. Lamb, of the C. L. Constant Co., has retired from that organization to become associated with the Proprietary Mines Company of America, offices at 15 Broad street, New York. He is at Elk City, Idaho, at present.

The National Academy of Sciences at its recent meeting elected the following new members: Jacques Loeb, professor of physiology in the University of California; W. A. Noyes, professor of chemistry, University of Illinois; Charles Schuchert, paleontologist, professor at Yale University; D. H. Campbell, professor of botony, at Stanford University, California; John Dewey, professor of philosophy at Columbia University, New York. Forest Ray Moulton, astronomer professor at University of Chicago. Thomas Burr Osborne, chemist of the Connecticut Agricultural Experiment Station, New Haven, and Professor Schiaparelli, astronomer, Milan, Italy.

Ronald Drake died at Riverside, California, April 25. He was the son of Francis Drake and was, himself, a student of mining engineering.

Erick H. A. Nordain died in New York, April 27. He was for some time connected with the Oroville Dredging Co., Ltd., as electric engineer and had recently completed installing dredge machinery on the Nichi river near Zaragoza, Colombia.

The Secretary of the Interior has withdrawn from entry approximately 13,500,000 acres of land in southeastern Montana. It is believed to contain valuable deposits of coal. It has been withdrawn pending examination and classification. The withdrawal is made on the recommendation of the Director of the Geological Survey. This is the largest single order covering coal territory not previously withdrawn, which has been made since Secretary Hitchcock made the original coal withdrawal in 1906.

APRIL COPPER REVIEW

By Misha E. Appelbaum*

During the month of April, copper has gradually sagged until at the close the metal is freely offered at 12¾ delivered in 30 days, equivalent to about 12⅝ f. o. b., New York. The American consumers have a very small supply on hand but as indicated in my last review are pursuing a hand to mouth policy so that the actual buying power is not sufficient to cause any material change in prices. The exports for the month of April are around thirty million pounds and the domestic deliveries should be in the neighborhood of about sixty-five million pounds, and if April production will not show a decrease, there will be another increase in the visible supply. This will offer very little inducement to the American consumers to buy liberally. The outlook is as yet not very promising. It is reported that the Copper Producers' Association intends to stop publishing the monthly statistics. I do not see what difference it will make whether or not these figures are published since the law of supply and demand governs prices, and manufacturers can easily judge from their own business whether consumption is good or bad. The present moment, however, would seem a very inopportune time to stop the publication of these figures lest it should be interpreted to mean that the statistical position is liable to become worse instead of better.

Metal Prices.

LOCAL METAL PRICES.

San Francisco, May 5.

Antimony	12—12¾c	Quicksilver (flask)	49—49½
Electrolytic Copper	15¼—16½c	Spelter	7—7¾c
Pig Lead	4.75—5.70c	Tin	36—37½c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Apr. 21	12 63	4.35	5.24	53⅝
" 22	12.63	4.35	5.21	53¾
" 23	12.57	4.35	5.18	53¾
" 24	Sunday.	No market.		
" 25	12.57	4.35	5.18	53⅝
" 26	12.57	4.35	5 13	53¾
" 27	12.57	4 35	5.10	54⅛
" 28	12.37	4.36	4.97	54¼
" 29	12.37	4.36	4.95	54
" 30	12.37	4.36	4.92	54¼
May 1	Sunday.	No market.		
" 2	12.31	4.36	4.91	54¼
" 3	12.31	4.36	4.89	54⅛
" 4	13.31	4.36	4.87	45⅛

*President of the New York Metal Selling Company.

Market Reports

ANGLO-AMERICAN SHARES.

Cabled from London.

	Apr. 28. £ s. d.	May. 4. £ s. d.
Camp Bird	1 12 9	1 9 6
El Oro	1 7 6	1 7 0
Esperanza	2 8 9	2 8 9
Dolores	1 8 9	1 8 9
Oroville Dredging	0 10 0	0 8 9
Mexico Mines	8 12 6	8 11 3
Tomboy	0 18 0	0 18 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, May 5.		Closing prices, May 5.
Adventure	5¼	Mohawk	47
Allouez	40	North Butte	31¾
Atlantic	6	Old Dominion	32¾
Calumet & Arizona	57	Osceola	132⅛
Calumet & Hecla	575	Parrot	13¼
Centennial	16	Santa Fe	1⅞
Copper Range	65½	Shannon	10⅛
Daly West	8	Superior & Pittsburg	11¾
Franklin	11	Tamarack	48
Granby	41	Trinity	5
Greene-Cananea, ctf.	8½	Utah Con	20
Isle Royale	13¾	Victoria	2½
La Salle	12	Winona	6¾
Mass Copper	6¼	Wolverine	116

(By courtesy of J. C. Wilson, Mills Building.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, May 4.		Closing prices, May 4.
Amalgamated Copper	65⅛	Miami Copper	20⅝
A. S. & R. Co.	74⅝	Mines Co. of America	⅛
Boston Copper	17⅞	Montgomery-Shoshone	⅛
B. C. Copper Co.	5¼	Nevada Con.	18⅛
Butte Coalition	17⅞	Nevada Utah	¾
Chino	10	Nipissing	9⅞
Davis-Daly	1½	Ohio Copper	2
Dolores	5¼	Ray Central	2⅛
El Rayo	2¼	Ray Con	16⅝
Ely Central	⅞	South Utah	1¼
First National	2⅛	Superior & Pittsburg	11⅞
Giroux	6⅞	Tenn. Copper	26
Guanajuato Con	1	Trinity	5¾
Inspiration	7½	Tuolumne Copper	3¼
Kerr Lake	8½	United Copper	4⅞
La Rose	4	Utah Copper	41⅝
Mason Valley	7⅛	Yukon Gold	4⅛

SOUTHERN NEVADA STOCKS.

San Francisco, May 5.

Atlanta	$ 14	Mayflower	$ 2
Belmont	2.80	Midway	28
Booth	14	Montana Tonopah	85
Columbia Mtn	6	Nevada Hills	65
Combination Fraction	43	Pittsburg Silver Peak	70
Daisy	8	Rawhide Coalition	25
Fairview Eagle	10	Rawhide Queen	30
Florence	2.20	Round Mountain	49
Goldfield Con	8.02	Sandstorm	4
Gold Kewenas	5	Silver Pick	
Great Bend	3	St. Ives	15
Jim Butler	17	Tonopah Extension	80
Jumbo Extension	23	Tonopah of Nevada	7.30
MacNamara	27	West End	37

(By courtesy of the San Francisco Stock & Exchange Board.)

COMSTOCKS.

San Francisco, March 31.

Alpha	$ 9	Kentuck	$ 14
Alta	20	Lady Washington	7
Andes	9	Mexican	1.37
Belcher	34	New York Con	3
Bullion	10	North G. & C.	31
Caledonia	49	Occidental	26
Challenge Con.	31	Ophir	1.47
Chollar	18	Overman	1.00
Confidence	1.05	Potosi	36
Con. Imperial	7	Savage	37
Con. Virginia	1.12	Scorpion	7
Crown Point	93	Seg. Belcher	20
Exchequer	23	Sierra Nevada	32
Gould & Curry	28	Silver Hill	28
Hale & Norcross	39	Union	35
Julia	20	Utah	8
Justice	10	Yellow Jacket	92

OIL SHARES.

San Francisco, May 5.

Associated Oil	$50.50	Monte Cristo	$ 3.25
Bay City	2.00	Palmer	1.27
Blue Moon	26	Paraffine	1.40
Chicago Crude	11	Premier	1.27
Claremont	1.82	Record	6.00
Enos	1.40	S. F. & McK	20.00
Four	16	Sauer Dough	1.90
Illinois Crude	51	Sesnon	8.00
Junction	50	S. W. & B.	55
Mecca	1.50	W. K. Oil	3.15

(Courtesy California Stock & Oil Exchange.)

Monthly Statement of Dividends Paid by Active Listed Oil Companies to April 30, 1910.

Company.	No. of Div.	Date paid	Amount per share.	Amount of dividend.	Total paid to date.
Alma	15	Apr. '10	3	$11,400.00	$171,000.00
Amalgamated Oil.	29	Mar. '10	1.00	50,000.00	1,450,000.00
Amer. Petroleum.	10	Apr. '10	1.00	126,735.00	1,183,430.50
Apollo	2	Mar. '05	1	2,000.00	4,000.00
Associated Oil Co.	4	Mar. '07	1.50	446,055.00	1,548,368.55
Bay City	4	Feb. '10	20	20,000.00	90,000.00
Brookshire	45	Jan. '10	1	5,000.00	442,500.00
Caribou	60	Apr. '10	25	20,175.75	720,707.49
Chicago Crude	2	Mar. '07	0½	5,000.00	15,000.00
Claremont	59	Apr. '10	2	10,000.00	335,000.00
Coalinga Pacific	18	Dec. '09	10	6,500.00	107,250.00
Columbia	40-41	Apr. '10	½-½	9,992.62	284,789.49
Del Rey	3	May '09	0½	3,927.50	11,782.50
Esperanza	26	Dec. '09	2	3,200.00	49,450.00
Euclid	38	Apr. '10	1	3,500.00	127,500.00
Four	68	Feb. '09	1	3,000.00	213,000.00
Globe	21	Apr. '10	1	6,000.00	87,000.00
Hanford	12	Jan. '06	2.00	4,000.00	80,000.00
Home	A18	Apr. '10	2	2,000.00	476,000.00
Homestake	46	Apr. '10	10	1,000.00	78,250.00
Illinois Crude	38	Apr. '10	1	2,000.00	90,000.00
Imperial	68	Apr. '10	60	60,000.00	2,000,000.00
Junction	8	June '09	1	2,500.00	20,000.00
Kern Oil	2	Nov. '09	22	22,000.00	42,000.00
Kern River	41	Apr. '10	10	2,000.00	102,000.00
Linda Vista	20	Mar. '10	1	3,838.50	72,931.50
Lucile	16	Dec. '09	10	2,670.44	42,727.04
Mascot	3	Apr. '10	1	5,000.00	15,000.00
Mex. Petroleum	44	Apr. '10	1½	85,616.70	3,562,960.24
Mecca	6	July '09	3	12,675.00	71,825.00
Monte Cristo	60	Apr. '10	10	50,000.00	440,000.00
Nevada County	3	Oct. '08	4	10,000.00	40,000.00
Palmer	11	Apr. '10	1	18,020.05	268,380.95
Paraffine	6	Apr. '10	1	3,000.00	18,000.00
Peerless	77	Sept. '09	6	6,000.00	801,000.00
Piedmont	6	Aug. '09	1	3,890.00	22,987.30
Pinal	56	Apr. '10	10	14,992.00	902,093.50
Pittsburg	10	Nov. '07	24½	58,800.00	124,800.00
Premier	1	Apr. '10	1	10,000.00	10,000.00
Record	10	Apr. '10	7½	7,500.00	62,500.00
Reed Crude	11	Dec. '09	12	12,000.00	1,124,000.00
Rice Ranch	19	Apr. '10	1	3,000.00	102,000.00
Royalty	18	Apr. '10	1½	300.00	15,766.66
S.F. & McKittrick	24	Apr. '10	30	15,000.00	355,000.00
Sauer Dough	50	Apr. '10	2½	4,987.50	522,291.00
Section 25	2	Apr. '10	25	10,000.00	20,000.00
Sesnon	7	Apr. '10	20	20,000.00	110,000.00
Silver Tip Oil Co.	4	Feb. '10	10	7,500.00	30,000.00
Sovereign	18	Apr. '10	1	5,000.00	95,000.00
Sterling	23	Mar. '10	12½	31,250.00	778,250.00
Superior	11	Feb. '10	1	5,000.00	57,500.00
S. W. & B.	7	Sept. '09	1	3,770.00	41,470.00
Thirty Three	59	Apr. '10	20	20,000.00	690,000.00
Traders	16	Apr. '10	1.00	14,960.00	194,146.50
Union	165	Apr. '10	50	124,813.00	6,493,068.15
United Petroleum.	104	Apr. '10	50	40,375.50	2,219,335.43
Wabash	28	Apr. '10	1	3,000.00	123,000.00
West Coast (pfd.)	4	Mar. '10	2.00	20,816.00	83,264.00
Western Union		Dec. '07	2.00	20,000.00	484,951.00
West Shore	47	Dec. '08	5	5,000.00	235,000.00

Total dividends paid to date $29,958,276.80

Total dividends paid by the above companies for April 1910 ..... 710,368.12

The Nipissing and La Rose companies of Cobalt have just re-elected their old boards. The two directorates now have five members in common. There has been news of good strikes on both properties and in the case of La Rose some sharp market advances. It is conceded now that in course of time there will be a merger of the principal Cobalt mines, with the two mentioned as the nucleus. As lower grade ores are being extracted many economies in operations could be effected by a consolidation.

PUBLICATIONS RECEIVED

Any of the books noticed in these columns are for sale by or can be procured from the Mining and Scientific Press.

Porfirio Diaz President of Mexico. The Master Builder of a Great Commonwealth. By José F. Godoy. 8vo. pp. 253. Ill., maps, diagrams, index. G. P. Putnam's Sons, New York. 1910. Price $2.

The history of Porfirio Diaz is the history of the consolidation of the Mexican people into a nation. His career covers the period from the war between Mexico and the United States down to the present time, from an epoch when disruptive forces kept the country torn and impoverished to the peaceful days of a strong and progressive government bringing prosperity and widening opportunity. He is the greatest Latin American who has ever lived, greater far than Bolivar, greater even than San Martin. He alone, of all Spanish Americans, has demonstrated constructive statesmanship of the highest order. It is not often that so many remarkable qualities are blended in a single nature. As a guerrilla warrior he possessed the dash and daring of a Marion or a Morgan; as a campaigner he showed extraordinary powers of generalship; as a politician he has proved himself a leader and controller of men under circumstances which place him in a class by himself. His military exploits have been singularly like those of that other Diaz, the famous Cid Campeador. If one be disposed to doubt the achievements of the Cid it is only necessary to consider the military marvels performed by Porfirio Diaz to be ready to concede that tradition did not exaggerate the prowess of the medieval chieftain. More remarkable, however, than these deeds of valor, has been the power to harmonize conflicting interests and ambitions, and to hold the reins of authority firmly while carrying out his plans for the upbuilding of the nation. It has required an iron hand to do it, and sometimes it has necessitated despotic acts, the virtue of which can be measured only by the good which has followed to the people as a whole. Mexico today enjoys universal financial credit based upon confidence in the solidity of the structure which Porfirio Diaz has created. This is a sufficient answer to the criticisms of his detractors. But for these successes much that he has been forced to do would write him down as a tyrant; instead he stands before the world as a statesman. No petty tyrant ever seeks to enlighten his people; but from the beginning of his political career President Diaz has fostered and promoted education in Mexico. The public school system of the Republic has reached a high state of perfection under his intelligent guidance. He has zealously labored to increase transportation facilities, which develop a people not only industrially, but intellectually also through larger contact with the world. He has scrupulously sustained the national credit abroad, and provided a banking system at home which is a model of excellence. He has encouraged the introduction of foreign capital, until Mexican investments have become a general favorite with financiers.

The time will come when great biographers will find in the life of Porfirio Diaz material for illuminating exposition of the methods of a master-builder of a great commonwealth. That time has not yet arrived. The attempt made by José F. Godoy will add nothing to the lustre of the man he portrays. The book before us is little more than a catalogue of events; it does not interpret the man in his relation to the difficult problems he has met and solved. As notes for a biography the work is useful; as a reference work on recent Mexican history it will prove convenient; but it lacks inspiration. It is always difficult for a contemporary to set forth the deeds of a great man in proper perspective; it is equally difficult for one of his own countrymen to discriminate between the trivial and the important in the life of his idol. The book is at least a reply to recent diatribes which all thinking men had discredited because of the manifest personal animosity which they displayed. In the face of the great work which Porfirio Diaz has accomplished no one can rob him of the honor he has so splendidly won.

Hendy's Handy Atlas of the World. Pp. 128, 6 by 8 in. Joshua Hendy Iron Works, San Francisco. 1910.

This convenient little book contains 84 pages of colored maps of the principal states and countries of the world, with supplementary illustrated tables of statistics of areas and population, and, finally, 28 pages of miscellaneous useful tables and information. It is attractive in form, up to date, and full of short cut rules and tables of equivalent such as the men around mines constantly need to use. It is substantially bound and evidently prepared for use rather than mere show.

Twenty Five Years of Mining, 1880-1904. A Retrospective Review. By Edward Ashmead. Pp. 184, index. The Mining Journal, London, 1909. Price $1.25.

This little volume deals with the flotation of mines in Great Britain and the Colonies during the period indicated in the title, with many statistical tables of production. In a certain sense it is a recapitulation of present day British mining interests, and gives a great deal of information of value to investors, and to all who are concerned in mining.

Reconnaissance of Some Mining Camps in Elko, Lander, and Eureka Counties, Nevada. By W. H. Emmons. U. S. Geol. Surv., Bull. 408. Pp. 130, ill., map. Washington, 1910.

A timely and valuable report on an area which will attract many prospectors this year.

Mine Accident Investigations of the United States Geological Survey. By George S. Rice. Pamphlet, reprint from Jour. Western Soc. Eng., Vol. XIV.

An excellent general statement of this new and interesting branch of the Survey work.

Cripple Creek Mines, Year 1910. Pamphlet. Pp. 47. Colorado Springs, 1910. F. H. Pettingell. Price 25 cents.

A summary of reports made to the Colorado Springs Mining Stock Association by listed companies. A convenient and valuable handbook.

Mineral Production of Virginia, During 1908. By T. L. Watson. Virginia Geol. Surv., Pp. 141, ill., map. Charlottesville, 1909.

A convenient handbook giving statistics of production and notes on occurrence and distribution.

Physiography of the St. Louis Area. By N. M. Fenneman. Illinois State Geol. Surv., Bull. 12. Pp. 83, ill., maps. Urbana, 1909.

An informing and accurate account of how the industry and history of one area has been conditioned by geology.

Temiskaming and Northern Ontario Railway Commission. Report on Mining and Power Development for 1909. By A. A. Cole. Pamphlet. Pp. 48, ill. Toronto, 1910.

Preliminary Report on the Mineral Production of Canada, 1909. By John McLeish. Canada, Dept. Mines. Mines Branch, No. 62. Pp. 18. Ottawa, 1910.

Geology of the Vicinity of the Tumamoc Hills. By C. F. Tolman, Jr. Pamphlet, reprint from Pub. 113. Carnegie Inst. of Washington. Pp. 13, ill., map.

History of Coal Mining in Iowa. By James H. Lees. Iowa Geol. Surv. Vol. XIX. Pp. 521-604. Des Moines, 1909.

A brief and convenient reprint.

Redemption of the Great Valley of California. By A. D. Foote. Pamphlet, reprint with discussion, from Trans. Amer. Soc. Civ. Eng., Vol. LXVI.

Iron Ore Deposits of Vancouver and Texada. By Einar Lindeman. Canada, Dept. Mines, Mines Branch, No. 47. Pp. 29. Maps. Ottawa, 1910.

Mining Industry of Idaho, 1909. By F. Cushing Moore. Eleventh Annual Report of the Inspector of Mines. Pp. 137. Boise, 1910.

MINIATURE EXCAVATING BUCKETS

Contractors are so accustomed to considering only maximum handling capacity in connection with excavating buckets that a demand for buckets of minimum capacity is decidedly unusual. In work carried on by the Cranford company in connection with the special foundations of a part of the New York Rapid Transit Subways and some adjacent buildings such buckets were used. About 350 cylindrical steel and concrete piles 14 in. diam. and varying in length from 8 ft. under some buildings to 60 ft. under the subway, have been sunk through earth, sand, and gravel, with stones of considerable size. The piles were constructed by putting down steel shells and then filling with concrete. Owing to the limited headroom and contracted working space none of the usual methods could be used. It was necessary to use $^{7}/_{16}$-in. steel casing in successive 2-ft. lengths, overlapping about a foot. These were driven by means of a hydraulic jack or drop hammer. This was accomplished without much trouble by using a cap on

Hayward Buckets in the New York Subway.

top of the upper section of the casing, but the removal of the material at first proved decidedly troublesome. Various means of taking the sand and gravel out of the 14-in. shells were tried without success, until the idea of employing a miniature excavating bucket was suggested.

It is quite a stretch, or contraction, of the imagination to picture an excavating bucket, which is regarded instinctively as a pretty ponderous affair, working inside one of these small cylinders, yet the accompanying illustration shows how it was done. The problem was taken up with The Hayward Company, which supplied five Orange Peel buckets each weighing 28 lb. Each of these was 18½ in. high when open and 17½ when closed, 12½ in. diam. when open and 10¾ when closed. They were operated, like the ordinary sizes, with two lines, one at the head of the bucket and the other attached to the bull-wheel. These were carried up to the sheaves of a double block and managed by two men, and they removed all the material successfully. This unusual kind of excavating was necessarily conducted in a succession of stages. After the casing was forced down a few feet by the jack, the cap was lifted off, and the material taken out with a bucket. Other sections of the casing were then placed on top of those already sunk, and the driving was resumed until it was necessary to use the bucket again. If a large stone was encountered it was broken with a drilling bit, which was churned up and down until the rock was broken. The size of some of the pieces of stone brought up by these little buckets, when compared with the size of the buckets themselves, was surprising. After a casing had been sunk and tested to see that it had the bearing capacity required by the Public Service Commission, it was filled with concrete, thus completing the pile. The work was carried on below sea-level in water-bearing material, which made it necessary to keep pumps at work to clear the trench. As the material was excavated from a casing, water filled it to within a few feet of the top. The buckets frequently operated in 25 ft. or more of water, and it is understood that one of them could excavate from 3 to 8 lineal feet of material in a day.

It is apparent that these little buckets are adapted for other classes of work which often cause trouble; such as digging and cleaning wells and handling materials heated in kettles or caldrons. For example, articles thrown into a hot bath could be removed in this way by perforating the blades of the bucket to allow the liquid to drain out. The variety of such uses is conjectural, of course, but the application of a small-scale replica of a large excavating apparatus to such an unexpected purpose as that described above suggests the probability of a considerable field.

COMMERCIAL PARAGRAPHS

Edward L. Dufourcq has moved his office to Rooms C 22-23-24 of the Produce Exchange Annex, New York.

Sidney Carton is on a trip to Mexico and Arizona in the interests of Geo. W. Myers, of the Chrome Steel Works.

The Bucyrus Co. is building an 8-ft. close-connected placer gold dredge to be operated in Burma, India, equipped complete with steel hull.

The San Francisco office of the Vulcan Steam Shovel Co., of Toledo, Ohio, is now at 1106 Metropolis Trust building. W. R. Bassick is Pacific Coast manager.

The Sullivan Machinery Co. announces that its general offices at Chicago have been moved from the Railway Exchange building to the Peoples' Gas, Light & Coke building, 150 Michigan avenue.

A. Leschen & Sons Rope Co., St. Louis, Missouri, advise that they have the contract for constructing an aerial tramway for the Standard plant of the United States Smelting & Refining Co. at Colorado City, Colorado.

M. R. Ritchie, of the Llewellyn Iron Works, has recently made an extended trip through the northern part of Arizona and portions of Nevada. He went in the interests of the New Standard concentrator, and mining and milling machinery in general.

Osgood, Carter & Co. is the name of a new firm formed by S. W. Osgood & Co. and T. Lane Carter. The company will make assays, analyses, and tests of material as well as examinations and reports. Offices are at 627 First National Bank building, Chicago, Illinois.

The name of the C. L. Constant Co. has been changed to the Constant-Herzig Co. Charles S. Herzig is president of the new concern and will have charge of the engineering department. C. L. Constant will have charge of the chemical laboratories. The executive offices and laboratories have been combined at 42 New street, New York City.

The Smith-Emery Co. has been organized in Los Angeles and will have a complete ore-testing plant and assay office at 245 South Los Angeles street, Los Angeles. E. A. Slater is manager and the company is closely affiliated with Smith, Emery & Co. of San Francisco. The property and equipment will cost more than $40,000, and the plant will be in the heart of Los Angeles.

One of the largest hydro-electric developments in this State has just become public with the awarding of a contract to Allis-Chalmers Co. by the Northern California Power Co. for the initial installation of machinery. The contract calls for all the machinery and accessories and will include three 7000-hp. single horizontal turbines with cast-iron spiral casings. The runners are 50 in. diam. These turbines are each connected to a 5000 K.V.A., 6600-volt, 60-cycle, 3-phase alternator.

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EDITORIAL.

THE steamer *Corwin* sailed from Seattle May 10 bound for Nome and crowded with freight and passengers. For several years this boat has held the record for first arrival at Nome.

THE BILL establishing the Bureau of Mines at Washington has gone to the President for signature. Since Mr. Taft has already expressed approval of the project, it will doubtless have become a law by the time this reaches the reader.

NEARLY FIFTY YEARS ago the MINING AND SCIENTIFIC PRESS was founded. Next week we shall celebrate the event by re-publishing some interesting things taken from early issues, together with other articles dealing with present-day problems.

DEATH, in removing from this world's activities King Edward VII of England, has taken away one who wielded a powerful influence for the world's peace. The sympathy of the whole world goes out to the English people, coupled with the best of good wishes to the new king, George V.

IN one of our earlier issues, Mr. E. L. Allison, in discussing conservatism, was made to pass severe criticism upon Mr. David T. Day in connection with his work on black sands. Mr. Allison has asked us to say that this was far from being his intention and was due to omission of a 'not' in copying a first draft of his letter. This correction we are glad to make.

COPPER PRODUCERS ASSOCIATION figures for April were discouraging. The increase in stock was 18,579,281 pounds. Production amounted to 117,477,639 pounds, a decrease of 2,589,828, but deliveries were also 4,112,231 pounds less, domestic sales amounting to 67,985,951 pounds, and exports, 31,332,403. The total stock of metal, May 1, was placed at 141,984,158 pounds.

CEMENT production, according to figures collected by the United States Geological Survey, increased at least 20 per cent in 1909 and amounted to over 61,300,000 barrels, worth, at 85 cents, approximately $52,250,000. This is a startling proof of the building activity of the year, and it is interesting to recall that, despite predictions to the contrary, the cement output increased even in 1908, when most mineral industries fell behind.

PANAMA and the Canal Zone are to be visited by the American Institute of Mining Engineers this autumn. It is proposed to leave New York early in November and devote three or four weeks to the trip. Cuba and other points in the West In-

dies will be visited. The number in the party is limited to 150 and the probable expense is fixed at $200 each. The members of the Institute will not only see considerable mining in Cuba, but the application of mining methods to ordinary engineering work on the Canal. There are those who hold that an even larger infusion of mining engineering would have benefited the work on the Isthmus.

TEXAS is mainly thought of as an agricultural State, and by many somewhat more narrowly, as merely where 'they raise cain'. Mr. W. B. Phillips has, however, recently compiled figures showing that in the twenty-seven years ending with 1908, the mineral output of the State had amounted in value to $151,676,346. He estimated the output for 1909 at $15,000,000 additional. The Presidio silver mine at Shafter is famous, the El Paso tin deposits show distinct promise, the Plateau zinc properties are now shipping, and the discovery of an adequate water supply has put mining in the Quitman mountains on a new basis.

SAN FRANCISCO is to entertain the American Chemical Society this year, July 12 to 15 inclusive. A special train on the Santa Fe will bring a large delegation of Eastern members, and numerous local excursions are planned. It is possible that the Puget Sound cities will be visited. The Pacific Coast has much to show the chemists that will be of technical interest as well as an unequaled list of scenic attractions. The visitors are sure to have an enjoyable time, but the main benefits will be those flowing from the stimulation of chemical research resulting from the scientific sessions. Germany is our great exemplar in devotion to chemistry, and that Empire is already deriving enormous pecuniary benefit from the development of the chemical industries. It is a current saying that everything used in the laboratories is 'made in Germany' save matches, which are well known to be made in Heaven. While there may be some slight exaggeration in this, it is true that we have much to learn from the Germans.

THE PANAMA PACIFIC EXPOSITION now seems assured. Congress is not likely to resist an appeal for recognition when it comes from a community which supports its faith by raising by public subscription, over $4,000,000 in one day. Such an amount, raised so quickly, indicates a unanimity of sentiment and purpose sufficient alone to guarantee a great exposition. The opening of the Panama Canal in 1915 will be an event of the greatest importance to the whole world. It is fitting that it should be celebrated at the chief city of the Pacific Coast, the region which is most vitally concerned in establishing new and cheaper routes of travel to the East. Every effort should be made to enlist the widest possible co-operation. The mining industry should make an especially good exhibit, since, had it not been for the wonderful placers of California, the whole history of the Coast would doubtless have been radically different. Mining has been the basis of industry in this region not only historically but economically, and it is yet. The present opportunities in mining are not adequately appreciated, and the exposition will afford the Western States an unrivaled opportunity to attract the world's attention. To do this it will be necessary that the men in charge have the confidence of mining men not only locally but throughout the world. They must be men with whom co-operation is easy, and it is not too soon to be thinking of such matters. The United States Geological Survey has found it necessary to abandon all forms of co-operation with the present State Mineralogist, and it would be a fatal mistake to select any such person to invite the world to participate in an exposition of mining and metallurgy. We hold no brief for anyone, but we believe that it is not too soon to insist that the best possible man be selected.

THE GOLDFIELD CONSOLIDATED report for April gives new proof of the greatness of that mine. The total production for the month amounted to 14,918 tons, dry, with an average value of $75.11. The total return was, however, $1,134,800, as 8000 ounces of gold were recovered in the cleaning up of the burned part of the mill. The costs for the month amounted to $16.83, including $4.11 per ton construction cost due to fire loss. The mining cost alone was $4.49. The loss in tailing is given at $2.22. The profit per ton was $56.06 and the total profit, $839,040. The actual value of the ore sent to the mill during the month was $590,000, on which the extraction amounted to $560,000. High-grade ore to the value of $314,000 was sent to the smelters, making the gross actual production for the month $904,000. In development 2582 feet of advance was made and about twice as much ore was placed in sight as was mined during the month. The detailed monthly reports now being furnished are as satisfactory in form as their content is doubtless pleasing to stockholders.

The Carnegie Foundation

The 'disgrace of dying rich' seems likely to overtake Mr. Andrew Carnegie despite really heroic efforts to distribute his wealth in a manner beneficial to the public. Few men who have given largely, have been at such pains to study intelligently the problem of giving and to safeguard the purpose of their benefactions; yet there is serious doubt as to the value of some of Mr. Carnegie's most notable gifts, and valid criticism against others. He has been occasionally unfortunate in the men who have been chosen to administer the funds that he has devoted to public service. The Carnegie Institution at Washington, a great trust devoted to scientific research, and already accomplishing much good, publishes its reports in such limited editions and in such expensive form as to place them beyond the reach of most men interested. It practically operates to conserve science for the select few, rather than to diffuse it among the great masses. The Carnegie Libraries, which so plentifully besprinkle America, have proved a burden in more than one community, and it may be questioned whether it is of benefit to encourage hopes by the gift of a building, in a village where public funds are only sufficient to support the necessary janitor and librarian, and little

or nothing is left for purchase of books. Not every community looks at the matter as sanely as a certain mining town in Colorado. This village, which shall be here nameless, derives its public revenue from saloon licenses. When the women agitated the matter of a Carnegie library it was found that acceptance of the gift would entail providing an additional $1000 per year. This naturally involved another saloon, and the town council, after debating the question, decided that "this would not be fair to the fellows already in business," and so there is no Carnegie library there.

The gift of money for a united engineering building in New York has resulted in the American Institute of Mining Engineers being in debt, and appeals have been made to members to subscribe a fund for the liquidation of the debt. All this has its defense, and a proper one—that the objects are worthy, and that the gift provokes others to help themselves. The Carnegie Foundation for the Advancement of Teaching raises, however, other questions. The administration of the Foundation has recently come under severe criticism for changing the rules so that a teacher is no longer eligible on the basis of 25 years of service alone, but must also show disability. In other words, 'retiring allowances' as a reward of service, give way to pensions to those no longer useful. It is argued that this converts the pension into a charity, and it is suggested that in making this change the Trustees have exceeded their legal authority. To us these matters are of less importance than certain others which have come up since the Foundation was organized.

It will be recalled that the benefits of the fund were not to be extended to teachers in schools having church affiliations, and the resulting spectacle of colleges cutting loose from denominations which had previously supported them, has been a strong tribute to the power of money. The benefits, in any event, to the teacher have been somewhat questionable. Certainly the probability of a 'Carnegie pension' has been used as an argument why men should accept low salaries in the meanwhile, and fear of the pensions drawing away good men has led State universities and other schools to make every effort to obtain 'recognition' by the trustees of the Foundation. It was clearly necessary for the administrators of the Foundation to establish rules defining what is a College or University within the terms of the gift. This task has been taken very seriously by Mr. H. S. Pritchett, the president. As it is being done, it amounts to standardizing American educational institutions. This is a task neither the States, the United States, nor the National Educational Association have ever seriously attempted, and yet it is quietly assumed by a private foundation on the mere authority conferred by wealth. Already grave questions have arisen. The University of Illinois was rejected, and others have been told to mend their manners and their curricula. That there has been need for some more definite standards in educational work in this country may be freely granted without conceding the advisability of giving to a private corporation the power to fix these standards. America has prospered greatly because of giving the exceptional man the freest opportunity. The flexibility of our educational system has been at once the expression of our economic condition and the means of our development. It will become rigid soon enough without artificial aid, and special students have sufficient difficulty in making their way now. Private foundations, however well meaning and helpful in purpose, become harmful when they directly or indirectly usurp the functions of government, and some dollars cost too much to be worth buying.

University of California and Mining

The University of California is celebrating its semi-centennial, an event of large interest to mining men among others. Through its College of Mines the University has profoundly influenced the development of mining technology, and its graduates have directed the development of some of the greatest of the world's mines. The University grew out of a private school opened at Oakland in 1853. In 1860 the site at Berkeley was purchased and the 'College of California' opened. It was for some years supported by private subscriptions, but in 1867 was presented to the State and was given the land and funds set aside by the Federal Government for the support of State colleges of 'Agriculture and Mechanic Arts.' Instruction was at first literary and classical, but when it became the State University, courses in agriculture and engineering were added. Instruction in mining was taken up some fifteen years after the founding of the school. The College of Mines is now one of the most important in the University. It is housed in a beautiful white granite building, the gift of Mrs. Phoebe A. Hearst, dedicated in 1907. It is interesting to note that the buildings of the mining schools of California and of Nevada were paid for with money won from the mines, in the one case by Mr. George R. Hearst and in the other by Mr. John Mackay.

It is men, however, and not buildings that make a school, and California has been fortunate both as to instructors and students. Mr. S. B. Christy is now closing his thirty-first year of service as Dean of the Colleges of Mines, and in geology, at first Mr. Joseph Le Conte, and later Mr. A. C. Lawson, has grounded the men in the study of ore deposits. These men have influenced the profession not only indirectly through their students, but also by their researches and publications. Mr. Christy did much to clear up the difficult problems incident to the cyanidation of gold ores, and more recently has worked upon the influence of the electric current in precipitation. His students have, throughout the world, made records for themselves in research and management. Messrs. Charles Butters, C. W. Merrill, F. W. Bradley, C. H. Munro, W. W. Mein, and J. R. Farrell, to mention only a few, form a group of mining engineers of which any school might well be proud. The training of men who work effectively is the especial province of a school, and, measured by this standard, the College of Mines of the University of California need not fear comparison. We feel sure we voice the wishes of the profession in extending congratulations and good wishes.

The Raymond Dinner, New York City, April 30

"To be seventy years young is sometimes far more cheerful and hopeful than to be forty years old," said Oliver Wendell Holmes upon attaining his three-score-and-tenth birthday, and this thought was no more appropriately used than when it appeared on the first page of the program of the testimonial dinner to Rossiter Worthington Raymond at the Plaza Hotel on the evening of April 30. Dr. Raymond reached his seventieth year of youth on April 27, but the committee gave him three days' grace so as to be sure, and besides Saturday night allowed an intervening day of rest in which to recover. It was a notable event.

The honored guest of the day might have been supposed to be celebrating the passage of not more than the fiftieth milestone, except for the informationed conveyed by the program, and the advertising of the fact by the announcement sent out by the committee. Dr. Raymond looked younger than he did ten years ago, and were it not for the fact that we know they don't, we might be made to believe that in his case at least, the hands of time were turning backward. It was a great gathering of old friends, many coming from considerable distance to pay their tribute to the recognized dean of the mining engineering profession in the United States. From Bethlehem came 'Uncle John' Fritz, several years more than four score, from Chicago came 'Bob' Hunt, from Toronto came B. E. Fernow, from Washington came several, and from England came R. T. Bayliss to award the medal from the Institution of Mining and Metallurgy. The Canadian Mining Institute sent its greeting by its president, and the Mining Society of Nova Scotia confided its good cheer to its vice-president, who struck a windstorm in Boston and had to send the message on by wire.

Dr. Raymond is best known to most of the mining industry through his twenty-seven years of service as Secretary of the American Institute of Mining Engineers. It is conceded that the peculiar success of A. I. M. E. banquets has been the innovation of having ladies present. And they were there on this occasion in numbers. The members of the Institute who did not have, unless for good and sufficient reason, a wife or sweetheart or sister, was properly a pariah and an outcast. The duties of toast-master devolved upon James Douglas, and a better choice for the presiding officer could not have been made. Dr. Raymond was seated at his right and Mrs. Raymond at his left. In front of the toast-master was placed a model of a mining scene, and at a given signal during the evening this opened in the middle, displaying as a mineral deposit, a magnificent silver tea service, commemorative of the occasion, and a testimonial of the love and reverence of Dr. Raymond's host of friends. A unique feature associated with the service was the pictorial representation on each separate piece of some phase or incident of Dr. Raymond's life. On the tray was engraved a view of the Grand Canyon of the Colorado, which he so fondly loves, and beside the view is engraved his poetic tribute to the Canyon, beginning:

"A thought of God on earth expressed!
The silence of His perfect rest;
The patience of eternal power;
The ceaseless change from hour to hour:
Forms in alternate gloom and flame
That bids yet evermore the same,
And do but wear such fitful guise,
Reflected in our human eyes,
Which compass in their human range,
The things that change, or seem to change."

On one of the pieces was engraved the full rigged ship, *The Great Western*, on which in 1858 Raymond, then but 18 years of age, sailed as third mate; on another is a view of Heidelberg, where he studied in 1859; on another is a picture of Raymond himself in his student's garb of Freiberg, where he pursued his studies in 1860-61; another represents him in the uniform of a United States soldier (1861-64). Other pieces show him as Santa Claus with the children, as the orator, and as a man of society. The interior of Plymouth church, which he has attended since boyhood, is engraved on one of the pieces; and, appropriately, the sugar bowl presents vignettes of Dr. and Mrs. Raymond united by a true lover's knot.

The list of speakers looked rather ominous, but Mr. Douglas in his opening address announced that the five-minute rule was in force, and it was generally observed. The responses to the toasts, while thus made brief, were eloquent tributes to the man as a man, a scientist, a Christian, a man of letters, an engineer, a husband, a father, a friend. In introducing the speakers, Mr. Douglas first referred to the false idea of life as represented by one William Shakespeare in the "seven ages" and cited Dr. Raymond as a contradiction of the "sans teeth" condition of the man of seventy. The first speaker was E. Gybbon Spilsbury, chairman of the general committee, who read the letters of regret from those unable to attend. Among them were greetings from Andrew Carnegie, W. B. Cogswell, D. W. Brunton, W. P. Blake, Sam F. Wellman, S. B. Christy, George Otis Smith, and John Hays Hammond. Appreciative applause followed the reading of the telegram from the San Francisco members, and the engrossed testimonials from the British Iron & Steel Institute, and from the Verein Deutsche Eisen Hütte Leute. R. F. Bayliss crossed the ocean to present to Dr. Raymond the gold medal of the Institution of Mining and Metallurgy, and Sorzano De Tejada, presented the greetings of the Société des Ingénieurs Civils de France. The Canadian Mining Institute was represented by its president, F. D. Adams, who testified to the affection in which Dr. Raymond is held by the members of the Canadian society. They felt, he said, that Dr. Raymond was one of those who proved the theory that virtue became a habit after fifty years of practice. Lyman Abbott, pastor of Plymouth church, Brooklyn, wanted to say what he had to say behind Raymond's back rather than before his face, and the back was quickly turned. His tribute was to the man as a help, and guide, and counsellor, and friend to his pastor. The sister engineering societies, the

Civil, the Mechanical, and the Electrical were represented respectively by John A. Bensel, George Westinghouse, and T. C. Martin. It was Mr. Martin's review of the linking of the electrical with the mining world that showed the debt of the former to the latter for everything but the water in its stock. He spoke of the discovery of the Roentgen rays, the work of Madame Curie in radium, and gasped for breath as he announced that this was a world of rays—a Ray monde. To the hall of fame in mining literature where are placed the names of Mark Twain, Bret Harte, Joaquin Miller, he added that of R. W. Raymond.

W. L. Saunders, chairman of the committee on speeches, had the honor of giving the address to Mrs. Raymond. A portion of his remarks were as follows:

"Lord Burleigh in giving advice to his son, said: 'Use great prudence and circumspection in choosing thy wife, for from thence will spring all thy future good or evil'. Forty-seven years ago was a critical period in the life of our guest: young, able, ambitious, and yet strong in faith and love, he knew that the glory of young men should be their strength, and so towering in the confidence of twenty-three he plucked from the highest boughs this 'flower of wifely patience'.

"The story is told of a man who led in everything. He was the captain of the ball team, the leader in his class, the county chairman, and the deacon in the church. In due course he took to himself a wife, and a friend who knew him well was asked how he was getting along since he married. He always led everyone, and it was said that no woman could ever get ahead of him. 'Oh', said the mutal friend, 'he is still leading, I suppose, but his wife is just behind holding the reins'.

"On behalf of his friends and yours it is my privilege to lay these flowers at your feet.

"Here is a rose for you for every year of wedded life: It lifts its face above the thorns as you have always done—as you do now—

"'Here mark you, where the bolt of Cupid fell:
It fell upon a fragrant little flower,—
Before, milk-white, now crimson with love's wound'."

In responding to the speeches, letters, and telegrams of felicitation, Dr. Raymond seemed at first and for once in his life at a loss for words. Praise, he said, humbled, while it exalted his spirit, and he wanted simply to say "thank you, thank you, thank you," but for fear that his hearers might conclude that some strange mysterious change was wrought by the turning of a seventieth birthday, he must say something. His sense of gratitude was deep, and more than once the words were choked by the pent-up feeling, and tears were in his voice and in the eyes of more than one who sat before him. He said he was not going to allow a little thing like seventy years to retard his work. He was still in the harness, and he did not restrict his day's labor to eight hours. In the course of his remarks he stated that his life had not been entirely what his early ambition had looked forward to. His ambitions had been overruled, but he had lived a happy—happy life, and he felt that all was for the best.

Coal Mine Accidents and Their Prevention

By J. A. Holmes

*If we are going to attempt seriously to reduce the loss of life and the waste of resources in our mining industries, we must carry on investigations and inquiries to determine the causes and to devise preventive measures; we must promptly and adequately inform the miners and active mine officials of the results of such investigations and inquiries; we must revise our laws and regulations in accordance with the best information thus obtained; and we must look to a proper enforcement by the States of such laws and regulations. We must also go to the tap-root of the evil—that is, we must improve the economic conditions on which this great industry is based.

Our coal industry in its phenomenal growth has nearly doubled during each succeeding decade of the past 80 years. It has had to do more than keep pace with our increasing population, for, while it supplied less than one ton of coal per capita to the American people in 1870, it has had to supply nearly six tons per capita during 1907. Its growth has been too rapid for systematic development; and the industry today represents a great host of scattered, warring, discouraged elements, without organization or co-operation. In this industry are now employed some 700,000 miners, who work at some 6000 different mines and produce yearly about 500,000,000 tons of coal. Not only is the nation increasingly dependent upon this coal for its heat and light and for power for its manufacturing industries and transportation facilities, but this coal and other mineral products now contribute more than 65% of the total freight tonnage of the country. The economic conditions upon which coal mining is based in this country are so fundamentally bad, and the evil consequences are so far-reaching as to both time and extent and are so essentially national in character, that this subject demands the earnest consideration of our best statesmen, as well as of our best engineers.

There can be no permanent industry without reasonable profits. It is unjust and irrational that in this great and essential branch of industry reasonable profits or even the payment of operating expenses should be dependent upon methods involving unnecessary sacrifice of human life and unnecessary waste of resources which we can neither replace nor restore and which will be essential to the larger future development of the country. The following observations will serve to make this situation clearer: (1) In spite of this rapid growth in our demand for coal, the normal productive capacity of our coal mines if operated continuously would greatly exceed this demand. (2) Ruinous competition exists not only between the operators in the same field, but between the operators of one field as against those of another field or in another State where different mining laws and regulations are in force. (3) This competition is, first of all, driving out of the business

*Address delivered, with approval of the Director of the U. S. Geological Survey, at the tenth annual meeting of of the National Civic Federation of New York.

the small operators, except where they find protection under local freight rates, and is forcing even the larger operator to mine coal under conditions which he cannot approve but from which he finds no escape. If he and his fellow operators endeavor to 'get together' and place the price of coal at the mine on a reasonable basis they go to jail under either a Federal or a State statute; and, as the only alternative, each must live (or succumb) by underbidding the other, which he can do only through following the wasteful and unsafe mining methods which prevail in this country today in spite of the desire of every operator to improve them. (4) Even when the demand for coal and the prices are at their best, under existing conditions the operator can mine only that part of his coal which can be taken out most cheaply and sold at the higher prices; and the remainder must be left underground in such shape as may preclude its future recovery. And thus we waste yearly approximately 250,000,000 tons of the nation's fuel supply. (5) The American mine owner is as humane as the mine owner of any other country, and he would like to follow every practice and use every appliance for safety to be found in Great Britain, or France, or Belgium, or Germany, or elsewhere, but he pays his miners higher wages and, at the same time, receives for his coal at the mine half the price received for similar coal by the operator in those countries; and he must employ miners an increasingly large percentage of whom come to him unfamiliar with either the practices of the industry or the language and traditions of the country. (6) The penalty which the nation is paying for this bad system is this increasing waste of essential resources and the still more unpardonable increasing waste of human life—the yearly loss of 250,000,000 tons of coal and the killing or injuring yearly of 8000 to 10,000 men.

The fact cannot be too clearly emphasized that it is the nation that pays this penalty; and that its increasing evil results will lessen the nation's future development. The remedies for this bad situation are: (a) Investigations and inquiries, such as are now being conducted by the Government, as to the causes of mine explosions and other similar investigations as to the causes of mine accidents of other kinds and as to the methods of prevention. (b) The dissemination of information among the miners and the active mine officials as to these causes and remedies. (c) The training of men at each mine as to the best methods of using explosives, using electricity, handling gases and dust, and timbering, preventing and extinguishing mine fires, as well as the methods of rescue work and of first aid to the injured. (d) The development of better, more uniform, and enforceable State mining laws, rules, and regulations, based upon accurate data and experience. (e) Active determined co-operation between the miners and the mine management and the State's inspectors in the enforcement of these rules and regulations, with a view to the maintenance of the safest possible conditions in every mine. This means strict and rational discipline in and about every mine among miners and mine officials. (f) State mine inspectors should have better support in the way of compensation and allowance for travel expenses, greater permanence in office, and freedom from political and other outside influences; and wherever possible their efforts should be supplemented by the employment of special private inspectors by each company.

The above are all parts of the program for lessening and alleviating mine accidents, but they do not complete the program. It is an essential part of this program that: (g) The ruinous competitive systems upon which coal mining in the United States is based at the present time should be changed and that the price paid for coal at the mines should be such as will permit and secure safe and efficient mining—mining unaccompanied by either this large loss of life or waste of resources, mining which can have due regard not only to the safety but also to the health and comfort of the men who toil underground and whose labor is so essential to the welfare of the nation. All this can be done without adding appreciably to the burden of the average American citizen, without any increase in the price of coal at the poor man's cottage, and without the risk of any unreasonable restraint of trade. An increase of ten or twenty cents per ton in the price of coal at the mine would greatly increase the possibilities for safety and clean mining and would not necessarily mean any increase in the cost of power to the consumer, who in many cases could save more than that much per ton by adopting more efficient methods in the use of this fuel. Nor is it believed that large consumers of coal would object to this reasonable increase in price, in behalf of safety, clean mining, and reasonable operating profits, if assured that their competitors would have to pay the same and that the price would be reasonably stable. The injustice of the situation is apparent when it is seen that of the $3 or $6 per ton paid for coal at the point of consumption only $1 goes back to the mine to be divided between the miner, the operator, and the land owner, to cover investments in mine equipment and development, all the labor and costs and dangers of mining operations, and the loading of the coal on the cars ready for shipment.

It is for the law-makers to devise a plan that will permit this needed co-operation among the mine operators in behalf of greater safety for the miner, less waste of resources, and reasonable profit on investments, and that will also protect the public against the possible abuse of this privilege. The coal industry needs and deserves fair treatment at the hands of the American people, and upon the receipt of such treatment depends in large measure not only the welfare of the operators—though nobody cares about *them*—but also the welfare of the 700,000 miners who daily risk their lives in supplying the fuel for the nation's industry and commerce and the heat and light for the nation's comfort and convenience, and the welfare of the industry itself as an essential part of our future national development.

The United States Steel Corporation has been within the last few days curtailing operations to such an extent that it is estimated by steel experts in the Pennsylvania district that the reduction in output amounts to 20% among the blast-furnaces.

Mounds Formed by Mineral Crytallization

Written for the Mining and Scientific Press
By Frank L. Hess

Twenty miles west of Randsburg, in the Mohave desert, lies a playa or periodic lake known locally as Salt lake. It covers probably between 20 and 25 square miles and is a type of lake bed found at many places in the southwestern desert where the waters from the surrounding mountains collect in fault valleys which have no outlet. Those that flow into Salt lake are collected from the Rand, Lava, and El Paso mountains, at the south end of the Sierra Nevada, and in this drainage basin are a large variety of rocks. Among these are Tertiary sandstones which were probably laid down in water more saline than that of the ocean, as they contain some gypsum. As the waters of the lake can escape only by evaporation, the salts brought in from the surrounding country gradually accumulate. The most prominent on the surface of the lake bed is common salt and from this the lake has received its name. Besides common salt, there are sodium carbonate, sodium sulphate, cotton-ball or ulexite (one of the borax minerals), and gypsum. The common salt is distributed all over that part of the bed of the lake which is wetted by ordinary stream flow, but it is by no means evenly distributed. The other minerals are found only in certain portions of the lake bed or the immediately adjacent land. The lake bed is so flat that the eye can perceive no slope to it.

Near the shore at the southwestern edge of the lake bed, three miles from Cane Springs, are a number of low mounds from 2 to 4 ft. high and from 20 to 200 ft. in diameter (Fig. 1), whose peculiar, evenly rounded appearance attracted my attention during a visit to the locality on December 16, 1909. The water which sometimes surrounds the mounds is probably never over 4 to 6 inches deep. The outside of the mounds is powdery, soft earth fissured with cracks, part of which are parallel to the circumference of the island while the others criss-cross between these. Upon digging into them it was found that four to six inches below the surface there was a layer of white, comparatively pure, hydrous sodium sulphate (mirabilite) three or four inches thick. Below this was a spongy mass of sodium sulphate crystals mixed with more or less dirt. In several other mounds examined, instead of mirabilite the salt contained was sodium chloride (common salt) crystallized in a peculiar columnar form. The effect of its crystallization has been the same in raising mounds as that of the sodium sulphate.

In crystallization, sodium sulphate takes up more than its own weight of water (126.8%) and the expansion is considerable.[1] Evidently the expansion of the salt in crystallization has raised certain parts of the lake bed until they have reached their present height in these islands. Mixed with the mirabilite is about 3% glauberite (magnesium sulphate) which imparts a taste so bitter as to give the impression that the percentage is much higher.

I have described a somewhat similar mound known as the 'Oil Bubble' in the Lost Hills south of Tulare lake in the San Joaquin valley (Fig. 2). The 'Oil Bubble' which stands on the south side of a draw running through the hills, is between 10 and 15 ft. high and about 65 ft. in diameter, and is composed of small crystals of gypsum, most of them less than one-quarter inch in length, mixed with enough clay to permit the mass to be easily kneaded. This mound also contains a small amount of material resembling greatly oxidized asphalt, stained slightly with native sulphur. At the time it was visited the mound was wet and sticky, and it is said to remain moist throughout the summer. It is reported to give off bubbles of gas, whence the name 'Bubble', the supposed asphalt suggesting the name 'Oil'. It is thought that the mound was formed by the evaporation of water carrying gypsum in solution, the clay probably being brought to the place by winds. The excessive dryness of the surrounding country makes it seem probable that the water comes from a considerable depth, rising through the Tertiary gypsum-bearing sandstones.

Fig. 1. Cane Springs Mound.

Fig. 2. The 'Oil Bubble' in the Lost Hill, South of Tulare Lake.

The most important hydro-electric developments of Canada are at Niagara, where it is estimated 5,000,000 continuous electrical horse-power can be produced. Of this about one-tenth will be utilized when the stations now running are fully equipped. Four stations on the Canadian side can produce about 450,000 electrical horse-power.

*Published by permission of the Director of the United States Geological Survey.

[1]Hess, Frank L., 'A Reconnaissance of the Gypsum Deposits of California': U. S. Geol. Surv., Bull. 413, p. 15.

Evolution of Well-Drilling Machinery

Written for the MINING AND SCIENTIFIC PRESS
By JOHN L. COWAN

With hundreds of 'strings' of tools drilling for oil in California, the beginning of well-drilling supplies an interesting field for research. Pennsylvania erected a monument last year, commemorative of Drake's exploit in drilling the first oil-well, at Oil City, in 1859; but Drake made use of tools and appliances copied from the devices originated long before on the banks of the Kanawha river, in West Virginia.

Well-drilling machinery is so much a matter of course nowadays that it is difficult to realize that if men wanted to make a hole in the ground a century ago they were compelled to dig it. That was laborious, tedious, and costly; and early settlers in the Eastern States made it an invariable rule to build their cabins close by a spring, that they might escape the toil of digging a well for water. The first well ever drilled was not put down to obtain water, nor in search of oil or gas, but in order to obtain a more bountiful supply of salt water than seeped out upon the surface. The 'salt licks' of the Kanawha valley were worked from the time of the first white settlements west of the Alleghanies, and had been used by the Indians for unguessed centuries before. Herds of buffalo, elk, deer, and other wild animals frequented them for the purpose of licking the salt-impregnated earth. To this fact they owed their name, just as this circumstance led to their discovery. The most famous of all the salt licks of the valley was the 'Great Buffalo' lick, about three miles above the present site of Charleston, near the mouth of Campbell's creek. In 1794, Joseph Ruffner, an enterprising farmer from the Shanandoah valley of Virginia, purchased the land upon which the Buffalo lick was situated, and two years later he leased it to Elisha Brooks. Early in 1797 Brooks began the manufacture of salt from the brine that oozed up through the mud and slime—this being the first manufacturing industry ever established on the west slope of the Alleghany mountains. His 'factory' consisted of 24 iron kettles placed in a double row, with wood fires underneath. The kettles were filled with brine, from which the water was evaporated by boiling. When all the moisture had been evaporated the salt was ready for market. Of course the brine that found its way through the mud was dirty, and the product showed many discolorations and impurities, and it was not long until American inventive genius found room for the introduction of improvements.

The first improvement was to sink huge hollow sycamore logs into the earth. As the brine bubbled up through the logs, it was dipped out in buckets and transferred to the kettles. The brine secured in this manner was comparatively free from sand and dirt, and the salt secured by evaporating this showed great improvement in appearance and quality. The sycamore logs, called 'gums' by the pioneers, were from 8 to 12 ft. long, and 3 to 4 ft. in diameter. They were maintained in an upright position in the soft earth by props and ropes, and were reached by planks laid from the solid ground across the mire. In this rough and ready fashion, Brooks managed to secure about 150 lb. of salt daily, which sold readily at his factory at 10c. per lb. As the only other sources of supply were on the seaboard, involving a long and dangerous trip across the mountains to 'tote' it to 'the West', he experienced no difficulty in disposing of all he could make, his market extending to every settlement west of the Alleghanies from northern Pennsylvania to Tennessee.

In 1803, the elder Ruffner died, leaving his property to his two sons, David and Joseph. At about the same time the term of Brooks' lease expired, and the Ruffner boys refused to renew it. They then began the manufacture of salt on their own account, reaping the benefit of the extensive business built up by the former operator. For a time they contented themselves with following the methods used by Brooks; but they were young, energetic, and ambitious, and desirous of improvement. They reasoned that if they could get below the soft mud and sand through which the brine forced its way, to the true source of the supply, they would be able to obtain it in larger quantities, and that it would be pure and entirely free from dirt. In 1806 they began their labors, and after much difficulty succeeded in getting their 'gum' down to bedrock at a depth of 18 ft., and in cleaning out the slime and sand from the hollow log. As they expected, pure, clean, strong brine slowly welled up through the porous sandstone into the 'gum'. How to penetrate the sandstone, and thus permit the salt water to have free and unimpeded flow, was the next problem that presented itself for their solution. They had observed quarrymen drilling holes two or three feet deep to hold their powder for blasting, and concluded that an adaptation of the same principles would enable them to accomplish the desired result. They, therefore, made a long iron drill, with a 2½-in. chisel bit of steel at the point, and attached the upper end to a spring pole. The motive power was supplied by their own brawny arms. In this tedious and laborious manner the first well ever drilled in solid rock was begun and carried to a successful conclusion. By November 7, 1807, they were 17 ft. in solid rock, when they struck a fissure from which issued a stronger flow of salt water than they had previously obtained. When 11 ft. deeper, another 'pay' was tapped, and in January, 1808, when 40 ft. in the rock, and 58 ft. from the surface, they were rewarded by an ample flow of strong pure brine, and the work of drilling was completed.

The first well through solid rock had been successfully drilled, but now an unforeseen difficulty presented itself. In ascending through 40 ft. of porous and fissured sandstone, the strong brine was more or less diluted by fresh water from nearer the surface, and a certain amount of sand was carried up from the friable rock that constituted the sides of the well, impairing the purity of the salt. In those days steel or iron pipes were unobtainable. Even sheet iron could not be secured, and if it had been there was no one west of the mountains who could bend it and weld it into tubular form. Once more

the Ruffners were obliged to rely upon their own ingenuity. With no tools save axes they cut and whittled two long strips of wood into half tubes. Then carefully fitting the edges together they wrapped the whole from end to end with twine, and their long wooden pipe was complete. The 'packing' was made by wrapping twine and old cloths around the pipe to make it as nearly watertight as possible thus preventing fresh water and sediment and adulterating their supply of brine. In this slow and laborious manner was drilled, cased, tubed and packed the first well, the work involving the nucleus of nearly every idea later developed into the expensive and efficient machinery first used on a large scale in the oilfields of Pennsylvania, but now employed throughout the world and used in bringing in the gushers that are directing the eyes of all oil operators to California. Although the Ruffners did not know what petroleum was, they were the real pioneers of the vast industry that depends absolutely upon well-drilling apparatus and machinery.

Early in February 1808, the Ruffner brothers made their first lifting of salt from their new well, and at the same time reduced the price to the unprecedentedly low figure of 4c. per lb. Success begets imitation, and it was not long until the Kanawha valley was filled with salt works, modeled after that of the Ruffners, and supplied with brine secured from wells drilled in the same manner. By 1817, thirty such establishments were in operation, with an aggregate annual production of nearly 700,000 bushels of salt. With these extensive operations came further improvement in the methods used for drilling and operating the wells. The first was devised by a tinner, who deserves to have a monument erected to his memory; but unfortunately his name cannot now be learned. He went to Charleston expecting to do a thriving business making tin drinking cups, pans, and other household utensils. Seeing the great expenditure of time and labor necessary for the construction of the wooden tubes used in the salt wells, he proceeded to fill a long felt want by supplying tin tubes in convenient lengths, and soldering them together as they were lowered into the well.

However, the usefulness of a tin tube was short. The strong brine rusted it quickly, making it necessary to replace it with a new tube in a short time. This may have been all right from the tinner's point of view, but it speedily led to the adoption of copper. The next notable improvement was the introduction of 'seed bags' for packing, instead of the old rags and twine used by the Ruffner's and their imitators. A buckskin bag, open at both ends, was drawn over the lower end of the tube like a sleeve. It was then partly filled with flaxseed, in the space between the bag and the tube. Both ends were securely wrapped and tied, and the tube lowered into the well. The water soon caused the seed to swell, making an absolutely watertight packing at the bottom of the well, preventing the escape of salt water on the outside of the tubing, or the entry of fresh water or impurities from outside into the tubing. The seed bag is still sometimes used for packing oil-wells in some parts of the country, but india rubber is preferred on account of its better lasting properties. For some years the salt water was lifted from the wells by hand in buckets until some unknown genius rigged up a more complicated apparatus consisting of a pump lever, crank and shaft, operated by a blind horse or mule traveling in a circle. It was essential that the animal be blind. Otherwise he would become dizzy from traveling around and around in an orbit so circumscribed. This was considered a really wonderful stride forward, and held the field until in 1828, when the steam engine was introduced, displacing bone and muscle in drilling wells as well as in pumping salt water. At about the same time the derrick and the walking beam came into general use in the Kanawha valley.

In 1832, 'Billy' Morris, an unlettered Kanawha driller, invented the slips or 'jars'. This is a long double link, with jaws that fit closely, but slide easily up and down. They are made of the best of steel, are 24 to 30 in. long, or even more, and fitted with a pin and socket joint. They are placed above the heavy 'augur stem' and its cutting chisel 'bit' for the double purpose of relieving the long augur stem from a part of the shock from striking the solid rock, and of delivering a quick cutting stroke. When, as frequently happens, the tools become fastened in the bottom of the well, the 'jars' enable the driller to loosen them by a quick upward or downward jar — hence the name. Deep wells in soft formations of clay or shale may be, and usually are, drilled without the use of the jars, but such operations in hard rock would be impossible. As a public benefactor, therefore, 'Billy' Morris deserves to rank with Whitney, Howe, Watt, Stephenson, and McCormick. He never patented his invention, and, of course, died poor. No monument marks his grave, but he is more deserving of renown than many whose deeds live in bronze and marble.

It will, therefore, be seen that long before Edward Drake drilled the pioneer oil-well on the banks of Oil creek, in Pennsylvania, practically every important tool and appliance necessary to sink a gusher in California today had been forshadowed in the Kanawha valley, in what is now the State of West Virginia; and wells had been drilled, in some cases several hundred feet deep, through solid rock strata. Soon after the day of the Ruffners, many of these wells drilled for salt were 'ruined' by oil or gas or both, contaminating the brine and rendering the salt unfit for use. Not until long after the early Pennsylvania oil-wells had made the first thrilling chapter of the oil industry, did West Virginians remember the traditions concerning oil and gas in the salt wells of the Kanawha valley, and set to work for the development of what proved to be one of the great oil regions of the East.

As part of the improvements that will take place in connection with the Broken Hill city's fire service during the year, it is proposed to install a complete electrical fire-alarm system throughout the city. This has been badly needed for some years past, and will, when brought about, greatly facilitate matters in connection with the turning out on the occasion of a fire.—*Australian Mining Standard.*

Glimpses Underground

Written for the Mining and Scientific Press
By T. A. Rickard

The accompanying eight sketches give glimpses of the Cornishman at work underground in the tin mines of the 'old county'. These sketches were

Fig. 1.

made by George Seymour, the first president of the Institution of Mining and Metallurgy, who died in 1896, and are based on his earlier recollections of

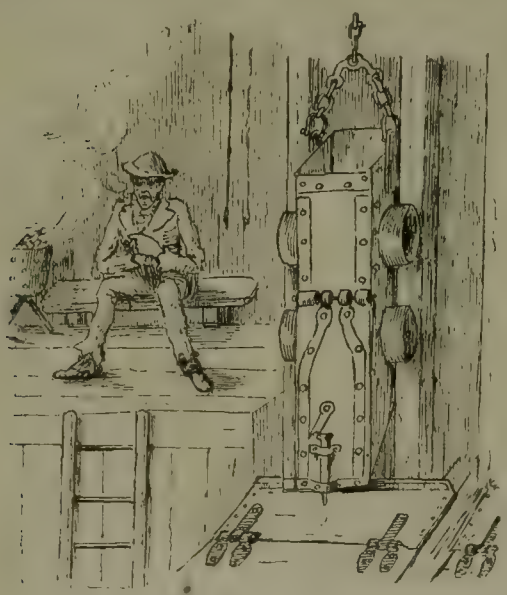


Fig. 3.

Cornish mining, so that they represent an era now past and methods now largely discarded. This must be said lest our Cousin Jack friends should consider these pictures a little libellous in their humorous exaggeration. To Messrs. Bainbridge, Seymour & Co. we owe permission to publish the sketches.

The first shows an important incident of work underground, namely, an interval of rest. These four miners, in two pairs, are breaking their descent on the ladder by having a yarn or 'touch pipe' on their way down. Three of them are on the 'sollar' or platform, while the fourth is on the ladder but resting his elbows on the boards. The drills or 'borers' have been laid asid. The costume of the men includes

Fig. 2.

a linen 'hat-cap' fitting tightly over the head, which is then protected by the hard hat made of resin, to which the candle is attached by a lump of clay. Their

Fig. 4.

clothing is woolen all through. In the sketch the foot-way or ladder compartment of the shaft is shown, contiguous to the rods and pipes of the pumping machinery. A shaft would consist of three compartments, namely, the man-way, the haulage-way for two skips working in balance, and a capstan compartment for moving the heavy portions of the

pumping machinery. The only criticism admissible relates to the ladder, the wrungs of which are too far apart, they appear to be at intervals of 15 inches. 10 inches is admitted to be the best. Moreover, the ladder stands too nearly upright and the shaft is not fenced as now required by the regulations.

In the next sketch Fig. 21 we see the pit men examining the pumping machinery or 'pit-work'. The big pipe is the 'pump-column' through which the water is forced to surface, while the smaller vertical shaft is the pump-rod, which communicates the stroke of the engine to the pole of the plunger. One of the men appears to have something round his neck, and it may be the tressed hemp for packing the stuffing-box of the pump.

Fig. 5.

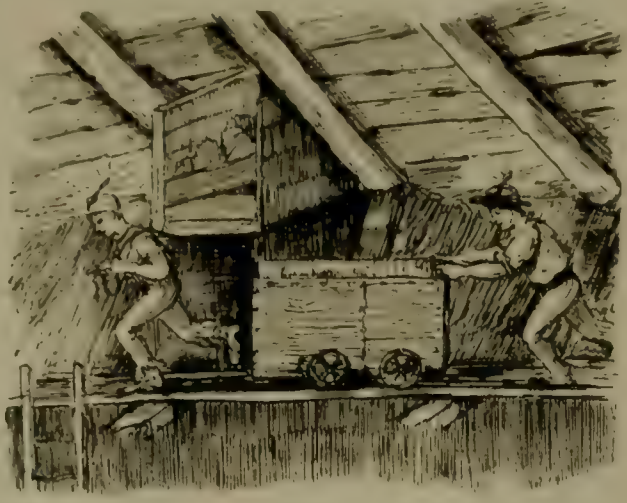


Fig. 6.

Fig. 7.

The 'lander' at surface is represented (Fig. 3) in that attitude of repose attributed everywhere to the man who attends to the tipping and starting of the skip. He is having a 'touch pipe', things are going meely, and he is rewarding himself with a little comfort. An old kibble or 'devil' is being used to hold the 'cherks' or embers needed to keep him warm. The skip itself is not as large as those at Kimberley, but 't will do, 't will serve. As it comes up the man lifts the door or 'lip', and then drops it again into place; next the skip is lowered and the lander releases the pin at the bottom, permitting the ore to be discharged. Then he rings the bell, the skip is raised, the door is drawn back, the skip is lowered into the mine. The method is rational but antiquated.

Fig. 8.

The predicament of the man on the chain-ladder is obvious; he is ascending from the bottom of a shaft where he has just lit the fuse that will start a blast (Fig. 4). The chain is used because the blast will destroy a wooden ladder. Most engineers have had experiences that will arouse their sympathy for the miner in the sketch. He is a gymnast perforce and will develop the muscles used in rowing. The

chain-ladder is replaced by windlass as soon as the shaft has been deepened. Then he will descend by placing one foot in the bucket while the other is used to stay the gyrations due to the twisting and untwisting of the rope.

In the next sketch (Fig. 5) an even worse predicament is illustrated, for our friend has lost first his candle and then his hat; and he seems to be in a hurry, so we presume that a blast is imminent, or possibly, a 'crush' or 'cave' has started in the winze, for the timbers look unsteady. The artist called his sketch "A scrambly old place."

"Running back from the shaft" is the title of the next (Fig. 6). This shows a 'pass' or chute, by which the ore descends from the stopes. Of the two men, one is pushing, while the other is pulling the truck, which is empty. They are going up-hill. Of course, the underground road-ways are now better kept, but it may be said that in most mines—in Cornwall, as well as elsewhere—the importance of attention to this detail is not sufficiently appreciated.

The seventh sketch represents the men "going to grass," that is, to daylight and to home. Here also the ladder is not quite correctly represented as regards the intervals between wrungs. The first man is carrying a keg, for drinking water, and his 'sling of borers', or set of drills, attached by a chain, which is shown more clearly in the case of the man farthest from the ladder. The miner at the face of the ladder is fingering his clay and adjusting the candle.

Finally (Fig. 8) we have a comical representation of "the sensations of a miner" who has been too familiar with his dynamite. His state is indeed parlous; his cap, water-keg, pick, shovel, and ladder are all in flight, while he himself has received the drill in a vital region. He will never be so careless again.

NEW MINING BUILDING

The mining engineering building at the University of Wisconsin, formerly the heating plant, is nearing completion. Much of the equipment has already arrived. A concrete floor divides the interior into a basement and an upper story, with a gallery and an open mill space at the south end, and the metallurgical furnace in the extension. The basement portion is to contain the crushing and screening room, the ore-bins, supply room, dark-room, and ash-wells. The upper floor is divided into a large assay furnace room, a chemical laboratory, a balance room, two offices, and the gallery on which will be installed the hand ore-dressing equipment and the mining museum. Each student is to have a separate desk which is to be supplied with both air and gas-pipes, and a separate pulp balance for each, while every three students will have precise gold balances, mounted on solid concrete tables. Sinks and fuming hoods, and a lavatory with a shower bath and lockers, are also to be provided for their use. All dust producing operations, so far as is possible, will be confined to the crushing room, where an exhaust ventilating system will keep the air free of the flying particles from the ores. The new plant will be available for next year's work.

MINERAL RELATIONS FROM THE LABORATORY VIEWPOINT

By Arthur L. Day

*The fundamental problems of rock formation, to which petrologists are now giving serious attention, require much more than a perfunctory application of chemistry and physics. The present relations of the minerals in the rocks are accessible to the microscope under convenient conditions of observation, but their development from the fluid magma requires a laboratory study of the rock-forming minerals over a wide range of measured conditions of pressure, temperature, and concentration.

Recent laboratory studies have developed the fact that the temperature of crystallization of a mineral from its own liquid or from a mixture is generally variable and therefore untrustworthy in revealing the conditions of equilibrium during formation. Melting point measurements therefore furnish better determinations of the temperature of change of state. It is also necessary that the methods chosen for such determination be appropriate to the substance under investigation, for minerals are characterized by strong individuality of behavior near the melting temperature, which makes it impossible to apply a single property (the appearance of fluidity, for example) to determine when melting occurs in all substances. The lack of sharpness in melting point determinations is partly the result of carelessness in preparation of experimental conditions, partly of molecular inertia or viscosity which prevents any rapid rearrangement of the molecules of the liquid, and occasionally (in isomorphous mixtures) is due to changing composition during the change of state. The first of these can be eliminated; the second is characteristic of certain minerals and therefore a matter of record; the third is an essential feature of the problem requiring special study. The earlier melting point data offer little evidence upon which to discriminate between these cases. An important factor in rock formation is brought to light by the second of the properties noted above, of which an excellent illustration is found in quartz. In the laboratory, the fusion of pure silica does not occur below 1600° and is accompanied by conditions of extreme viscosity. In nature, vein-quartz appears to have crystallized below 800° and to have been very fluid at that temperature. This suggests that volatile ingredients must have assisted in the formation of natural quartz of which only traces now remain, and its proper laboratory study must include these ingredients. The situation also reveals what is perhaps the chief function of pressure in rock formation, namely, in holding the volatile ingredients in solution.

Bounties to the amount of $40,908 were paid by the Canadian Government from October 1, 1908, to February 18, 1909, inclusive, to the Dominion Steel & Coal Co. and the Nova Scotia Steel & Coal Co. in the form of bonuses on coal used in the manufacture of iron and steel in the province.

*Read before the Geological Society of Washington and abstracted in *Science*.

The Los Angeles Aqueduct Tunnel Work

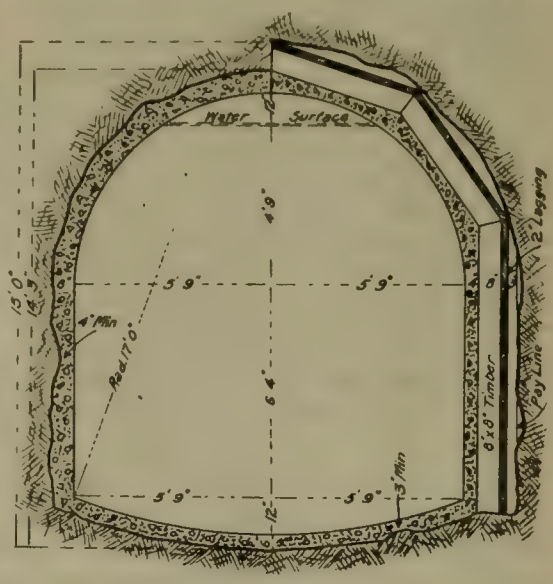
The city of Los Angeles is constructing an aqueduct to bring water from Owens valley to the head of San Fernando valley, whence it will be distributed for domestic purposes and irrigation. The line as finally located includes

	Miles
Cutlined canal	21.08
Lined canal	152.25
Tunnels in rock	17.24
Tunnels in earth	11.08
Siphons	14.19
Flumes	1.72
Total	217.56

The large amount of tunnel work is of especial interest to mining engineers. Experience which the aqueduct engineers obtained in this work was so favorable from the first that repeated changes in plan have been made increasing the amount of tunnel, decreasing open-cut work, and shortening the length of line. A description of record driving at one of the tunnels has been given by Burt A. Heinly.* Some further consideration of costs and methods may be of interest.

The cross-sections of the various tunnels differ slightly. One, typical of the work on the Saugus division, is shown in the accompanying figure. For this cross-section the excavation amounts to 6.7 cu. yd. per lineal foot where the ground must be timbered, and 5.93 where no timbering is necessary. The concrete used in lining is 1.314 and 1.029 cu. yd. for timbered and untimbered respectively. The capacity of this tunnel is 1000 sec. ft. at a velocity of 7.81 ft. per sec. This section is used, among other places at Tunnel 73. At the long Newhall tunnel, No. 104, a similar but smaller section is driven. For this the excavation is 5 cu. yd. timbered, and 4.12 untimbered; concrete 1.11 and 0.80 cu. yd.; capacity 420 sec. ft., and velocity 4.91. At Tunnel 82 a slightly different section of the same capacity is used.

In the main the tunnels are driven in soft rock, sandstone and cemented gravel being most common. On the Saugus division, the one nearest the city, the ground stands well whether wet or dry. The favorable character of the ground has been an important factor in reducing the costs. While there have been many difficulties, including gas and the inflow of oil, there has been relatively little of the ground which was faulted and moving as in mines and not a great deal of hard igneous rock such as is abundant in mining districts. Much of the work has been done by hand. Frequently the holes could be drilled with augurs and after blasting up to the spring line, the rest was picked down. Some excellent records both as to cost and speed have been made on the Saugus division of which D. L. Raeburn is engineer. At Tunnel 82, with J. T. Nolan in immediate charge, a typical month's record showed: North portal, 399 ft. progress, 399 ft. timbered, unit cost $8.58 per ft. for excavation, $1.42 for concreting; at the south portal the corresponding figures were 434, 424, $7.72, $1.16. For the total work the average cost of the tunnel undined, was $9.43. The ground here is a compact sand and clay. Three miners work at the breast boring with hand augurs and getting in two rounds per shift of 8 hours, the holes being 3 ft. deep and a round consisting of 6 to 9 holes. Two other miners trim down the sides and pick down the top working on a false staging. Five men shovel, tram, and timber, and there is a foreman for each crew. The eleven men constitute a unit. Miners are paid $3 when working in dry ground and $3.50 when it is wet. The shovelers and trammers get $2.50 and $3. A minimum of 4 ft. is required where the ground does not need timbering and of 3½ where it must be supported. A bonus of 25c. per foot is paid for all above this, the money being divided among the men working in the drift. In practice it amounts to additional compensation to the amount of 75c. to $1 per day per man, but the system greatly increases the speed of the work and decreases the cost. Much the same organization is maintained at other points though where the ground is harder hand-drills are necessary. In the Newhall tunnel, driven in wet cemented gravel, four men work at the breast with hand-drills. At this tunnel one month's progress was as follows: North portal, 176 ft., unit cost $29.36, timber $5.92; south portal, 301 ft., $14.44, timber $6.35. The total progress at that date had amounted to 5572 ft., at a unit cost of $17.65 for excavation and $5.30 for timbering. Concrete lining had been put in 1017 ft. of sides and arch at a unit cost of $5.66 per ft., and in 1075 ft. of bottom at a further cost of $1.91. Tunnel 73, C. B. Worthen, constructing engineer, was driven by hand-drilling through wet shale at the north, and schist at the south. A typical month's work here was: North portal, 168 ft., $18.94; south portal, 126 ft., $26.29. For a total distance of 3271 ft., the unit cost was $26.35. The unit cost of the tunnel complete except for bottom lining was $43.43 per foot.



Cross-Section of Tunnel.

*'A World's Record in Tunnel Driving', MINING AND SCIENTIFIC PRESS, October 30, 1909.

In comparing these figures the cross-section as well as the character of the ground should be taken into account and it is also proper to state that these are not picked out as representing the best records either as to cost or speed. With these reservations in mind, the following miscellaneous data regarding cost per foot in a number of the tunnels on the aqueduct may be read with interest.

COST OF TUNNELS DRIVEN WITH MACHINE-DRILLS.

Tunnel.	Distance Feet.	Average Cost.	Ground.
12 North	848	$19.34	Hard granite.
12 South	824	21.63	" "
13 North	...	22.93	" "
14 South	...	28.12	" "
15 South	...	22.73	" "
16 North	...	21.66	" "
16 South	...	16.98	" "
17	...	18.31	" "
3 South	774	12.92	Gas in rock.
3 South	1124	14.09	
7 North	1347	14.68	
1 B	1251	9.37	Granite.
3	1014	12.60	"
2	1021	10.57	Wet and blocky.

The above are average costs for tunnels complete, timbered, and ready for lining. The unit figures in each case differ a little from those given but fall within the range indicated. The powder consumption ranges from 4.30 to 39.09 lb. per lineal foot of advance. At the Elizabeth tunnel, November, 1909, using powder of 40 to 60% strength, 17.50 lb. per lineal foot of advance was used at the north portal and 38.09 at the south. This tunnel is driven in hard rock with machine-drills. In the same month at Tunnel 73, 5.80 lb. was used at the north portal and 8.20 at the south. The excavation here is in a soft sandstone and the holes are drilled by hand.

One of the most interesting phases of the work is that of lining the tunnels with concrete. The mixture is 1 to 7, natural gravel and sand being used with portland cement. The latter is in part manufactured at a plant built and operated by the Aqueduct Bureau, and in part purchased on bids in lots of 2000 bbl. or more. The cement costs approximately $1.15 per bbl. when so bought, or $1.45 delivered on the work. It is mixed outside the tunnels in Ransome or similar machines and carried to the work in tunnel cars. The process of lining involves (a) setting the forms; (b) dry-packing where the section has been over-broken; (c) placing the mixture for walls and arch; (d) tearing down the forms; (e) smoothing and plastering the surface; (f) lining the bottom. The forms consist of a series of wooden pannels placed horizontally and fitting against steel ribs. The latter are in two pieces joined by a removable key at the crown of the arch and each extending down to a mud sill at the side. To prevent crowding in, the base of the rib and the sill are braced by sprags against the ends of the cross-ties under the tunnel track. The ribs are made of light T-steel, shaped to conform to the finished cross-section, and are easily placed and removed. Dry-packing with boulders and broken rock is necessary in order to economize the concrete. It is impossible to break a tunnel so as to conform absolutely to a cross-section and leave exactly the calculated space for timbers and concrete lining. One of the difficulties of the work was to train miners not to overbreak the section. In dry-packing the boulders are placed by hand as the pannels in the forms are shipped into place so as to leave as nearly as possible a uniform space for concrete. The minimum thickness of the latter allowed is 4 inches.

In lining the sides the concrete is shoveled from the car directly into place as the panels and dry-packing proceed. To cover the arch it is necessary to have a movable stage. This is known as a 'jumbo' and is a long platform stretching from side to side and supported by legs which straddle the regular track and run on extra temporary rails laid near the foot of the wall. As the work progresses the whole structure moves forward. At the front is a hinged inclined track that can be lowered by means of a motor on the jumbo, and up which the cars loaded with concrete, rock, and panels, may be pulled by an electric hoist. The platform is long enough to permit a full gang of men to work.

After about 36 hours the forms are torn down and the rough places trimmed with small hammers. The surface is then coated, where it is necessary, with a thin wash of cement which is practically a plaster. Later the regular track is torn up and the bottom lined, the work resembling sidewalk laying. Concrete workers are paid $2 to $2.50 according to the character of the work. Foremen get as much as $4 per day. The work here, as in all other departments, is on an 8-hour basis. Under these conditions the concrete costs $5.28 to $8.07 per cu. yd. in place, the amount varying with local conditions and depending somewhat on the relative amounts of arch and bottom work included in each piece of work. The cost for labor and mixing covering complete lining of 853 ft. of Tunnel 20, amounted to: bottom, $2.39; sides, $1.87; arch, $2.85. The total costs on this particular piece of work were:

	Per Foot of Tunnel.	Per Cubic Yard.
Lining bottom	$0.88	$6.72
Lining sides	1.81	6.20
Lining arch	2.79	8.07
Plastering walls	0.31	0.17*

*Per square foot of surface.

The cost for bottom was a little low here, other figures being $1.16, $1.33, $1.91 per foot of advance. Total costs per foot of advance at other places ran, $4.33, $4.54, $5.21, $7.89. These figures are of considerable interest in view of the requirements regarding fire-proofing stations and main entries in coal mines in some of the States, and the desirability of concrete linings for shafts and entries under many other conditions.

Raising is sometimes employed to extend a single shaft driven in the foot-wall in the soft iron ore-fields of northern Michigan. At a convenient point on the bottom level, a winze is sunk in the ore to proposed depth, and from its foot a drift is run to a point below the centre of the shaft. Raising is then started, a chute built, and the dirt handled through the winze, where it is either stored or hoisted from the old bottom level. Ventilation is provided by a small blower.

New Analytical Methods

Written for the Mining and Scientific Press
By F. H. Mason

The analyst is always on the lookout for new methods that will facilitate his work without impairing its accuracy, and he will particularly welcome a quick, accurate, volumetric method for determining sulphates, that has a clear, sharply defined end-point. Such a method A. D. Mitchel and Clarence Smith claim to have discovered,[1] and, judging by the results given of analyses of sulphates of ammonium, sodium, zinc, magnesium, copper, and potassium, they have a good warrant for their claim.

Their method, like most modes of determining sulphates, is based on the precipitation of the sulphate by barium chloride. They, however, use a slight excess of the reagent, and determine the excess indirectly by a slight excess of ammonium dichromate, the excess of which, in its turn, is determined by its oxidizing action on a solution of ferrous-ammonium sulphate. The reagents required are a n/5 solution of barium chloride, an n/10 solution of ammonium dichromate, an n/20 solution of ferrous-ammonium sulphate, and a freshly prepared dilute solution of potassium ferricyanide, the last for the purpose of an indicator. The indicator is used externally on a white, glazed, porcelain tile in an exactly similar way as in the determination of iron by the dichromate method, and the first appearance of a green tinge is taken as the end-point. In making the calculations, it must be born in mind that, while the ammonium dichromate solution is n/10 as an oxidizing agent, it is n/30 as a precipitating agent.

The analysis is conducted by dissolving the substance containing the sulphate in water, hydrochloric acid, or, if necessary, nitric acid, and precipitating the sulphate by running in, from a burette, a slight excess of the barium chloride solution. The mixture is brought to a brisk boil, neutralized with ammonium hydrate, sodium acetate and acetic acid are added, then slightly more than enough of the dichromate solution to precipitate the excess of barium is run in from a burette, and the mixture is made up to 100 c.c. and allowed to settle. When the solution has settled, 25 c.c. of the supernatant liquid are withdrawn with a pipette and titrated with the ferrous-ammonium sulphate solution, using potassium ferricyanide as an external indicator. Since most chromates are soluble in acetic acid, the method is of wide application. Some, however, such as copper, give a coloration with potassium ferricyanide, which obscures the end-point, but, it is claimed, with practice, a well defined end-point may be found at which the green affects the predominating color. Exclusive of weighings, it is said that five determinations can be made in an hour. In cases where only small amounts of sulphates have to be determined, weaker solutions may be used.

A new method for the detection of caesium, rubidium, and sodium is proposed by Walter C. Ball.[2] Though, at the present stage of his work, Ball only offers the method as a qualitative one, in the case of sodium it has been found of quantitative value. For the detection of caesium and rubidium, Mr. Ball uses bismuth-sodium nitrite prepared by dissolving 50 gm. of pure sodium nitrite in 100 c.c. of water, neutralizing with nitric acid, if necessary, and adding 10 to 20 gm. of bismuth nitrite. The solution is filtered from any residue and must be kept in a well stoppered bottle, as air renders it turbid. As the reagent hydrolyzes by the addition of much water, forming an insoluble oxinitrite, it is necessary to add the solution to be tested to a large excess of the reagent.

This reagent is used as follows: (1) Detection of rubidium: On the addition of 1 c.c. of a 2% solution of rubidium nitrate to 5 c.c. of the reagent acidified with a few drops of dilute nitric acid a bright yellow crystalline precipitate forms immediately. With a 0.5% solution of rubidium nitrate a precipitate occurs in a few minutes, while with a 0.25% solution a slight, easily distinguishable precipitation occurs on standing. (2) Detection of caesium: With caesium the reagent gives a similar precipitate only lighter in color; the reaction, too, is more sensitive, one-fifth of a milligram of caesium in 1 c.c. of solution may easily be detected. Though the reagent does not serve to distinguish caesium from rubidium, in the absence of the heavy metals which interfere and must, therefore, be removed before testing, it serves to distinguish them from potassium, lithium ammonium, thallium, and so forth, which are not precipitated by the reagent. (3) Detection and estimation of sodium: For the detection of sodium a reagent is prepared by dissolving 50 gm. of potassium nitrite, as free as possible from sodium, in 100 c.c. of water, neutralizing with nitric acid, and adding 10 gm. of bismuth nitrite; to the liquid, after filtration, a solution of 10% caesium nitrite is added until the bright yellow precipitate, invariably produced, owing to the contamination of potassium nitrite with sodium, ceases to be formed. The mixture is allowed to stand for several hours and is then filtered, after which more caesium nitrite solution is added until the liquid contains about 2.5 gm. of caesium nitrite. The reagent must be kept as free as possible from air, and if turbid, must be filtered. One per cent solutions of sodium nitrate or sulphate give with the reagent an immediate yellow crystalline precipitate, while 0.5 c.c. of a 0.01% solution of sodium, as nitrate, gives with 2 c.c. of the reagent a precipitate within 12 hours. Thus, it will be seen, 0.00005 gm. of sodium can be detected. Most of the heavy metals interfere and must be removed before testing, but zinc, cadmium, magnesium, barium, calcium, strontium, lithium, thalium, and potassium do not interfere.

In order to make the reaction of quantitative value, it is necessary to know the composition of the precipitate. Results from a number of analyses show the probable composition to be $5Bi(NO_2)_2$, $9CsNO_2$, $6NaNO_2$, which contains 3.675% of sodium. The results of experiments given lend hope that ultimately the reagent may come into use for the purpose of quantitative analyses.

[1] Trans. Chem. Soc., 1909, 95-6, 2198.
[2] Trans. Chem. Soc., 1909, 95-6, 2126.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Camping with the Geologists

The Editor:

Sir—The practical mining man is beginning to realize the value of the work of the United States Geological Survey. The 'rock hunters', as the prospectors formerly called them, are the real sort. They are not in the forests, or out in the great wilds merely to 'kill time' and draw pay from a generous government. It is their work to investigate not only the manner in which the evolution of the earth's great surface features has been effected, but, to discover the hidden mineral resources of the country, and present the results of their investigations to mining men in practical form.

On the Winter Trail.

Camping in California

And they do work—these men of the trail, for they are, after all, half-brothers to the veterans of the pick and pan. I was with a party of the geologists for a few days, and for genuine absorption, faithfulness to the task in hand, perseverance, and earnestness, these 'rock hunters' have the most gold-fevered pocket-hunter badly beaten. At 5:30 they are up from beds made of pine boughs, ferns, sand, or hard earth. The early morning air is nearly always crisp, cool, and keen; very keen, in fact, if it be late fall with a heavy hoarfrost whitening the earth, or midwinter with two feet of snow on the ground. At 6 o'clock the cook's call sounds from the mess-tent, and the men file in and are seated around the temporarily constructed table. The morning repast is no dainty nibble of cookies, cocoa, and toast; it is a hearty breakfast of steaming coffee, wild game, and hot biscuit. At 6:30 the chief of the party gives his orders for the day, stating in detail just what each is to do and where the next camp will be. By 7 all are hard at work. In most sections of the West, where the principal work of the Survey is carried on, there is little difficulty in finding good camping grounds. Everywhere out in the wilds is the cool delightful twilight of the forest, the tang of the fir and cedar, and the sound of babbling snow-melted streams.

When camp is made, space is cleared for the sleeping tents, a wider space for the mess-tent, and a trail opened to the nearest stream or spring. The party is supplied with several pack ponies and saddle horses, to move the outfit from place to place. There are also two extra ponies for the camp cook or the roustabout to use in bringing in supplies. The trails built by the rangers and patrolmen of the Forest Service are proving of great assistance to the men of the Geological Survey, as the latter are now able more easily to penetrate the isolated sections of the far west. Camps of Government surveyors and foresters can now be found near together, and the outdoor life of the two differs but little.

Much of the work of the Geological Survey is the making of the contoured topographic maps, that are now so widely used by mining engineers, prospectors, and locators. These maps are made in the rougher mountain regions and thinly populated areas, on a scale of 1:125,000, or two miles to the inch; in the more valuable and thickly populated areas, they are made on a scale of 1:62,500, or one mile to the inch. Special maps for detailed representation of areas of unusual mining interest are occasionally made on still larger scales. The standard atlas sheet is 20 by 16 inches in size. Sheets made on the two-mile scale embrace an area of between 900 and 1000 square miles, while those on the one-mile scale embrace only 225 square miles.

The Geological Survey intends to be practical; in truth, the results of its labors are intensely practical. The geological map in its final form is a representation of the topography and geology of the area included. The real geological map represents all that

the geologist preparing it knows of the distribution of the rocks occurring within its limits so far as the scale upon which it is made will allow. Taken in connection with the topographic base, it presents the distribution of the various rocks in the best form for the use of men interested in the mineral formations and resources of the region. To make something even more practical, and to meet the demand of mining men, a second map is prepared, upon which the rocks carrying minerals of economic value are indicated by distinct colors. These maps refer only to the areal distribution of rocks. What is known of the underground geology is graphically illustrated on a structure-section sheet and a sheet of columnar sections. With the four sheets before him, the mining engineer has at hand, in graphic form, a summary of all that the closely observing geologists who prepared it can tell him of the area.

To get the data for these maps, and get them correctly and completely, is as stated, the main work of the men of the Geological Survey. They must endure hardships, and content themselves with the life of men who 'keep close to the soil'. Half-brothers as they are to the prospector, theirs is the genuine freedom of the mountaineer. Difficult and dangerous as is their task at times, they enjoy it, not for the dangers and difficulties themselves, but for the health and vigor and the keen enjoyment of living, and, most of all, for the real love of the work itself.

DENNIS H. STOVALL.

Grants Pass, Oregon, April 25.

When the Day's Work is Over.

Ditch and Flume Information

The Editor:

Sir—I notice in your issue of April 23 'Inquirer' wants to know what size flume he needs to carry 50 ft. per second of water on a grade of 16 ft. per mile. My experience has been that he will need about a 3-ft. flume, 2½ ft. in depth. He will get about 7 ft. velocity, if his flume is well built and fairly straight. In the ditch he will find that water at this velocity will have a tendency to scour too much unless the ditch is in rock. I should advise his reducing the grade along the ditch. The best flume is made by using two 1-in. boards, inside lapping outer crack. This I have found better than 2-in. boards and easier repaired. If the timbers for the setts are in the rough, he should not use anything of less diameter than 3 in. at small end, and for sills not less than 4. If sawed timbers are used 4-in. square had better be used.

HYDRAULIC MINER.

Granite, Colorado, April 30.

ASSOCIATED OIL COMPANY

*The Associated Oil Co., whose $40,000,000 stock has been admitted to the lists of the New York Stock Exchange, is the first petroleum company listed. Unable to secure better than 12c. per barrel for their product, some forty of the largest producers in the Kern and McKittrick fields, owning 60% of the former and 80% of the latter, incorporated the Association in October 1901 in California. The Southern Pacific company, partly as consideration for funds advanced to provide transportation facilities, secured a controlling interest in 1905. On June 30, 1909, Southern Pacific held $20,069,003 of the stock. Of recently authorized $25,000,000 first refunding mortgage 5% bonds, due January 15, 1930, $10,000,000 have been sold. The company has outstanding, also, $2,746,000 first-mortgage 5% gold bonds, due August 1, 1922, to be refunded with part of the above authorized issue. About $25,000,000 of authorized stock was issued for properties taken over. The remaining $15,000,000, the $2,746,000 first-mortgage bonds, $10,000,000 refunding bonds, and $8,445,979 appropriated from earnings have been employed in construction and acquisition of pipe-lines and ships, purchase of stocks of other companies, and in development. The Associated owns real estate valued at $25,107,973, improvements and personal property valued at $9,152,648, and $13,769,355 of stocks and bonds, carried on the books at $12,046,837. The chief items under this last amount are $3,500,000 Associated Pipe Line stock, $4,222,461 Associated Transportation Co. stock, and $2,500,500 Amalgamated Oil Co. stock, all par value. These three represent an equity of over $10,000,000 in pipe-line and oil-land properties. In addition the Associated owns 60% of the $2,081,600 stock of the West Coast Oil Co., 90% of the $1,000,000 stock of Recruit Oil Co., controlling interest in three companies with stock of $250,000 or less, one of which paid $300,000 dividends in 1908; a minority interest in seven other companies with capital of $500,000 or less, and owns the $150,000 stock of the Bakersfield Iron Works, which manufactures oil-well supplies, and the $500,000 stock of the Associated Supply Co., a supply distributing agency. Owned and leased fields have the following estimated minimum producing capacity (barrels): Kern River, 526,000,000; McKittrick, 47,233,000; Coalinga, 32,617,000; total, 605,850,000.

*Abstract from the *Boston News Bureau*.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Electro-magnets are now being extensively used in factories to handle castings, and recently a cargo of kegs of nails was raised by this means from a barge that was wrecked in the Mississippi river near New Orleans.

The length of cast in place piles is limited, but piles cast and driven may be of any length. When driven with a core or pipe, the maximum length thus far attained is 45 ft.; no cores have been made longer than this, while the difficulty experienced in pulling the pipe renders a greater length impracticable.

Siphons may often be used to relieve pumps. In the case of a mine pump lifting water to a height of 550 ft., from which point it falls over a cliff 400 ft. high, a siphon will help. Not more than 30 ft. of head can, however, be taken off, since beyond overcoming atmospheric pressure the siphon has no effect. An air-valve must be placed in the crown of the arch, as a certain accumulation of air at that point is unavoidable.

Treatment by caustic baryta and lime is ideal for boiler water for these reagents would remove both corrosive and scale-forming properties. However, the cost of both the hydrate and oxide of barium is at present too great. The reactions that take place are as follows:

$$CaSO_4 + Ba(OH)_2 = BaSO_4 + Ca(OH)_2.$$
$$Ca(OH)_2 + CO_2 = CaCO_3 + H_2O.$$
$$Ca(OH)_2 + CaH_2(CO_3)_2 = 2CaCO_3 + 2H_2O.$$

The present transmission system of the Idaho-Oregon Light & Power Co. in the region surrounding Boise comprises two water-power generating stations, one of 1500-kw. capacity at the Horseshoe bend of the Fayette river, and one of 900-kw. capacity at Barber dam on the Boise river six miles from the city of Boise, together with about 112 miles of high-tension transmission line, approximately one-half of which operates at a transmission potential of 66,000 volts and one-half at 23,000 volts.

Toadstool-like erosion forms have been described by D. B. Sterett as occurring over the outcrop of a batholith of coarse porphyritic granite in York county, South Carolina. Some of the 'toadstools' are ten to fifteen feet high and of similar thickness, and are still firmly attached to the underlying granite mass by stems which may be only one-third as thick as the boulder. The granite also outcrops as floors or bosses similar to the occurrences at some of the quarries of the Piedmont region.

Generally speaking, shafts are 'raised' when a new opening is desired for a developed mine, or when one or two or more shafts, connected by drifts or levels, is to be extended. The method employed consists in driving to a point directly under the proposed opening, whence a small raise is started, which is enlarged later to full size. The muck is dropped into cars on the lower level through a chute, and hoisted through the existing shaft, or used to fill up rooms or workings from which the ore has been removed.

In drying the air for the blast of a furnace by the process developed by F. Daubiné and E. Roy, the apparatus is composed of ten similar and superimposed units, measuring about 10 ft. square and 16 in. high. Each unit has three elements: (1) a grating of water-cooled, externally ribbed tubes, which carry calcium chloride; (2) a series of tubes, triangular in section, imbedded in the chloride and resting upon the grating on one of their edges, through which the furnace gases are passed; and (3) two flat sheet-iron chamber, one at the moist-air intake, and one at the dry-air outlet. The air to be dried is impelled by a fan into a distributing conduit, whence it is distributed among the intake chambers mentioned above and from these chambers it passes to the various units of the apparatus. The air then passes downward through the mass of the chloride, which offers to the air a gradually increasing section. The dried air passes into a collecting chamber, whence it is led to the intake of a blowing engine. Each blast-furnace is provided with four apparatus of the type described. At any given time one is in operation for drying the blast, one is being heated by gases drawn from the furnace to dry the chloride, one is being cooled, and the fourth is held in reserve.

Corrosion of iron is unavoidable. No iron has ever been or ever could be manufactured that would not rust in moist air unless protected by some sort of covering, for the reason that pure iron itself has a tremendous affinity for oxygen and the slightest contact between iron and oxygen in a more or less unstable condition causes the immediate combination of iron and oxygen known as rust. This tendency to corrode is characteristic of the metal itself and is independent of the presence of the impurities it may contain. Iron does not rust when entirely submerged in pure water or water not containing free air; neither does it rust in a perfectly dry atmosphere. The beginning of oxidation is due to the presence of sufficient quantities of free oxygen in the presence of sufficient moisture to act as water of dissociation, this condition permitting the escape of hydrogen and the consequent oxidation of the steel or iron. The great variation which occurs in the rusting of iron and steel is probably due to unequal distribution of the impurities necessary in their manufacture. Iron does not occur in a pure state, and in the process of the manufacture of wrought iron and steel, small amounts of impurities occur more or less unequally distributed throughout the mass. It has been claimed that the small proportion of manganase which steel contains adds greatly to its tendencies to oxidize. This, however, is not borne out by actual experience and the removal of manganese does not carry with it freedom from oxidation. The difficulty lies not in any one cause or element contained in the steel, but in their unequal distribution throughout the steel which permits differences of potential at different points.

Special Correspondence

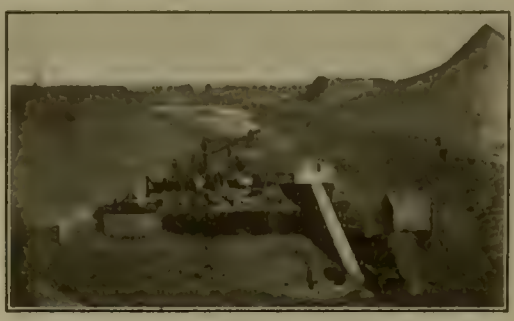
KALGOORLIE, WESTERN AUSTRALIA

February Production and Dividends — Labor Troubles at Norseman —Diamond Drilling —New Plants. —Tube Mill Liners

Progress reports of underground development in our mines show nothing of a startling nature, but steady work is going on as deep as 2650 ft. the present depth of the Great Boulder. The Perseverance is opening as much ground as possible while its new mill is being erected. The Horseshoe has recovered somewhat from its big drop in January. The South Kalgurli announces its reserves as 156,939 tons at $7 per ton. The February returns from the principal mines were as follows:

Name	Tonnage	Value.	Profit
Associated	10,532	$77,000	$6,200
Associated Northern Blocks	2,285	14,000	4,000
Chaffers	3,746	29,000	4,000
Golden Ridge	2,142	27,000	14,000
Golden Horseshoe	23,109	200,000	45,000
Great Boulder Proprietary	16,297	225,000	115,000
Great Fingall	9,473	71,000	10,000
Hainault	5,705	37,500	7,500
Ivanhoe	18,322	199,500	100,000
Kalgurli	10,020	130,000	37,500
Lake View Consols	10,553	71,000	11,500
North Boulder	810	24,000	15,000
Oroya Brownhill	20,448	31,500	20,090
Oroya Black Range	4,300	43,000	9,000
Oroya Links	10,377	73,000	18,500
Sons of Gwalia	13,505	117,000	50,000
South Kalgurli	9,025	60,500	12,500

The gold output for the State for February was valued at $2,350,000, being a drop of $250,100 when compared with the same month in 1909. Only $13,500 was paid in dividends by the Black Range Mining Co., this being an off month for dividends. There has been some argument as to wages on the Norseman field, some 120 miles south of Coolgardie, and the Miners' Union has rejected the Chamber of Mines offer. The matter will now go before the Arbitration Court. Miners are paid from $2.96 to $3.50 per 8-hour shift, while the average wage for other labor is about $2.96. During the month 37,527,000 gal. of water were used by the Kalgoorlie mines, treating 131,000 tons of ore, this averaging 286 gal. per ton milled, or 1.43 water to 1 of ore. In the February issue of the Chamber of Mines Journal, J. A. Thomson, who is associated with J. M. Maclaren in the geological survey of this field, writes on the effect of certain rocks on the cost of diamond-drilling in Western Australia. The commonest rocks in this State are granites, amphibolites, and greenstones; and the average cost of diamonds per foot in boring these rocks is $1.44, $3.20, and $1.50 respectively. He explains that the reason why the wear of the diamonds is less in the granites and greenstones than the amphibolites is that in the former there is little interlocking of any two minerals and the quartz breaks off in large pieces; but in the latter there is much interlocking of fine-grained minerals, thus requiring more grinding away. The wear is not excessive in the latter, but the rock has a tendency to wear smooth facets on the diamonds, necessitating frequent resetting, making progress slow and costs higher. The amphibolite from the Gwalia Consolidated is quite an abnormal rock. The texture is so dense that the separate minerals can with difficulty be distinguished under the highest powers of the microscope. It is a patchy rock made up of two parts. One is green, made up almost entirely of interlaced hornblende. The other is gray, and apparently made up of a fibrous felt of zoisite. Much diamond-drilling has been done here, but many points have never been satisfactorily explained. For example, why when a drill is set at a certain angle, does it invariably turn at right angles to the dip of the country, rather than cut along it? The Associated company is now doing exploratory work with the diamond-drill. Development work is going on at 2000 ft. The Associated company has ordered an exhaust turbo-generator to be driven by the exhaust steam of the present steam engines and compressors. Motors will be installed for driving mills furnaces, pans, agitators, and other machinery, and a large saving is expected to be the result. Two more Krupp ball mills are to be put in at the new mill of the Perseverance. The burned furnace shed has been rebuilt, the ore bins are well under way, the ball mill foundations finished, and erection of mills being proceeded with. Ball mills are easily put together. I have seen a No. 5 erected in 24 hours. The Great Boulder company is installing another Griffin mill, and one duplex Edwards roaster, making 13 of the former and 3 of the latter type. At the Golden Horseshoe it is proposed to add 20 stamps, while those in the old 50 head mill will be entirely renewed and the crushing weight of 170 stamps brought up to nearly 1200 lb. each. At present four more tube mills are being erected in the 100 head mill. The liners being used in the



Cassel Plant at the Lake View Consols, Kalgoorlie.

Part of Consuls dump on the left; that of Great Boulder on the right; electric road of the Perseverance near the Cassel plant.

mills running are of corrugated steel, the plates being some 36 by 10 in. and 3 in. thick at the widest part of the corrugation. Some of these have been in use for nine months, with little wear, and seem good for two years or more. It would seem that such shaped liners would have a tendency to tumble the pebbles about more than the ordinary smooth ones. This is a much desired point in tube-milling. The plates are of some special German steel, and are expensive. The Lake View Consols is also about to use these liners in the new tube-mills being installed, to take the place of some that have been running over nine years. The mill manager thinks these corrugated liners will crush better, but will take more power. More attention is being given to increasing the efficiency of many of our milling plants of late, and some interesting notes should be procurable.

TORONTO, CANADA

Shipments for First Quarter.—Porcupine Isolated.—Camel's Back Lake Rush Over.—Dominion Steel & Coal Corporation.

A comparison of Cobalt shipments of ore for the first quarter of the year shows a small decrease, the figures being 6911 tons for the present year and 7076 tons for the corresponding period of 1909. This, however, only applies to Cobalt proper, the difference being more than made up by Gowganda and Elk Lake output for the three months, of 324 tons. Moreover, bullion to the amount of 78,500 oz. has been sent this year from two plants, the O'Brien and the Buffalo. When the fact that during the earlier months of the year many plants were delaying, or limiting production while waiting for power, is taken into consideration, the showing is by no means an unfavorable one. This circumstance, moreover, sufficiently explains the absence of new shippers from the list of eighteen mines contributing to the output. The only strictly new producer represented was the Waldman with 32 tons, the Hargrave which figures on the list with a 20-ton consignment, being practically in the same category, as it is three years since its former shipment. The Crown Reserve report for the quarter ended March 31, shows ore shipped to a total net value of $380,849, and a net profit on operations amounting to $287,267.

Out of this dividends amounting to $265,322 have been paid. The surplus on hand was $571,221. The capital of the Gifford has been increased from $15,000 to $250,000. W. G. Trethewey, one of the pioneers of the camp, has again taken up active work, having assumed control of the Dominion Cobalt Mining & Development Co., which holds a location adjoining the North Cobalt mine. The Porcupine gold camp has been practically cut off from the outer world for a time owing to the unusually early spring and the breaking up of the winter roads. This, of course, seriously interferes with development and Frank Cochrane, Minister of Mines, to prevent hardship has extended, until June 15, the time in which the 30 days' assessment work must be done on claims staked between January 1 and March 15. Early in the month sensational reports of rich finds of gold at Camel's Back lake, north of Sesikinaka lake on the Temiskaming & Northern Ontario railway, hired several hundred prospectors to undertake the journey only to return a few days later disillusionized. The blame is laid on E. E. Jones and A. Blackburn, two prospectors who started the rush and sold claims for $2000. They are under arrest at Haileybury charged with perjury and fraud. Progress is being made in the direction of the long contemplated Dominion Steel and Dominion Coal merger. The directors of the two companies have prepared a proposition to submit to the shareholders. A holding company to be styled the Dominion Steel & Coal Corporation is to be organized, which will take over the common stock of the shareholders of both companies at par and in addition pay them $4 for each share in quarterly installments. The plan is understood to meet the views of the larger shareholders.

WASHINGTON, D. C.

Mine Inspectors for Alaska.—Investigating Committee Hearings. — Changes in the Mint. — Surveys in Land Grants. — Mine Rescue Stations.

The House Committee on Mines and Mining is in the midst of a hearing on the bill of James Wickersham, delegate from Alaska, which seeks to provide four mine inspectors for the territory. Mr. Wickersham, Lewis P. Shackleford, of Juneau, Alaska, attorney for the Treadwell Mining Co., and Wilford B. Hoggatt, former governor of Alaska, were most interesting witnesses. Mr. Wickersham made the statement that in event of war, it would be necessary for naval vessels on the Pacific Coast to obtain their fuel supply from Alaska, as there was no coal west of the Mississippi river of such high grade as that in his territory. He also referred to the recent disaster in the Treadwell mines as showing the necessity for some sort of inspection. The number of men killed in that accident, he said could not be learned owing to the lack of mine inspectors. He had a letter from a miner to the effect that from 24 to 65 men had been killed in this one accident, and that between 30 and 40 had been killed in separate accidents from January 1, 1908, to date. He estimated that 20,000 miners in Alaska needed this inspection. Mr. Shackleford, representing the Treadwell company, declared that Mr. Wickersham had exaggerated the number of deaths at the Treadwell mines; that they were not more than six a year, and that but 39 were killed in the recent accident. He favored inspection of mines and suggested that the supervision of such inspection be lodged with the United States Geological Survey, or with the Bureau of Mines. Mr. Hoggatt, the former governor of Alaska, who is a mine owner in the territory, also asked that the Geological Survey or Bureau be placed in charge of the inspection, objecting to the provision in the Wickersham bill that the President appoint the inspectors. "We must have fair inspection," said Mr. Hoggatt. "Our mines are of low grade and the margin is very small. In one of the mines, on Douglas island, the margin of profit three years ago—I have not seen the report since—was 14c., and there were 250 men employed in that mine. Now, a burden which would wipe out that 14c. would put out of employment 250 men." Asked about the placer mines in Alaska, he said: "Well, the placer mines are fast disappearing. There is practically no placer mining at Nome now, excepting the dredging and hydraulic mining. In two years from now the drift mining in the Fairbanks country will be a thing of the past: unless we find new camps there will be no such mining in that country. We will probably find new camps, as there is a tremendous area of gold-bearing gravel." The committee decided to leave further consideration of the bill to a sub-committee of five.

At the investigation into the Forestry Service and Interior Department, Alfred H. Brooks, in charge of the Alaska investigations of the Geological Survey, told of the probable length of time the coal supply of the United States would last. He declared that at the present rate of consumption it would require 4913 years to exhaust the supply. These figures were arbitrary, he said. Figured on a basis of the increasing consumption Mr. Brooks said it had been estimated that the supply in the United States would be exhausted in from 100 to 150 years. Somewhere between the 150 and 5000 years he declared, the truth would be found. Mr. Brooks told the committee he thought there had been too much alarm as to the exhaustion of the coal supply. Adna Johnson, of Ironton, Ohio, member of the committee of the House on Coinage, Weights and Measures, has reported a bill which seeks to save $30,000 a year in the weighing of silver coins. The old law requires that in adjusting the weight of silver coins the following deviations shall not be exceeded in any single piece: In the dollar, the half and quarter dollar, and in the dime, 1½ grains. This stands in the amendment, but the following clause is stricken out, "And in weighing a large number of pieces together, when delivered by the coiner to the superintendent, and by the superintendent to the depositor, the deviations from the standard weight shall not exceed 0.02 oz. in 1000 dollars, half dollars, or quarters, and 0.01 oz. in 1000 dimes. The Director of the Mint declared that under the old law three separate weighings of the coins was necessary, two by machinery and one by hand. The committee has reported the bill favorably. Mr. Johnson has introduced another bill which provides that the standard troy pound of the Bureau of Standards shall be the standard troy pound of the mint. The House has just passed a bill appropriating $500,000 for the survey of public lands lying within the limits of land grants, and to provide for the forfeiture to the United States of unsurveyed land grants to railroads. Thomas H. Carter, Senator from Montana, has introduced a bill providing for agricultural entries on coal lands. Frank Mondell, from Newcastle, Wyoming, has introduced a bill to appropriate $200,000 for the establishment of 11 additional mine rescue and experiment stations.

MEXICO

Railway Extensions. — Casados Mill. — Lucky Tiger Report. — Palmarejo & Mexican goes to Oceana Con.— Plomosas Zinc. —Pinguico Mines.

State governments of Mexico are manifesting a willingness to guarantee a reasonable rate of interest on money invested in branch railroads to open and develop territory, and this promises to result in a number of important mining districts securing transportation facilities within the next few years. Heretofore Mexican States have almost invariably assisted in the construction of important railroad lines by the granting of subsidies, but the interest guarantee is more attractive to investors, as a return on the investment is assured from the start. The government of the State of Durango has just granted to Francisco Neugebauer a concession for a railroad from the terminus of the International railroad, a merger line at Tepehuanes to the Guanaceví mining district, and a feature of the concession is a guarantee of 6% interest for a period of 25 years. The State of Zacatecas has arranged a renewal of a concession for a railroad from Camacho, on the El Paso-Mexico City line of the National Railways to the Mazapil mining district, and in connection with the renewal has guaranteed 5% on the mortgage bonds to be issued to provide funds for construction. Foreign capital will be interested in the building of the Guanaceví line, and some of the most promising mineral territory in Durango will be opened. Guanaceví is one of the famous old districts of that section of Mexico, and several foreign

Chinipas, Chihuahua.

tube mills will pass over Deister slimers before being discharged into the solution tanks. The Casados are among the big properties of the Hostotipaquillo district, and are notable among the mines of that district for the high percentage of gold in the ores. They have been under development by the present company during the last three years, and returns from high-grade ore shipped during development are more than covering present expenses. The ore in sight is estimated at over 200,000 tons. W. R. Ramsdell, who is at the head of the Casados enterprise, is one of the principal American operators of that section of Mexico.

The annual report of the Lucky Tiger Combination Gold Mining Co. shows that the rich El Tigre gold mine in Sonora produced $1,087,273 during 1909. The profit amounted to $586,597, and the dividends paid out of the profits to $409,500. During the twelve months 8161 ft. of development was accomplished, making a total of 34,759 ft., which has resulted in placing in sight ore estimated at 257,000 tons. The company is now developing at the rate of 70,000 tons annually. The question of power for the mine and for reduction machinery is still unsettled. The Mexican Union Railway Co., Ltd., of London, has acquired the Torres & Prietas mineral railroad and concession from Mrs. Myra T. Seymour. The line is narrow gauge, extending from Torres, on the Sonora railway (Southern Pacific) to Represo, a distance of 27 kilometres, and the concession gives the right to build to a connection with the Yaqui river line of the Southern Pacific. The London company plans to open important mineral territory by the construction of this extension.

AUSTIN, TEXAS

Plateau Zinc.—Shafter Silver Mines. — The Quitman Mountain District Finds Water.—El Paso Zinc.

There is a large amount of development now going on in the Plateau zinc mining district. The Texas Zinc Co., the Lone Star Co., the Buck Mining Co., the Howard Mining Co., and the Reed Mining Co., are all working. A recent shipment of five cars of ore from this district to the smelter gave an average return of $800 to the car. It is stated that assays of the ore give an average of 60% zinc. The Plateau Concentrating & Mining Co., recently organized with a capital stock of $250,000, is preparing to develop its zinc claims. Some work has already been done, and it is stated that a considerable tonnage of high-grade ore is in sight. The conditions are so favorable that the company will erect a concentrating plant. Young Brothers and associates who own the Last Chance mine, situated in the Shafter district, are rapidly developing that property into a large producer of silver. It is stated that more than 2000 tons of ore are now on the dump, and that several thousand have been blocked. The vein has a width of 20 ft. at a depth of 100. It is planned to erect a mill and install other machinery. The water supply is abundant and the conditions for working the property are said to be highly favorable. A zinc claim in the Shafter district, owned by J. C. Driffel, is being developed. William Crosby, of El Paso, recently purchased an interest in the Lula B. mine, in the Quitman mountains. An adit is being driven. It is now about 125 ft. long and is in mineralized rock. The recent development of a fine flow of water by the Southern Pacific in a well at Etholin station in the Quitman mountains, is regarded as important. Heretofore the development of the claims has been retarded by the lack of water, and the general belief was that none could be found within reasonable depth. Steps have already been taken by a number of mining companies to sink wells. The shaft that is being sunk on the Tamma silver mine in the Quitman mountains is said to be in good ore. The mine is owned by John Moffitt of El Paso. A rich shoot of high-grade copper sulphide was recently encountered in the Little Lightning mine, owned by John Gilcrease, also in the Quitman mountains. It is reported that the El Paso Tin Mining & Smelting Co. will erect a 50-ton dry-concentrating plant at its tin mine on Franklin mountain. A large amount of ore is blocked out. S. H. Chauvenet, of Sheridan, Pennsylvania, is president of the company, and W. E. Koch, of El Paso, general manager.

GOLDFIELD, NEVADA

Consolidated Builds Power Equalizer. — Florence Goldfield for April.—Discovery on Ford Lease.

At Jumbotown, a collection of buildings near the Clermont and Laguna claims, the Consolidated Mines Co. is now preparing for the installation of a power equalizing station, with storage batteries of large capacity, the installation to involve the expenditure of $30,000. Specifications call for a plant of 2000-hp. capacity. At this point is situated the transformer station from which electric power is sent to hoists at the Clermont, Mohawk, Red Top, and Combination shafts, as well as to the central compressor-plant. The Consolidated company is now using 1000 hp. at the mines and mill, from the Nevada-California Power company's line. Structural steel and other materials to be used in reconstructing the damaged part of the mill are arriving. The time to elapse before the plant is again operating at full capacity is now contingent upon the promptness with which the requisite new equipment is delivered. Another ore-shoot of excellent proportions has been exposed on the 900-ft. level of the Clermont. High-grade ore, chiefly from the 750-ft. Clermont workings, is being shipped to the smelters. The company's normal earnings of approximately $700,000 monthly will be maintained. In the last report of the secretary it is said that the loss by fire did not exceed $125,000. The financial report for the quarter ended March 31, accompanying dividend checks for 50c. per share paid on April 30, shows gross receipts for the quarter of $2,162,282, disbursements $603,496, and net receipts $1,558,786. On January 31 dividend No. 6 was paid, amounting to $1,779,549, and on March 31, the company's cash balance was $2,189,248. After the payment of dividend No. 7 on April 30, also 50c. per share, the company had more than $1,000,000 in cash in its treasury and officials say there is no reason to doubt that the dividend for the current quarter will be paid.

According to reports of the managers of the Florence Goldfield mine the output treated in April approaches 160 tons daily and a recovery of 95% of the gold content is being maintained. This is the largest tonnage ever handled by the Florence. The main shaft is being enlarged to two compartments and manway from a depth of 530 ft. to the surface and with the completion of this work several good ore-shoots that heretofore have been exposed only above the 350-ft. level will be explored from the bottom of the shaft. The long drift to the north is now entering the productive area of the old Reilly lease on the 350-ft. level where a raise will be driven shortly to connect with the old workings. Stopes of large size are now being opened in good ore at the southern extremity of the main workings, in ground formerly embraced in the Little-Florence and Rogers leases. In the latter an excellent orebody was developed by a winze to a depth of 570 feet.

The most important discovery of record on territory of the Merger Mines Co. has been made in the past week on the Ford lease, embracing the original St. Ives shaft and workings. During the past year several shipments of good ore have been made from the 150-ft. level and the ore-shoot has now been penetrated on the 250 and 350-ft. levels. Assays of over $100 per ton had been secured at the 250-ft. level for over a week when the drift exposed 2 ft. of ore averaging from $150 to $200 and accompanied by seams on the footwall carrying as high as $1000 per ton. The appearance of the vein on the 350-ft. level is also encouraging. This ore-shoot was exposed by the original St. Ives company and was followed to the boundary line of the Algae fraction, owned by the Velvet Mining Co. before the consolidation. Work was abandoned by the St. Ives and the drifts were permitted to cave. The Ford lease extends across the Algae and the lessees were forced to drive through some caved ground to reach the ore. They are now sacking ore sampling over $100 per ton and will proceed to open the vein on the 450-ft. level. The 550-ft. shaft of the Codd lease on the St. Ives will be sunk to a depth of 1000 or 1200 ft. The upper levels of this lease have produced some rich ore from a narrow vein.

JOHANNESBURG, TRANSVAAL

Rand Mines Ltd.—East Rand Proprietary.—Low Working Costs.—A Technical Debate. — Equipment Expenditures. — Mine Ventilation.

The chorus of chairman's addresses and the deluge of annual reports continue to dominate the field of events. Facts and happenings give way to opinions and promises. At the same time company meetings as a whole have been unusually interesting, and the majority of chairmen have seized the opportunity of touching upon important questions of general concern, beyond the commonplace limits of a revival of stale statistics. The two most important meetings of the year—those of the Rand Mines, Ltd., and the East Rand Proprietary—were held on the same day (March 23). The subsidiary producing companies of the Rand Mines yielded over one-sixth of the Rand's output and made working profits aggregating £2,367,000 during the year 1909. G. E. Webber summarizes the annual results of the group, the best first-row deep-level mines of the Rand, as follows:

Development footage for year	132,657
Tonnage in reserve at end of year	14,507,186
Tons mined	4,145,785
Assay value of waste rock	0.543 dwt.
Tons crushed	3,651,084
Grade before crushing	7.783 dwt.
Average extraction	95.324%
Average yield per ton: mills, 5.089 dwt.; cyanide works, 2.330 dwt.; total	7.419 dwt.
Average value per ton	31s. 1.7d.
Average working costs: mining expenses, mining 10s. 6.96d., developing 1s. 8.62d., total 12s. 3.58d.; production expenses, 4s. 6.77d.; general expenses, 1s. 5.63d.; grand total	18s. 3.98d.
Average profit per ton	12s. 9.74d.
Total profit from current ore	£2,338,834
Total profit from accumulations	28,320

Upon the East Rand Proprietary Mines, Ltd., a year of excellent work was achieved, and the promise of improvement is substantial. Briefly, the most important results were as follows: Ore reserves, 11,371,761 tons; ore mined, 2,141,872 tons; sorting percentage, 14.37; ore milled, 1,830,280 tons; yield per ton, 29s. 2.3d.; cost per ton, 15s. 5.2d.; working profit, £1,259,057.

On the much debated question of low working costs per ton milled, Sir George Farrar made one emphatic remark demanding quotation: "I see no reason why your company should not always have the minimum cost that it is possible from time to time to attain; and, as I have frequently pointed out, minimum working cost means maximum possible profit per ton, maximum possible life, and consequently maximum profit per claim." The inwardness of this statement may not be quite clear. It is far from a platitude, but constitutes a deliberate statement that while 'costs per ton milled' have been reduced, the greatest total profit has not been a neglected consideration. At the meeting of the Rand Mines, R. W. Schumacher stated on the same day: "Low working costs are undoubtedly desirable as long as they are perfectly legitimate, but they are entirely subservient to the desirability of making the maximum profit per claim treated," and later, "Mr. H. F. Marriott has prepared certain tabular returns which will be filled in every three months, and show the working costs and results at crushing mines on the basis of the superficial square fathom extracted." At a dinner given by Lionel Phillips on March 23, Mr. Marriott was given an opportunity to explain fully the new scheme of returns, with the square fathom as the unit in place of the ton milled. Unfortunately, the speech or paper has not been thrown open to discussion—though even if it were, there would clearly be difficulties in the way of managers criticising their consulting engineers. Suffice it to state that

Mr Marriott's scheme has met with almost universal condemnation from technical men who have closely examined it. The quartz in Rathmines is not a generally distributed one, with exceptions owing to the large tonnage of ore drawn from sources apart from the stope faces. Even if it were something abnormal it would not indicate as a divisor whether the maximum profit would be obtained from the property. One of the managers has boldly declared that the scheme will take long to understand but will take less time to be dropped. W Laurie Hamilton, one of our veteran mine managers, has forcibly demonstrated the fallacies of the new policy, and at the same time defended Rand technical control against the charges of wholesale manipulation and dishonesty implied in Mr Marriott's pronouncements. Another vital aspect of Rand expenditures was dealt with at the Simmer Deep meeting, at which D Christopherson discussed the influences of what may be called the Caldecott metallurgical policy. A comparison was made between the new Simmer Deep mill and the Simmer East-Knights Deep plant, started in 1903. The latter, with 80,000 tons monthly capacity, has cost about £600,000 or £215 per ton milled per working day. The former plant, of 120,000 tons capacity, will have cost £450,000, or only £107 per ton per day. The saving may be attributed to (a) heavy stamps, (b) sand filter tables, (c) coarse crushing and high tube mill returns, (d) large units (vats, etc.), (e) electric power. For a strict comparison the Simmer Deep should be debited with a share of the capital expenditure on the Central Electric Power Station, but the distinctions are striking enough. The 10 ft. 6 in. Sirocco fan erected in the Angelo Driefontein mine has produced admirable results. The average air analysis before its introduction gave CO 0.011 and CO_2 0.552%, and since, CO 0.006 and CO_2 0.149. The reduction of temperature has been 2 to 3°. Artificial ventilation is being steadily extended.

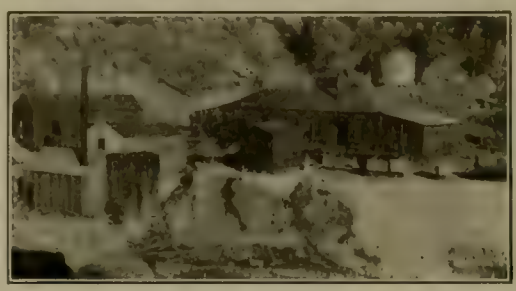
DENVER, COLORADO

Dissatisfied Investors.—Clear Creek Items. — Criminal Cases. — The Coal Situation.—Cripple Creek News.

Mining in this section has been unusually quiet for this season of the year. Projects that were expected to be under way have, in many instances, been delayed for lack of funds. Whether the numerous schemes that are plainly fraudulent have made investors wary or not is yet to be determined. The case of the Penn-Wyoming Copper Co., of Encampment, Wyoming, has been widely discussed by the discontented stockholders in this company, and they have brought suit against the directors of the company. The complaint charges that E. W. Cobb, E. A. Norton, F. B. Draper, and others have defrauded the stockholders of $7,000,000 to $10,000,000, by organizing the United Smelters Railway & Copper Co., with a board of dummy directors, and transferring, without the knowledge or authority of the stockholders, the property of the Penn-Wyoming Copper Co. The United Smelters Railway & Copper Co. was to liquidate a debt of $5,600,000 against the Penn-Wyoming company. This debt in reality, the stockholders claim, was for not more than $150,000. The suit brought by the stockholders as intervenors demands a receiver for the Penn-Wyoming Copper Co. Fraud is also charged against the same men in the manipulation of the stocks and bonds of 14 other corporations most of which operate in the Encampment district of Wyoming. The Greeley stockholders of the Rio Seco Mining & Milling Co., of Oaxaca, Mexico, are just now wondering whether they were buncoed by smooth promoters, or whether nature played a trick upon them. Favorable reports were made upon the mine by engineers in Mexico. The stockholders sent an engineer to examine the property and he agreed with the previous reports. Recently Thomas Price was sent to install the new machinery and pump out the mine. He now reports to the stockholders that ore of $3.50 per ton value is all that there is in the mine. A few tons had been shipped from the dump that ran $21 per ton, and this wide discrepancy makes the investors suspicious at least.

The greater part of the mining in the Clear Creek district is now being done by lessees. Several parties are working on placer ground in Dory Hill, at the foot of the creek. They are especially interested in how the Standard mine at Idaho Springs. A few prospectors around Georgetown are being developed with the idea of shipping to the plant of the Western Metals Co., which will be operating using the Malm process about July 1. As soon as the Georgetown plant is in successful operation the company intends to erect similar plants in the other sulphide districts of the State. The Newhouse tunnel has been advancing steadily since April 1. The men backing the project have bought the Gunnell group, which was a famous producer in the early days, and the tunnel is being driven ahead to cut the Gunnell vein. A notable consolidation was recently effected when W E Renshaw, manager of the Geta Consolidated Mining & Milling Co., was appointed manager also for the Specie Payment Mining & Milling Company.

By a recent order of Attorney General Wickersham all the criminal cases against individuals and corporations holding coal lands in Colorado, which were to be contested by the Government, have been dropped. This decision comes as a result of the failure of the Government's prosecution of the Kletal case last February. This ruling, however, does not affect the status of the numerous equity



Portal of Deep Drainage Tunnel, Cripple Creek, Colorado.

cases against the same parties. The Government expects to recover title to practically all the land in dispute by these cases. The State Railroad Commission has ordered a reduction in freight rates on coal from the northern fields to Denver and Littleton. The rate gives Denver 25c. per ton reduction, and Littleton 50c. per ton. Just at this time the consumer in Denver gets very little benefit from this decision, as the northern coalfields are tied up by a suspension of work which has continued there since the first week in April. The Puritan coal mine was opened on April 26, with miners imported from West Virginia. There has been no violence thus far. The operators say they will take back their old employees if they renounce their Union. The matter now looks like a test of endurance, as the operators decline to have anything to do with the representatives of the United Mine Workers of America.

The Cripple Creek district experienced about all the changes in weather that are possible at its altitude in Colorado during April. A howling blizzard kept ore teams in for two days during the month. Then on the 12th of the month the shaft-house of the Cresson Consolidated Mining Co. was struck by lightning and burned. This helped to reduce the output for the month. The total production was 55,540 tons, with a gross value of $1,290,335. Three companies paid dividends, as follows: Portland, $60,000; Vindicator Consolidated, $45,000; and Elkton, $37,500. The deep drainage tunnel was advanced 376 ft. during April, and is now 266 ft. from the El Paso shaft. A contract has been let for a churn-drill hole from the shaft bottom to the tunnel, a distance of 400 ft. An interesting case has just been settled in court. S. Jensen shipped a car of ore over the Florence & Cripple Creek railroad to the Pueblo smelter. While celebrating, he lost his bill of lading and landed in jail. Later the Cripple Creek Mine Owners' Association presented the bill of lading and ordered the car delivered at Victor. At the trial it was decided that as Jensen had not signed the bill of lading the railroad was liable for the full value of the ore.

NEW YORK

Utah Copper and Amalgamated.—Boundary District and British Columbia Copper.—North Butte. — Heinze and his Difficulties.—Cost of Living and Rand Output.

A new element may be introduced among the low-grade milling coppers, one that will make a strong bid for the place now held by Utah Copper. The Utah Copper coterie has a present producer of immense proportions in the combined Utah-Boston, which in turn owns practically 50% in the Nevada Consolidated; they also own a controlling interest in the Ray Consolidated and the Gila, which are about to be consolidated, which combined properties have ore reserves estimated at 70,000,000 tons, and milling facilities already under course of construction; the Chino Copper Co. is also a member of the same family, and is said to be developing an immense tonnage of ore. It had the misfortune to be recommended by Thomas W. Lawson, of Boston, and as a result has been through some painful market gyrations, but as a copper property is said to be making splendid progress. The possible rival of this leadership of the Guggenheim, McNeill, Jackling, Penrose group is Amalgamated Copper. It is believed that Amalgamated has been selling Anaconda; the stock has been held strong considerably above a market parity with Amalgamated on the recent exchange basis, and, should Amalgamated see fit to do so, it could sell a minority interest in Anaconda to the public, without weakening its hold in Butte. With the cash reserve so built up it could buy into the porphyries and, with its close-working arrangement with the International S. & R. Co., make at once a large place for itself among the low-cost producers. It is not known definitely, as yet, that Amalgamated interests have taken any steps looking to the acquirement of any low-grade producers; but such a step would be logical. The present semi-demoralized condition of the copper metal market and the copper share market and the economic waste now forced upon producers, who are obliged to keep plants running and throw cheap metal upon an already glutted market, are unanswerable arguments in favor of a copper merger or some equally effective method of co-operation. If a copper merger can be brought about that will carry some lean with the fat, that will allow the high-cost coppers to live, and that will require the porphyries to limit production in return for an added profit upon such restricted output, without at the same time throttling the small independent producer, whose production must be taken care of that new properties may be developed; such a trust would be a great factor for true economy. While the copper outlook is momentarily discouraging, copper consumed is copper consumed; and there is a day ahead when cheap copper will be exhausted. Long before the point of exhaustion is reached the market will be discounting the future.

The situation in the Boundary camp is not nearly so satisfactory as it might be. One of the items of strength in the British Columbia was the holding in reserve of about one and a half million pounds of copper. During the time when the General Development Co. was trying to get control of the British Columbia and Dominion Copper, and when the metal market afforded a price of about 14c., the company refused to part with its accumulated stock. Now, it is understood, that this copper has been sold at something less than 13c. The mines have been closed for some weeks on account of labor troubles and by reason thereof the contract between the Dominion Copper Co. and the British Columbia is in abeyance. The labor situation is a very ticklish one at the moment and it may result in keeping the properties closed for some weeks to come. The Lewisohn people are now definitely understood to be wholly out of both British Columbia and Dominion. There is to be a new issue of treasury stock made by the North Butte Mining Co. Ten thousand shares will be used in the purchase of the Croesus claim, which lies between the Berlin and the Jessie ground. The authorized capital stock of the North Butte is 600,000 shares, of which 400,000 shares are now outstanding. The company has for some time owned a large interest in the Croesus and the present step is in line with the recent acquirement of the Berlin in which North Butte also owned a large share and which they have just cleaned up by taking over the whole of the title. In reference to North Butte being left out of the Butte merger, the statement is made that under the laws of Minnesota, under which the company is organized, it is necessary to have the unanimous consent of the stockholders for such a step and the management has not felt sufficiently sure of their ground to make such a request of the shareholders. F. Augustus Heinze is being kept well forward under the spot light. The shareholders in United Copper have been following the proceedings against Heinze in the Federal court closely in the hope that some of the testimony would reveal the actual condition of that mysterious company. What United Copper owns in the way of property, or stock of other concerns in its treasury, is known to none outside of Heinze and his few confidants, who themselves, are more often in the dark than otherwise. A detailed report on United Copper would be welcomed even if made as a part of the court record in a criminal proceeding. At least, one or two pertinent facts have been revealed, such as the receipt of some ten and a half million dollars from the Cole-Ryan interests at the time of the formation of the Butte Coalition, when the Heinze interests sold the Corra, the Minnie Healy and the Nipper. The disposition of this sum has never been explained. Incidentally also it has been developed that the dividends paid by United Copper were paid out of the company's capital and it now appears that such stock interests as the company held in the Davis-Daly and in Ohio Copper and Stewart Mining have disappeared from the treasury and that the only asset is the cash received from the sale of the properties mentioned, or whatever may have been received for it when it left the company's treasury. Outside of the court proceedings, where Mr. Heinze is on the defensive, he is also being forced to show his hand in the market. For some months the Heinze stocks have been in the hands of the loan crowd and during the recent depressions there have been sales under the rule, in which Ohio Copper and other Heinze issues have been under forced liquidation. The action of Ely Central, an issue which has occupied a good deal of attention and consumed a good deal of printers' ink during the past few months illustrates aptly the changed attitude of the public. A few months since, the stock was a market leader, active at several times its present price, and then had a future wholly problematical. Indications now are that the property is to justify, to some extent at least, the predictions its friends have made for it, but now the public will have none of it; in fact the market declined sharply upon the news of a recent discovery. A short time ago, a Boston commission, endeavoring to trace to its lair the high-cost-of-living microbe, obtained from John Hays Hammond an estimate of the gold production of the Rand for the coming year. Mr. Hammond's estimate of $175,000,000 seeming large, a cable was sent to the Statist of London, asking for data. Mr. Mabson, the editor, answering the cable, gives his estimate of the output for the coming year at $162,500,000, with other African properties swelling the total of gold to $180,500,000. These figures are surprisingly large and demonstrate the growth of the mining industry, there being now a much larger number of mills in operation on the Rand than at any previous time in history. Markets for mining shares are being broadened. Some of the best known of the issues on the London Stock Exchange are being admitted to trading privileges on the Paris Bourse, among them Camp Bird and Mexico Mines of El Oro. The option for examination given to the General Development Co. covering the control of the Pacific Smelting & Refining Co., the re-organization of the Douglas Copper Co., has been extended to permit of more thorough examination by the Lewisohn engineers, now on the ground at Fundicion, Sonora, Mexico. The annual meeting of the Batopilas M. Co. was held in New York last week. One of the principal matters of business was the ratification of the recent arrangement whereby a part of the property was leased to the Batopilas M. S. & R. Co., Ltd., of London. Owing to delays on account of legal details this agreement has not as yet become effective, but the new company is expected to begin operations in May.

General Mining News

ALASKA

The statement of the Alaska Treadwell Gold Mining Co for the month ended April 15 states that the 240-stamp mill ran 30 days 11 hours, and the 200-stamp mill ran 8 days, 19 hours, crushing 49,750 tons of ore, and producing 900 tons of concentrate. The estimated free gold amounted to $76,680 and the value of the concentrate $50,735, the total realizable value being $120,809. The operating expense was $84,110, leaving a profit of $36,696. The stock of broken ore was increased 13,857 tons.

ARIZONA

COCHISE COUNTY

Orders have been placed for new machinery for the Commonwealth property at Pearce by the lessees, and the mill which was destroyed by fire a short time ago will be rebuilt. The mill had been in operation but ten days when the fire occured. Though the machinery was not a total loss it will all have to be repaired and it will be about six months before the mill is again in operation. —The west drift on the 120-ft. level of the Whitetail property at Paradise has opened an 18-in. shoot of copper ore. The sump on the 500-ft. level of the Holbrook shaft of the Copper Queen Consolidated Co. has been cleaned out as the raise from the 600 is expected to break through any time. At the power plant the foundation of the old compressor has been torn out and replaced by one that will support the new one which will handle 7500 cu. ft. of free air per minute. —The station has been finished on the 700-ft. level of the Bisbee Extension and drifts started on the ore. — At the Shattuck Arizona the station is being cut on the 400-ft. level. It is reported that the stock of this company is to be listed on the Boston Exchange.

GILA COUNTY

(Special Correspondence).—A cross-cut driven southeast from the Williams shaft on National Mining Exploration land is 75 ft. long and has just crossed from shale into quartzite. Since cutting an 18-in. stringer of high-grade copper carbonate at a distance of 50 ft. from the shaft, this cross-cut passed for 13 ft. through faulted ground containing much iron and some copper stain.——Nathan L. Amster, president of the Arizona Commercial Copper Co., announced on leaving Globe recently that the Eureka shaft, now down to the seventh level, will be sunk 300 ft. deeper.——The connection of the third level of the Hamilton shaft with the Pinto shaft has just been completed on the Cactus property. A similar connection will be made on the fourth level within a few weeks. Much of the chalcocite recently opened averages 4% copper or better.——Preparations are being made to sink a shaft on the Wild Air claim of the Little Miami Mines Co. recently organized by James A. Fleming, former president of the Warrior Copper Co., and associates, residing in Philadelphia and New York. The new corporation is capitalized for $1,000,000, divided into 1,000,000 shares of stock, 400,000 shares of which have been assigned to the treasury. The company holds about 60 acres of mineral land, lying between the Miami and Warrior properties. Richard Fleming, of Globe, is manager.

Globe, May 7.

GRAHAM COUNTY

A new concentrating table has been added to the equipment at the Gold Belt mill in the Morenci district, and it is probable that the capacity of the mill will be doubled in the near future. L. V. Hoyt is superintendent.

MOHAVE COUNTY

E. J. McNulty, local manager for the Aztec Turquois Co., of New York, stated that his company had patented 12 claims in the Mineral Park district, and completed all arrangements for extensive diamond-drilling and cross-cutting for copper ore.——At the C. O. D. mine, on Stockton hill, under bond to McLaughlin & Boyle, a rich find was made several days ago on the 100-ft. level of the new shaft when a foot of ore was cut which assayed about $300 per ton. The new discovery was made in a drift recently started about 400 ft. west from the old workings and is believed to be an extension of the old ore-shoot which yielded nearly a million dollars in the first 200 ft. of depth. The ore just found assays about 10% zinc, $12 in gold and nearly 600 oz. silver. The C. O. D. recently installed a fine hoist and will continue the shaft, which is now down 110 ft., several hundred feet farther. —A number of good prospects are reported in the Oatman district. In doing assessment work on the Jack Rabbit, near the Tom Reed, Hills Ridenour and John Coffey exposed a small streak of ore assaying a little over $200 per ton. —Nearby Krauss & Moore uncovered 7 ft. of good milling ore on the Lazy Boy. In the Boundary Cone shaft two shifts are averaging 2½ ft. per day. The shaft, now down 110 ft., is in good milling ore.

YAVAPAI COUNTY

The drift at the Golden Ridge Mining Co., operating in the Weaver district, is in 700 ft. on the ore, and will be advanced an additional 1000 ft. to open the Devonshire vein.

Having spent a year investigating the resources of the district the Rigby Mining & Reduction Co. has decided to erect a lead smelter at Mayer that will have a capacity of 100 tons per day.— Work has been resumed on the May flower group in Government canyon three miles from Prescott. The shaft is down 80 ft. with a good showing of copper-gold ore.——The Mint Mining & Milling Co. is to erect a 10-stamp mill and concentrating plant at its property in the Copper Basin district. The shaft is now down 140 ft. with drifts on that level, and it is the intention of the manager, George Montgomery, to sink to the 230-ft. level and commence work on the vein there while the mill is being erected.——The Tom & Dick shaft of the Juanita Mining Co. is down 210 ft. and a station is being cut on the 200-ft. level.

YUMA COUNTY

The smelter of the Clara Consolidated Gold & Copper Mining Co. has been blown in. The plant consists of a 700-ton blast-furnace and a converter-plant capable of producing 45 tons of copper bullion per day. The converter building is of structural steel, and is equipped with a 50-ton traveling crane. The handling of ore from the mines to the works is all done with electric power.

CALIFORNIA

INYO COUNTY

At the Casa Diablo the mill is running on ore from the Dry Bone stope and is crushing about 30 tons per day. The management is planning to put 10-mesh screens on the batteries and re-grind the pulp to 150 mesh before cyaniding. The shaft is now down 260 ft., and will be sunk about 75 ft. per month.——At the Golden Siren group, in the White mountains, the shaft is down 90 ft. on a 4-ft. vein of milling ore. An adit has been started that will cut the vein about 1000 ft. from the shaft and a steam hoist will be installed this summer. D. C. Adamson is in charge of the work.

MARIPOSA COUNTY

A rich vein has been opened on the surface of the Notches group, near Coulterville, and traced for 3000 ft., showing an average width of 3 ft. Frank Bixby, the owner of the property, has started a shaft.——Work has been suspended temporarily at the Hill mine but will be resumed some time this month.

NEVADA COUNTY

Work is to be resumed in the 600-ft. drift at the Belle France group of claims in the Grass Valley district.——The drift at the Oakman mine, in the Washington district, has opened 6 ft. of $15 ore.——The Ethel mine above Gaston has resumed operations after having been idle all winter. At the time work was stopped on account of the bad weather the drift had opened a promising shoot and it is on this that the work will be concentrated.——A new compressor has been installed at the Norton group, in Willow valley, by the new owners and extensive development is planned. J. M. Fly is manager.——The last clean-up at the Champion resulted in a bar valued at over $4000 which will be more

than enough to satisfy the claims of the men.——New machinery is to be installed at the Kenosha mine and operations resumed on a larger scale.——The Roseville Mining, Milling & Leasing Co., which recently secured an option on the West Delhi group of claims on Columbia mountain, has commenced work in the 400-ft. adit and will drive it ahead about 175 ft. to intersect the vein. This will give the company about 700 ft. of backs.

PLACER COUNTY

The recent cutting of the channel in the Red Sea mine, three miles from Forest, has proved quite a stimulation to the mining of that district as the gravel has proved to be of considerable extent and of good value.——The Good Friday Gold Mining Co., which controls the Good Friday, Green, Enterprise, and Hilltop groups about three miles from Auburn, has commenced active work on the properties. The Good Friday is one of the pioneer producers of the county having yielded about $250,000 in the seventies.——Development is progressing steadily at the Crater and the mill is kept running night and day.——J. Toman has secured a lease on the Hibbe copper mine near Gorden bar on Bear river and will commence work in the shaft which has been sunk to a depth of 110 ft.——The adit at the Dewey is in over 400 ft. and has but a short distance to go before it will be under the shaft when a raise will be started.

SAN BERNARDINO COUNTY

(Special Correspondence).—The Gold Stone district north of Barstow is attracting considerable attention. A series of important discoveries have been recently made and work is under way on a dozen promising claims. Water is scarce and it is probable that two wells will be sunk in the hope of increasing the supply, which is now derived from Indian Springs and a few wells.——Smith & Parke are sacking ore on the First Chance claim for shipment to the Victorville mill. It assays $50 to $60 per ton.——The sinking of an incline shaft will start immediately at the Drumm-Barlow mine, 30 miles north of Barstow. The return on a recent shipment of ore to the Needles smelter was $97 per ton gold and 5 oz. silver. This was taken from surface workings.——The railroad has reduced the rates on ore shipments from Barstow to the Victorville mill as follows: $50 ore, $3; $20 ore, $2; $15 ore, $1.50 per ton. The mill is running steadily.——N. K. Millet is erecting a small mill near Dagget to treat ore from the Calico and nearby properties.—A miners' club has been organized at Barstow to exploit the resources of the district.

San Bernardino, May 9.

SHASTA COUNTY

E. F. Jones, a miner at Keswick, opened a pocket in one of the streets of the town and took out $385 in gold nuggets.——The Bank of Tehama County shipped a gold bar valued at $25,000 which represented the output of the Midas mine, at Harrison Gulch, for April. The shipments have been averaging about $30,000 per month.——The recent threatened strike at Coram has been avoided as the officials of the Western Federation of Miners have refused to sanction the action of the smeltermen who quit because a non-union man was promoted over them.

SIERRA COUNTY

(Special Correspondence).—The Middle Yuba Hydro-Electric Co. expects to have its power lines completed to Alleghany within a few weeks.——The owners of the Haskell Peak have decided to resume operations at once. Henry Goering is manager.——The Rainbow Extension Co., near Alleghany, has decided to erect a mill this summer. The adit is in 300 ft. and is being driven on the vein in which the ore-shoot is three feet wide and of milling value throughout its developed length. O. A. Harlan is manager.——The Phoenix mine, near Sierra City, has been bonded to James Buckley and J. S. Daveler, of Alameda. It is equipped with a 10-stamp mill.——The Swastika company has placed orders for a 10-stamp mill which will raise the total of the company to 20 stamps. Lawrence H. Holly is superintendent.——George S. Stone and associates have purchased a hoist for the North Fork mine and expect to place eight men at work before the end of the month.——The Gray Eagle mine has been attached for supplies furnished by grocery firms.

Alleghany, May 9.

TRINITY COUNTY

(Special Correspondence).—The Keating property on the north fork of Trinity river will have a 5-stamp mill erected this summer. There are four claims in the group and a number of small rich veins have been opened.——Neely Thomas, operating on the flats at the head of Coffee creek, is to build a mill this summer.——A two-drill Rand compressor plant is being installed at the Wagner property on Coffee creek. It will be driven by water-power.——The Blue Jay will begin the installation of an 8-hp. Graupner mill this month as arrangements have been made with the owners of the water in Morrison gulch to supply water for power. A large sulphide vein has been opened by the main adit.——The capacity of the Headlight sawmill will soon be doubled. Elias Ellery has secured the logging contract.

Carrville, May 9.

TUOLUMNE COUNTY

(Special Correspondence).—The company which recently acquired the Moffitt gravel mine on the Tuolumne river near Jacksonville is expending a large sum of money in preliminary work and equipment.——The work of repairing the collar of the Providence shaft is progressing satisfactorily and additional men will soon be put to work. The mill at the Dutch mine will be started within a few days. The extension of the drift on the 400-ft. level into the Sweeney mine, which adjoins the former and which is under the same management, is contemplated. The two properties have been connected on the surface by a car-track.——Milling has been commenced at the Yellow Rock mine, and it is the intention to install a cyanide plant.——High-grade ore has been uncovered on the 100-ft. level of the Ida Klein mine, near Stent.——A new hoist is being installed at the Sunnyside mine, south of Tuolumne.——The new adit being driven at the Leap Year mine, on Table mountain, has entered a strata of rich gravel.

Tuolumne, May 9.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence).—A. H. Colburn, manager for the Reliance G. M. Corporation, states that a plant of machinery will be purchased at once and installed at the Sporting Times property in the Georgetown district.——The Homestake G. M. & M. Co., operating a group of claims on Lincoln mountain, is to purchase a small compressor-plant during the next 30 days. A. L. Stephens is manager.——W. E. Renshaw, principal owner of the Gem mine, has been appointed general manager for the Specie Payment Mining & Milling Co., succeeding A. M. Wells.——The King Solomon property at Lamartine, will be entered among the list of steady shippers during the month.——The mill at the Katie Emmett mine is to be enlarged, five new rapid-drop stamps having been purchased. Ford & Cannady are operating under lease.——The Tolland adit, owned and operated by Albert Hall, has intersected the Lamartine vein to the west and a fine streak of ore has been uncovered.

Old Town Mine.

Idaho Springs, May 7.

GILPIN COUNTY

(Special Correspondence.)—The Pozo property in the Nevada district has been entered among the list of shippers. Ore is being sent to the custom mills for treatment.—It is believed that inside of two weeks the Eureka mill will be ready to start.—J. N. Caldwell, of Denver, is manager.

Two carloads of ore were shipped last week by Shearer & Co., operating a lease on the Old Town, to the Modern smelter at Utah Junction.—The Bencie Investment Co. has secured a bond and lease on the Victor property.

Central City, May 7.

GUNNISON COUNTY.

The cutting of a number of rich silver-lead veins of ore in the Dupont tunnel which is penetrating Galena and Treasury mountains has definitely decided the building of an immense water power and milling plant by this company. The starting of this new enterprise will be no later than June, and will, in all probability result in operations commencing on many other promising properties in that section.—The Hard Cash Mines Co., whose properties lie at the north side of Galena mountain, has decided upon putting in a compressor plant and a pyritic smelter by which the ore will be smelted to 60% copper matte. Gasoline will be used to drive the compressor engines and crude petroleum to smelt the ores.—It is understood that the North Pole property will renew work in Crystal Basin this season and a matte furnace will be built later somewhere down near the river to which the ore will be delivered by a tramway from the mine.—O. F. Thomas is planning to start up his mine above Gothic in a few days.

LAKE COUNTY

Work has been started on the Helena shaft in Iowa gulch and wires are being strung to bring power from the mains of the Leadville Light & Power Co. A new electric hoist, two compressors, and pumps are to be installed.—A new company has been formed to re-open the old First National claim in the same district.—Connections with the Silent Friend have been through the Yak tunnel and in the future the property will be operated that way.—The Penn property, on Breece hill, continues to be one of the steadiest producers in the district. A number of lessees are working in the mine and meeting with good success.—A stringer of high-grade ore has been opened in the winze sunk in the St. Louis adit and drifts started to explore it.—Ore is now being hoisted from both shafts of the Baby property in California gulch.

TELLER COUNTY

The measurements taken at the Roosevelt deep drainage tunnel show a gain for the month of April of 376 ft. The total length of the tunnel is now 13,218 ft., the distance remaining to the main water course will not exceed 2500 ft.—The plant at the main shaft of the old Rittenhouse company's Gold hill property, now owned by the Cripple Creek & Colorado Gold Mining Co. has been started by Carlson and others, who have taken a two years' lease on the 11 acres contained in the Happy Year, White Elephant, and Fraction No. 1 lode mining claims. The shaft on the Rittenhouse has been sunk to a depth of 900 ft. and the present lessees will prospect the ground by extending the several drifts and cross-cuts.—The Anaconda mill has been overhauled and additional machinery of improved design installed preparatory to its active operation. The mill has a capacity of between 40 and 50 tons per day, and negotiations are under way looking to the entering into a contract for the treatment of all ores mined on the property of the Mary McKinney Mining Co. by O. Keener and associates, who have made an important surface discovery of milling grade ore. The mill is under lease to Pascal Craig, under whose personal supervision the alterations to the plant have been made.—The Callie Leasing Co., operating the Callie mine of the Stratton estate, a Gold hill property adjoining the Lucky Corner, has resumed shipments.

WHITE PINE COUNTY

The United Mining & Holding Co. has purchased the Spar copper group of claims from the estate of C. L. Tutt. The group contains 55 acres of patented ground and has been opened by 2200 ft. of development work disclosing a series of veins.

IDAHO

ADA COUNTY

The George F. Root Mining Co. is building a 50-ton mill at Boise and contracts have been let for stamps, concentration tables, and tanks for a cyanide annex. The concentrate will be re-ground and cyanided. F. M. Field is the metallurgical engineer.

BINGHAM COUNTY

(Special Correspondence.) The Inter-Mountain Placer Mining Co., managed by Fred W. Crockett, has installed and put in operation a cyanide plant on the Snake river, four miles from Blackfoot, for treating the auriferous sand on the banks and benches of the stream. The material consists of ordinary sand and magnetite, containing fine gold in free particles and as a film on the black sand. It is said to contain 50c. per ton. The stuff is moved by scrapers and passed dry through a revolving trommel, giving an undersize product of 20-mesh and reducing 4½ tons to 1 ton. It is elevated to a launder and sluiced to leaching tanks in which 0.21 lb. KCN is used per ton of screened product. Thomas Ferguson, of the Holden Cyanide Process Co., of Salt Lake, who installed the plant, states that the screened material will average $2 per ton, and that it can be screened and cyanided at a cost of 75c. per ton, the extraction reaching 90% and over.

Blackfoot, May 6.

IDAHO COUNTY

The American Eagle mine, eight miles east of Elk City, has been bonded to A. W. Boyd and will be re-opened. The property has been idle for several years but paid well when operated previously under the supervision of Mr. Boyd, and is expected to become an active producer in a short time as the property contains several good shoots and is equipped with a 10-stamp mill.—It is reported that the Butte Oregrande mine has been sold.—A rich discovery has been made on the Topeka claims where telluride ore assaying high in gold and silver has been found.

SHOSHONE COUNTY

Statements filed with the assessor of Shoshone county show that the net profits of the mines in the Coeur d'Alene district were more than $2,100,000 in 1909, five of the prominent companies reporting as follows: Federal Mining & Smelting Co., Mace mine, $469,155; Wardner mines, $350,678; Bunker Hill & Sullivan, $575,547; Hercules, $325,305; Hecla, $189,169; Snowstorm, $169,966. The Morning mine at Mullan was the only big producer worked at a loss last year, the net amount of expenditures over receipts being given as $58,822. The Hercules and Bunker Hill & Sullivan also spent large amounts in improvements and repairs.

MISSOURI

JASPER COUNTY

(Special Correspondence.)—It is the plan of a number of the large mining companies owning mining lands to reduce the royalties for the lessees, to encourage prospecting, and development of the properties.—One of the main developments going on in the district at present is the prospecting by the Granby company.—The Carl Junction camp is coming into greater importance through the efforts of three companies in different parts of the camp. To the north J. B. Meredith has taken a lease, installed a centrifugal pump, and drained the land to the upper levels. To the south the Mohler-Smith Co. has installed two additional pumps and is keeping the water down. This company has also built dikes around the mouths of the old shafts and drifts in order to keep the water from overflowing from the high-water season of Center creek and Spring river. A Kansas City company is draining old shaft No. 1 and a centrifugal pump recently installed has proved very satisfactory.—In the Alba-Neck City camp there is greater activity than at any time in the past three years. Several old properties have been taken over by new operators and are now producing.—The Cliffwood company has been extending its holdings by taking over the leases of the Sand Hill and the Van Hoose properties in the same vicinity.

Joplin, May 7.

MONTANA

BROADWATER COUNTY

The Radersburg Consolidated Mining Co., which recently took over the Ohio-Keating gold property, is likely soon to come into possession of two other properties; one of the Dewdrop group of claims adjoining the Ohio on the northeast, and the other a group of three claims lying about 1000 ft. south of the Black Friday property. It is said that the Black Friday property has opened a body of ore at a depth of 450 ft., where the vein is said to be widening. Some of the ore taken out recently averaged about $50 net per ton. Good progress is being made in installing the electrical equipment at the Keating Gold Mining property, and provided no delays occur the surface plant on the Blacker claims will be in operation this month.

LINCOLN COUNTY

The work of installing the machinery in the new mill at the Sylvanite mines is now in progress by the Lincoln Gold Mining Co., and it is thought that the mill will be in operation within a month. The mines are being retimbered and miners will soon begin taking out ore.

NEVADA

ESMERALDA COUNTY

On May 7 the Ford-McKay lease on the southern end of the St. Ives claim of the Merger Mines Co., at Goldfield, opened one of the richest shoots in the district. The drift on the 250-ft. level had been following a 2-ft. vein from which ore assaying about $100 per ton was being sacked when the rich shoot assaying over $1000 for a width of 3 in. was opened.——At the Goldfield Annex lease a raise is now being driven from the north drift 80 ft. north of the shaft to tap the ore-shoot at that point and explore the fault zone nearer the shaft with a view to sinking to tap the extension of the big vein. The ore opened on the intermediate level above the 800 has proved somewhat erratic and pockety.——The buildings for the mill and accommodation of the men at the Del Monte property at Mina have been completed and the machinery is being placed in the mill. The ore-bins at the mine have been filled though it is probable that more bins will be erected at the mill as it is the intention of the company to accept custom ore.

HUMBOLDT COUNTY.

There has been considerable activity in the Seven Troughs district lately and there has been some talk of consolidating the claims in that camp with the Coalition group as a centre.

LINCOLN COUNTY

(Special Correspondence).—The Pioche Metals Co., which installed a gasoline hoist about the first of the year, has since then sunk a shaft 290 ft., and the intention is to continue sinking till a depth of 400 to 500 ft. is reached. When the bottom of the shaft is at the 300-ft. level a crosscut is to be run to the ore, which occurs in a contact vein between limestone and shale. It has been decided to install an air-compressor, to be driven by a gasoline engine. A carload of ore on the dump, soon to be shipped, is believed will net $20 per ton, after shipping and smelting charges are paid. The ore contains principally silver and lead. The company owns seven claims, and has under bond at $60,000, the 12 claims of the Pioche Consolidated Mining Co., all situated four miles from Pioche. David Lemmon is in charge of the work, C. A. Cook, of Salt Lake, being secretary and treasurer of the company.

Pioche, May 7.

NYE COUNTY

The main shaft at the Belmont mine, at Tonopah, cut an orebody 60 ft. below the 1000-ft. level that has the appearance of becomming a bonanza, the whole bottom of the shaft being in good milling ore.——As the result of the semi-monthly clean-up of the Montana Tonapah for the last half of April, 25 bars weighing 80 lb. each have been shipped to the Selby refinery bringing the total bullion shipment for the month up to 4100 lb. In addition to this 101 tons of concentrate were forwarded to the same firm. The mill is reported to be making an extraction of 91.6%.——At the Tonopah Extention mill the clean-up resulted in 17 tons of sand concentrate valued at $550 per ton, 18 tons of slime concentrate valued between $250 and $300 per ton and 8 bars of bullion weighing 900 lb. and valued at $9000. The mill is treating 110 tons per day and underground good ore is being opened by the development work in all parts of the mine. This is especially true on the 400-ft. level where the stopes have opened several good orebodies.——The Round Mountain Mining Co., at Round Mountain, shipped $33,000 worth of bullion as the result of the April clean-up.

WHITE PINE COUNTY

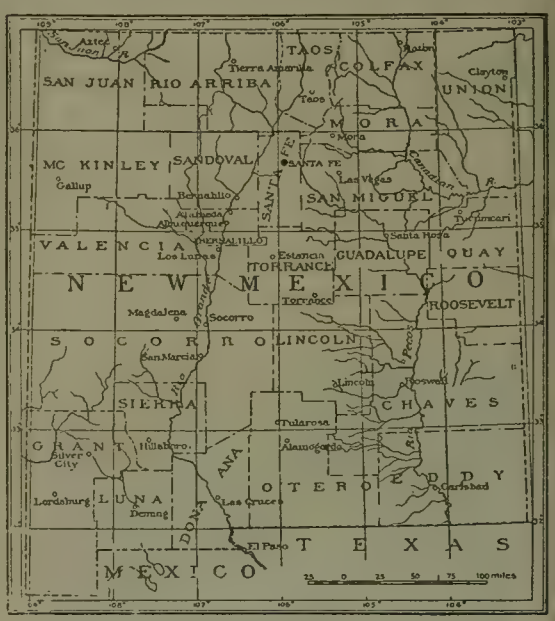
(Special Correspondence).—The Giroux shaft has been permanently timbered to the 1000-ft. level and the surface is being graded for a new hoist. Two compartments have been sunk to the 1200-ft. point, the remaining three will be completed at an early date.——The April output of the Nevada Consolidated was approximately 6,000,000 lb. of blister copper. It is understood that no effort will be made to increase production at this time and that the installation of a steam shovel on Liberty ground and the addition of a new unit to the concentrator will be postponed until next fall.——The Amalgamated Nevada Mines Co., operating a group of gold properties at Blackhorse, is installing a 10-stamp mill, two concentrators, and an electric lighting plant. James H. Marriott is general manager.

Ely, May 7.

NEW MEXICO

SIERRA COUNTY.

(Special Correspondence).—The Black Range Reduction Co. is having surveys made near the hot springs in the vicinity of Monticello preliminary to the installation of electric machinery for producing about 200 hp. for the company's properties in the north end of the district.——The owners of the Gold Dollar properties expect to install a large plant of machinery including air-compressor and other surface equipment soon.——A telephone line has been completed a distance of about three miles from the office of the U. S. Treasury Co. at Chloride to this company's main workings at shaft No. 1.



Map of New Mexico.

Chloride, May 7.

SOCORRO COUNTY

(Special Correspondence).—The drift on the 300-ft. level west of the Ernestine Mining Co. is in good ore the vein being approximately 5 ft. wide. The mill crushed 680 tons during the week producing 53 sacks of concentrate though no bullion was smelted.——In the Deadwood mines crosscuts on the No. 4 level are being driven through the No. 2 orebody.——The new mill of the Socorro company is run-

ning smoothly now crushing about 100 tons per day. The capacity of the Butters has been doubled to handle the whole amount of pulp from the stamps. The lower levels of the Mogollon Gold & Copper Co are being kept free from water and development is being carried forward from the main adit.

Mogollon, May 6.

OREGON

BAKER COUNTY

The Mollie Gibson Gold Mining & Milling Co has been incorporated to open the Mollie Gibson group of claims on the north fork of John Day river a few miles from Bourne. There is a 4-ft. vein on the group which is composed of 12 claims.——The management of the Gold Bug mine in the Susanville district has purchased the hoist that was installed at the Mountain Belle property and is now erecting it on the 300-ft. level of the Gold Bug. It is reported that the company will commence shipping the high grade ore some time in June.

UTAH

The 44 members of the senior class of the Colorado School of Mines are in Utah for a week of instruction and observation at the various mines and metallurgical plants in the State. The party is accompanied by the following members of the faculty of that school: A. J. Hoskin, A. C. Smith, mining; F. W. Traphagen, W. G. Holdane, metallurgy; H. B. Patton, geology; F. H. Cronin, mechanics. Butte and Anaconda are to be visited next.

JUAB COUNTY

(Special Correspondence).—The Uncle Sam mine, which is under the superintendency of C. C. Griggs, of Knightsville, is shipping about 30 tons per day of ore running $30 per ton, and the prospect is that this rate of shipment will be kept up during the year. The May Day, under the same management, is milling a small tonnage of ore and shipping some first-grade, the return from concentrate and crude ore being sufficient to pay operating expenses. In prospecting on the May Day to a depth of 1100 ft. the lowest workings were still in the leached zone, and heavier equipment will probably be provided for further sinking.——A new Hendrie & Bolthoff double-drum electric hoist will soon be installed at the 900-ft. shaft of the Yankee Consolidated Co. near Eureka, which will afford facilities for deeper sinking. The first 300 ft. was in porphyry, below which was limestone. Cross-cuts from the shaft have opened leached out veins at the 400, 500, and 800-ft. levels, and the object of further sinking is to open these veins where their filling may be mineralized. The old workings, from which five or six cars of ore were mined and shipped in April, are entered through a 2000-ft. adit, a 500-ft. incline from which was sunk 200 ft. in ore. This ore was found in parallel channels. The ore shipped was of two grades; the first-grade assayed 35% lead and 30 oz. silver; the second, 18% lead and 15 oz. silver per ton. L. Merriman, the superintendent, states that the dump contains 18,000 tons of milling ore.

Eureka, May 5.

WASHINGTON

OKANOGAN COUNTY

The Detroit-Oroville Exploration Co. has commenced drilling its property with a Sullivan Beauty machine that has a capacity of 800 ft. A 30-hp. boiler has been installed and three holes totaling 1000 ft. will be put down to test the ore.

CANADA

BRITISH COLUMBIA

(Special Correspondence).—The recent discovery on the Athabasca mine near Nelson is showing up well. The gold-bearing vein is 10 to 18 in. wide and has every appearance of continuity as far as opened. The ore contains a small percentage of silver, but the gold mills freely.——The ore now being opened up on the Panama on Sheep creek assays as high as 2220 oz. silver per ton.——The Aurora Mining & Milling Co., at Moyie, has taken a lease on the Alice concentrator at Creston and will separate the zinc from its silver-lead ore at this works before shipping to the Trail smelter, where zinc-bearing ore is treated. The zinc concentrate will be shipped to the Empire Zinc Co. at Denver.

The amount paid the lead miners of this district on account of bounty during the year ended March 31 was $33,000, about the same amount as for the previous year. It amounted to about 55c. per 100 lb. of lead. All of the ore was treated at the Trail smelter.——The strike of miners at Greenwood has not resulted in an absolute shut down of the B. C. Copper Co. workings. The management has announced its intention of continuing to work and has a force of 25 men at the mine and 35 at the smelter. The B. C. Copper Co. has finally secured a contract from the Dominion Copper Co. whereby the latter is to begin shipments of ore to the Greenwood smelter.——The Nicola Valley Coal Co. will build 1000 coke ovens as soon as the construction of the Kettle Valley railway is under way. The Pacific Coast Collieries property at Merritt will be opened shortly with a force of about 150 men, producing 500 tons per day. A 17-ft. vein has been found on the 107-ft. level. The Diamond Vale property in the same district is soon to put a force of 100 men to work. There is a probability of the Coal Hill syndicate starting work on its property.——The Canadian Pacific railway mining department has secured control of the coal properties of the Western Fuel Co. as an offset to the acquisition of the Dunsmuir mines by the Canadian Northern.——Large coal deposits have been found 200 miles north of Hazelton. It is of a bituminous character. One seam opened up has proved over 12 ft. thick.

Rossland, May 7.

In the Coast district there is much activity in coal mining; also much speculation in connection with prospecting in the Portland Canal district, where some ores returning high assay value in gold and silver have been found. Two or three companies are developing their mineral claims in a way that will prove their mining possibilities, but there are some of which this can not at present be said. The Portland Canal Mining & Development Co., in particular, has gone about its work in a systematic manner, first opening its property by several prospecting adits, and afterward erecting an aerial rope-way for conveying supplies to the claims and ores to a small concentrating mill it is equipping near the railway line. Among those reported to be largely interesting themselves in the new mining camp are Mackenzie & Mann, the well known firm of railway men, of Toronto, Ontario, who are stated to intend mining and smelting on a considerable scale in the district, besides building a railway of 20 to 30 miles to tidewater.

MEXICO

CHIHUAHUA

In a circular to the stockholders of the Rio Plata Mining Co. Henry W. Miller, the president, states that on completion of car No. 38 of concentrate, March 5, the stamp-mill was closed down in conformity with the recommendation of the general manager in the last annual report, in order to utilize the whole of the cyanide plant in reducing the accumulation of tailing to a point where all danger of loss during the rainy season will be eliminated. The stamps will again be put in operation about July 1 when the rainy season sets in. The general manager estimates that the minimum average net monthly profit for the fiscal year 1910 will be $20,000. The present quarterly dividend of 2% will be maintained until the board of directors think it advisable to increase it. The total value of the silver recovered during the month of March was $26,711 and the net operating profit $17,371.

SONORA

J. S. Williams, Jr., the superintendent for the Moctezuma Copper Co., is authority for the statement that the company will install an aerial tramway from the concentrator to Nocazari canyon to dispose of the tailing from the big plant. There has been a great scarcity of water this year and the tailing has not been washed away by the river as was expected.——A. J. King and associates have secured a bond on the Cinco de Mayo property south of Douglas and will develop the property on a larger scale.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

RALPH ARNOLD is at Washington.

ERROL MACBOYLE has gone to Nevada.

W. W. ORCUTT has gone to Washington.

E. J. SWEETLAND is at Guanajuato, Mexico.

SEELEY W. MUDD is expected at San Francisco.

COURTENAY DE KALB has returned to San Francisco.

H. F. A. RIEBLING, of Denver, is in Illinois examining lead mines.

BASIL PRESCOTT, who recently returned from San Salvador, was in San Francisco.

FRANCIS A. THOMPSON was at Republic, Washington, recently on professional work.

GARDNER F. WILLIAMS will attend the Semi-Centennial of the University of California.

L. HIGGINS was in San Francisco this week returning from Nevada to Los Angeles.

J. S. MCARTHUR was in San Francisco May 7 on his way from Cobalt, Ontario, to Mexico.

C. R. VAN HISE will attend the International Geological Congress at Stockholm this summer.

ROBERT MUSGRAVE is with the Exploration Company of England and Mexico, in Mexico City.

CLIFTON H. WILDMAN is manager at the Morning and Evening Star mines, Ward, Colorado.

H. VINCENT WALLACE is at the mines of the Tularosa Copper Co., Bent, New Mexico, this month.

ELMER A. HOLBROOK has returned to the East from Mexico, but is leaving immediately for a trip to Cobalt.

JOHN M. NICHOL is representing the Hammond Iron Works and the Hendryx Cyanide Co. at Mexico City.

MAURICE W. SUMMERHAYES, of El Paso, has gone to New York, Toronto, and Montreal on his way to London.

LUDWIG ROSE, mining assessor, of Cologne, Prussia, has been in Utah recently investigating mining and machinery methods.

L. VOGELSTEIN & Co. give the following figures of German consumption of foreign copper for the months January to March, 1910:

	Tons.
Exports of copper	44,663
Imports of copper	1,705
Consumption of copper	42,958

as compared with consumption during the same period in 1909 of 34,029 tons. Of this quantity 40,022 tons were imported from the United States.

The Prospector

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

W. F. C., Rosario, Mexico: Common yellowish green epidote.

H. A. C., Ingot, California: Quartz-vein rock stained with limonite and containing galena. No tungsten.

F. G. C., Lordsburg, New Mexico: The clay appears to be a disintegrated volcanic rock. It is not a fire-clay on account of its easy fusibility.

J. C. S., Danville, Washington: No. 1, a contact phase of granite or diorite; No. 2, quartz-vein rock stained with limonite; No. 3, diorite; No. 4, granite porphyry; No. 5, biotite diorite; No. 6, contact phase of granite or diorite; No. 7, diorite; No. 8, feldspar pegmatite.

Market Reports

LOCAL METAL PRICES.

San Francisco, May 12.

Antimony	12—12¾c	Quicksilver (flask)	48—49
Electrolytic Copper	15¼—16½c	Spelter	7– 7¾c
Pig Lead	4.70—5.65c	Tin	36—37½c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
May 5	12 31	4.34	4.87	
" 6	12.31	4.34	4.87	53⅞
" 7	12.31	4.33	4.87	53⅝
" 8	Sunday.	No market.		
" 9	12.44	4.31	4.89	53⅝
" 10	12.67	4.31	4.93	53⅞
" 11	12.69	4.31	4.99	54⅛

ANGLO-AMERICAN SHARES.

Cabled from London.

	May 4. £ s. d.	May 12. £ s. d.
Camp Bird	1 9 6	1 11 0
El Oro	1 7 0	1 7 3
Esperanza	2 8 9	2 14 9
Dolores	1 8 9	1 [illegible] 9
Oroville Dredging	0 8 9	0 9 4½
Mexico Mines	8 11 3	8 10 0
Tomboy	0 18 0	0 [illegible] 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, May 12.		Closing prices, May 12.
Adventure	6	Mohawk	49
Allouez	43	North Butte	32¾
Atlantic	7½	Old Dominion	37
Calumet & Arizona	63	Osceola	136
Calumet & Hecla	580	Parrot	14¾
Centennial	17	Santa Fe	1⅞
Copper Range	66	Shannon	11¼
Daly West	8	Superior & Pittsburg	12
Franklin	12½	Tamarack	52
Granby	40	Trinity	57⅛
Greene-Cananea, ctf	8¾	Utah Con	24
Isle Royale	17½	Victoria	3
La Salle	12½	Winona	8½
Mass Copper	6½	Wolverine	118

(By courtesy of J. C. Wilson, Mills Building.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, May 11.		Closing prices, May 11
Amalgamated Copper	69½	Miami Copper	21⅝
A. S. & R. Co	78⅞	Mines Co. of America	½
Boston Copper	18½	Montgomery-Shoshone	⅝
B. C. Copper Co	5⅞	Nevada Con	20¼
Butte Coalition	21	Nevada Utah	¾
Chino	12½	Nipissing	10
Davis-Daly	1¾	Ohio Copper	2½
Dolores	6	Ray Central	2⅝
El Rayo	3	Ray Con	18⅜
Ely Central	1⅞	South Utah	1¾
First National	2¾	Superior & Pittsburg	12½
Giroux	7⅞	Tenn. Copper	27⅜
Guanajuato Con	1⅛	Trinity	6
Inspiration	7¼	Tuolumne Copper	8½
Kerr Lake	8⅜	United Copper	6½
La Rose	4⅜	Utah Copper	45⅞
Mason Valley	7½	Yukon Gold	4⅜

SOUTHERN NEVADA STOCKS.

San Francisco, May 12.

Atlanta	$ 13	Mayflower	$ 2
Belmont	3.82	Midway	29
Booth	14	Montana Tonopah	94
Columbia Mtn	6	Nevada Hills	60
Combination Fraction	47	Pittsburg Silver Peak	70
Daisy	7	Rawhide Coalition	25
Fairview Eagle	12	Rawhide Queen	27
Florence	2.15	Round Mountain	50
Goldfield Con	8 00	Silver Pick	9
Gold Kewenas	6	St. Ives	16
Great Bend	3	Tonopah Extension	1.05
Jim Butler	23	Tonopah of Nevada	8 87
Jumbo Extension	22	West End	45

(By courtesy of the San Francisco Stock & Exchange Board.)

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS

MINING CLAIMS—ADVERSE POSSESSION

A possessor's right to ground covered by a mining claim, regardless of whether or not it was subject to location as a mining claim, may be supported by adverse possession alone. And such possession would give him all ledges or veins apexing within the boundaries of the claim, and the right to follow them within his side lines extended vertically downward. Whether or not such adverse possession would carry with it extralateral rights, in the event the ground passed to a town site for town site purposes under a patent seems never to have been passed upon and settled, and the Supreme Court of Nevada declined to pass upon the question, where the validity of a location could be determined without passing upon that particular question. But if the claim in question never passed under a town site patent, then the locator is entitled to any extralateral rights which he may have established by the evidence. And the rule is that a valid and subsisting mining claim on land covered by a town site patent at the time the patent was issued does not pass thereunder, nor is the title or right of possession affected thereby under the United States statute declaring that no title shall be acquired to any mine of gold, silver, cinnabar, or copper, or to any valid mining claim or possession held under existing laws.

Golden v. Murphy, (Nev.) 103 Pac. 394, July '09.

TOWN-SITE PATENT—EFFECT ON MINING CLAIM

The Supreme Court of Nevada questioned whether a discovery, sufficient to support a valid mining location so as to exempt such location from the provisions of a town-site patent, could be held to the same degree of strictness as would be required in the case of a mine known, or claimed to be known to exist at the time of the issuance of such town-site patent, but which had not previously been located. And where it appeared that the ground embraced within what was popularly known as the Canyon claim was sold as town lots under a town-site patent, it did not appear that the lot purchasers ever acquired a possession from the claimant to the ground under prior existing mining locations. It appeared, too, that the ground covered by the Canyon claim had been held as a valid and subsisting mining claim from a time long prior to the date of the town-site patent, continuing to the date of the controversy, and that no one ever questioned the right of the present claimant and prior locators of the ground covered by such Canyon claim to hold the same as mining ground and has never attempted to establish a superior right to said ground. Accordingly the Canyon mining claim was said to be a valid mining claim unaffected by the town-site patent.

Golden v. Murphy, (Nev.) 103 Pac. 394, July '09.

BOUNDARIES OF MINING CLAIM—MEANING OF 'ABOUT'

In describing the boundaries of a mining claim and in giving distances of the lines by the use of the word 'about' in connection with a certain given distance is meant that the given distance is not to be taken with exact precision, but that established corners and monuments are intended to control the actual distance stated. And in case of doubt as to boundary lines, monuments and lines actually marked and capable of identification control courses and distances.

Bullion-Beck & Champion Min. Co. v. Eureka Hill Min. Co., (Utah) 103 Pac. 881, Aug. '09.

PARTNERSHIP IN WORKING MINE

Persons who own a mine as tenants in common may form a partnership to work it in which the mine itself may or may not become a firm asset; or such persons may agree to work the mine in common without a partnership. But where a partnership was formed between tenants in common to operate a mine constituting the common property and after the mine had been so worked, one of the partners was entitled to sue his co-partners in equity for an accounting.

Howard v. Luse, 171 Fed. 584, June '09.

MINING LEASE—RECOVERY OF MINIMUM RENTAL

A lease of a coal mine provided that the lessee should not be required to pay the minimum rental but might continue mining operations where the coal was less than 2½ ft. in general thickness. In an action by the lessor for the minimum rental, the Supreme Court of Pennsylvania said that the burden was on the lessee to prove that the coal was of less thickness than 2½ ft., and where the evidence was conflicting, and tended to show that the lessee had not made proper examination to test the actual thickness, the lessor was permitted to recover.

Holt v. Kelley, (Pa.) 73 Atl. 947, May '09.

VALIDITY OF MINING CLAIM

A valid mining claim can only be based upon a discovery within the limits of the claim, and the existence of mineral in such quantities as to render the land more valuable for mining than for any other purpose, and the mineral discovered should be such and in sufficient quantities as to justify a prudent man in the expenditure of time and money in the exploration and development of the claim.

Golden v. Murphy, (Nev.) 103 Pac. 394, July '09.

COMPANY REPORTS

BROKEN HILL PROPRIETARY, LTD.

The forty-ninth semi-annual report of this company states that owing to labor troubles in Australia work underground with the exception of keeping the mines drained has been entirely suspended. As many of the mines at Broken Hill were short of coal and supplies, this company sold a portion of its stock, but had to curtail these sales owing to the long continuance of the strike. At Broken Hill the concentrator was kept running till near the end of the year, when it was shut down to give the Port Pirie smelter the benefit of the supplies on hand and keep it in continuous action, as it was here that the company was treating contract ore. The mill treated 184,387 tons of tailing from the dumps, producing 23,354 tons of slime, 8363 tons of lead concentrate, and 151,859 tons of re-ground tailing for further treatment in the zinc plant. The re-ground tailing produced 40,055 tons of zinc concentrate. The smelter treated 106,338 tons of material producing 39,826 tons of lead, 1,920,824 oz. silver, and 944 oz. gold. A new bag-house has been erected by the company and 3196 tons of sulphuric acid made. Of this 985 tons have been sold at satisfactory prices, the rest being used in the company's refinery. The average price for lead per ton was £12 17s. 11d., and for silver per ounce, 2s. 1½d.

STANDARD CONSOLIDATED MINING CO.

The year for this company, operating at Bodie, California, has been rather unsatisfactory, as work carried on during the past thirty-one years has almost exhausted the ore-supply. Old drifts and stopes were re-opened at heavy cost to secure low-grade ore that had been left in early days, and poor ore taken from the dumps. In the mill 20 stamps were kept in operation 168 days. During the year 10,990 dry tons averaging $14.16 were mined, milled, and treated in the slime plant at a total cost of $13.15 per ton, with an extraction of 86.76% for the entire plant. The New Standard mine purchased in 1907 has been prospected but no amount of milling ore opened. During the year the company has bought the Golden Lily claim, which is well situated and expected to contain bodies of commercial ore.

NIPISSING MINES COMPANY

The fifth annual report of this company, operating mines at Cobalt, Ontario, states that dividends amounting to $1,500,000 have been paid during the year and ore reserves estimated to the value of $3,269,000 blocked. There was mined 6412 tons ore containing 4,646,876 oz. of silver, the metal being recovered at a total cost of $0.1639 per ounce. Trenches aggregating 33.1 miles were dug to a depth of 3.4 ft., and 8451 ft. of development work underground carried forward.

Keeping Shop Records of Belting

The average mill and smelter buys a large amount of belting each year, which is chopped up and put on various machines throughout its plant as belting gives out. Few plants keep any record of the actual length of service of the belts. At the end of a year's time it is not definitely known whether the belt equipment for the various kinds of machinery in the shop has cost more than it should. All users of belting will be interested in a plan of keeping shop records which has just been devised by the engineers of the NEW YORK LEATHER BELTING Co, 51 Beekman street, New York City. Charts have been printed which can be tacked up on every floor in a factory, and, by merely filling in certain blanks, entailing little or no trouble, at the end of the year the exact record of belts on every machine on that floor can be absolutely checked up. The charts may be had by applying to the above company.

New Placer Mining Machine

The solution of the economical use of water, which has baffled placer miners for a long time, is said to have been satisfactorily worked out in a machine which is this month being placed on the market for the first time by The Moran Company of Seattle, Washington. The patent rights of the new apparatus, which is a gold-saver and tailing stacker combined, have been taken over from the Sibbett Mine Equipment Co. of Seattle. Associated with this company are J. B. Hodgdon, a mining man of long experience, and George E. Sibbett, a conveying engineer of known reputation. It is claimed that the machine, which has been named the Hodgdon, reduces the amount of water required for hydraulic mining to one-fourth the volume heretofore employed, or virtually increases the efficiency of the miner's inch about 400%. The machine rests on rails and can always be kept close up to the working face of the mine, with the result that the gravel capacity of each giant is practically doubled. In mining, the gravel is piped into the conveying flume, in the same manner as in bedrock flumes, but the water used in breaking down the face is all that is required to concentrate the gold, and this may be used over and over. The gravel is advanced by conveying machinery instead of the force of water, and a higher percentage of gold extracted than can be obtained by the ordinary sluicing methods. The flume is elevated at an angle of about 30°, and the tailing easily disposed of by being carried to any desired height. This machine uses only about one-fifth the power of a dredge of the same capacity. The manufacturers confidently expect that through the use of the Hodgdon system, hundreds of acres of placer ground will be opened up that were heretofore considered of too low grade for profitable mining.

Cost of Power Transmission—Electricity Versus Compressed Air

The Pneumelectric Machine Co. of Syracuse, New York, was recently asked to submit figures based upon the following assumptions; distance of transmission, 1 mile; power delivery to the mining machines, 200 hp.; air-pressure delivery, 80 lb.; voltage delivery for direct-current motor, 250; allowable loss of pressure in transmission, 10%; allowable drop in voltage in transmission, 10%. Assuming 20 cu. ft. of free air per minute required per brake horsepower for the air machine, the calculation shows that 620 cu. ft. of compressed air at 80 lb. would be delivered per minute, and that by D'Arcy's formula this volume would require an 8-in. transmission pipe. At $1.78 per foot the pipe one mile long would cost $8400. This then is the cost of the installation of the piping. In the case of the electric transmission, by assuming 93% efficiency for the motor, and at current prices for copper and cable hangers, calculation shows that the 640 amp. required at the motor would necessitates a cable of 1,250,000 cm., which would weigh 79,800 lb. The cable would cost $11,970 and the hangers $510, making a total cost for electrical transmission of $12,480. These figures show that as far as the cost of installation goes the air transmission would be cheaper than the electric wires, but the installation cost is really a small part of what might be termed the expense of transmission. The choice of system is reversed when the total expense is considered. This is shown by the size of the power station. For electric transmission 640 amp. at 278 volts would mean that the generator would supply 178 kw., and assuming a combined efficiency of engine and generator of 86%, 207 kw. or 278 hp. would be required at the power-house to produce 200 hp. at the motors. At $30 per horse-power, the annual expense would then be $9400. With the air transmission, on the other hand, a 2-stage compressor would require 172 hp. per cubic foot of free air per minute, making a total of 688 hp. required at the compressor to produce 200 hp. at the machines. At $30 per horse-power this would mean $20,640 per year. Stated in another way, the electric line loses only 78 hp., while the air line throws away 488 hp., which means that the loss, if air line were used in place of electric, would be $12,300 per year, a sum sufficinetly large to practically pay the original first cost of the electric wiring. This may seem large, but these calculations show the air transmission to be only about 40% as efficient as the electric transmission system.

PUBLICATIONS RECEIVED

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

YEAR-BOOK FOR 1908. Illinois State Geol. Surv., Bull. 14. Pp. 394, ill., index. Urbana, 1909.

A general report on the work of the Survey followed by special papers, including: 'Report of the Co-operative Topographic Survey of Illinois', by W. H. Herron; 'Studies of Illinois Coals', by H. F. Bain, Frank W. De Wolf, J. M. Lindgren, Perry Barker, George S. Rice, J. M. Snodgrass, A. Bement, W. F. Wheeler, C. K. Francis, and H. C. Hoagland; 'Coal Deposits and a Possible Oilfield near Duquoin', by Jon Udden; 'Costs of Foraminifera in the Carboniferous of Illinois', by R. M. Bagg; 'Natural Gas in the Glacial Drift of Champaign County', by C. F. Knirk; 'Artificial Silicates with Reference to Amorphous Silica', by W. S. Williams; 'Paleobotanical Work in Illinois in 1908', by David White; 'Proceedings of the Illinois Fuel Conference'.

ENGINEERING INDEX AND ANNUAL FOR 1909. Pp. 471. The *Engineering Magazine*, New York, 1910. Price $2.

This is the annual compilation from the 'Engineering Index', published monthly in the *Engineering Magazine*. The Index proper is preceded by a classification which will enable the user to quickly find articles on subjects of interest to him.

THE MISSISSIPPI VALLEY BETWEEN SAVANNA AND DAVENPORT. By J. E. Carman. Illinois State Geol. Surv., Bull. 13. Pp. 96, ill., index, maps. Urbana, 1910.

Another of the 'educational bulletins' in which the State Survey is attempting to make geology plain and serviceable to the people of the region discussed.

GEOLOGY OF THE ELIZABETHTOWN AND PORT HENRY QUADRANGLES. By James F. Kemp and Rudolf Ruedemann. New York State Museum, Bull. 138. Pp. 173, ill., maps, index. Albany, 1910.

This bulletin is of especial interest to students of iron ores, aside from its local value.

MINING INDUSTRY OF NORTH CAROLINA DURING 1907. By J. H. Pratt. North Carolina Geol. & Econ. Surv., Econ. Paper 15. Pp. 176, ill. Raleigh, 1908.

A general account of the occurrence and production of minerals in the State, with a special report on mineral waters.

WEATHERING OF COAL. By S. W. Parr and W. F. Wheeler. Univ. Illinois, Eng. Exper. Station, Bull. 38. Pp. 43, ill. Urbana, 1909.

Results of experiments, series of 1909, continuing the work described in Bulletin 17.

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EDITORIAL.

The Fulfilment of the Years

On May 24, 1860, the MINING AND SCIENTIFIC PRESS was founded at San Francisco. This issue is published 50 years afterward and celebrates a half-century of technical journalism. We cannot claim the antiquity of *The Spectator* nor that of *The Times*, but it is our privilege to be the oldest mining journal on the American continent. However, age in itself is nothing to boast of, unless accompanied by usefulness. Whether the MINING AND SCIENTIFIC PRESS has performed useful service during the past 50 years is for our readers, their fathers, and their grandfathers to say. All we can state with confidence is that the editors and managers of this paper have done their best, and that they have been rewarded by the increasing support of a host of friends scattered all over the world. To these friends it may prove interesting to recall the changes of control that have given a varied but consistent character to the paper. The first publishers of the *Scientific Press* were Winslow & Company, a firm whose active representative was J. Silversmith. He was succeeded in 1862 by W. B. Ewer and C. W. M. Smith, who in turn gave place, December 14, 1863, to Dewey & Company. Thus Alfred T. Dewey became identified with the MINING AND SCIENTIFIC PRESS, the addition to the name being significant. For 30 years he di-

rected affairs. In June 1893 J. F. Halloran bought control and retained it until December 1905, when he sold his interest to T. A. Rickard, who also became editor.

If long life be the reward of good conduct, the editors may take that unction to their souls, for it is a pleasure to state that nearly all of them are still alive and well. Almon D. Hodges, Jr., who was editor from 1869 to 1871, is now an honored citizen of Boston; Charles G. Yale, who edited the paper from 1871 to 1893, is statistician to the U. S. Geological Survey in San Francisco; and W. H. Storms, who was in charge between 1897 and 1905, has just published a valuable textbook on mine timbering. During shorter intervals Dr. Henry De Groot, E. B. Piper, J. D. McGillivray, Clarence S. King, and R. L. Dunn served in an editorial capacity. During his management Mr. Halloran also supervised the reading matter, and when he resigned the ownership became incidental to the editorship.

In the business department H. F. Dexter, a nephew of Dewey, is still on deck after 32 years of faithful service, and John J. Young, the chief of the composing room, has performed a service much more than mechanical for 27 years. Elsewhere the editor who was at the helm during the troublous days that followed the earthquake-fire of 1906 gives an account of the way in which the M. & S. P.—as it is known to its friends—was rehabilitated after a great disaster, and the story makes it evident that the spirit of true journalism united the entire staff and linked every member of it in loyalty to the traditions of an institution the spirit of which no physical disaster could destroy.

Fifty years is not much to the geologist, it is a brief period to the philosophic historian, but in California it is an age. In 1860 the Comstock Lode had just been discovered, the Civil War was about to begin, placer mining had reached its zenith, but vein mining had barely begun. In a feeble way smelting had been attempted in California. The existence of showy deposits in Calaveras county, as stated by Mr. L. S. Austin in this issue, led to the development of a metallurgical industry, which with some vacillation has continued to the present day. It is amusing, however, to note that the metallurgist of that period was content with, or resigned to, a capacity of eight tons of ore per diem for each of two blast-furnaces. As early as 1870 water-jackets were in use at the works mentioned at Copperopolis. Reverberatory smelting was also attempted at Antioch, a town now languishing at the junction of the Sacramento and San Joaquin rivers. This location illustrated thus early the necessity for placing reduction works at tidewater near the commercial focus of California. Today the Selby Smelting & Lead Company's great works on San Francisco Bay show how insistent was that demand, and how well it was answered. Near it are the works of the Mountain Copper Company, where advanced methods introduced by Mr. Lewis T. Wright, enable copper smelting to be conducted in the midst of a thickly populated district without offense or protest, the sulphur fume being reduced to commercial acid by the chamber process and used in the conversion of phosphate rock to the soluble form. The Peyton Chemical Company is also smelting copper ore and concentrate of gold-bearing pyrite, on San Francisco Bay, producing contact-acid from the sulphur fume. It is interesting to observe that in 1860 the era of machine work in mining was just dawning. The rich placers had hitherto furnished material from which to extract fortunes by hand methods. The rich ore-shoots on the Mother Lode and the northern gold-belt of California admitted the winning of profits by the application of home-made machinery of medieval design. The period of economy in operation, favored by the application of the principle of division of labor, was just beginning for the miner. But there had been a strong incentive to development. Just such enormous reward for comparatively small expenditure of capital was needed to awaken a nation to the possibilities its Continent held for yielding wealth from mineral deposits. It emboldened the pioneer; it gave faith; it drew to the task the men of stronger nerve and brain. These men went forth from the western fringe that had been dominated to the further conquest of a great interior that held opportunity, not greater than those men dreamed, for they were endowed with imaginations kindled by the gold of California, but as great as they hoped, though in a different way. Rich streams of golden gravel like those of the Black Hills, and elsewhere, though overwhelmed with greedy hordes of fortune-seekers, were only incidents in the later unfolding of resources that meant the subduing of a wilderness to the purposes of civilization. Witness the Comstock, which after a whirl of unrestrained excitement has become the basis of mining that will endure longer than we can now foresee! Witness also the enthusiasm at Butte when rich silver ores inflamed the minds of the early comers, who have been followed by the orderly multitudes who are winning millions of pounds of copper each year under the guidance of mammoth companies whose life will extend far into the future. The immense industries of Colorado have grown up within this epoch of fifty years, and Arizona, now threatening to become the premier mining region of America, was still unwrested from the Apache at the beginning of that period. The art of gold dredging has been evolved as a means for recovering the precious metal even from gravel of low tenor, and the cyanide process has revolutionized the metallurgy of gold and silver, while copper matte is now 'blown to blister' in a few hours, and then electrolytically refined, whereas a half century ago the slow and costly reverberatory process was used, producing at best only an impure grade of metal unless the original ore was of exceptional quality. And who, looking back upon this, can doubt that in the next fifty years even greater progress will be made? In that progress technical science will play a dominant part, and it will be the privilege of technical journalism in general, and of the MINING AND SCIENTIFIC PRESS in particular, to inform, to help, to guide the captains of industry under whose creative hands enterprise will flourish and commerce expand. No vividness of imagination is needed to picture the growth of the communities dwelling on the Pacific Coast of North America; the Panama

Canal is being built, the centre of population trends westward, the path of empire has halted, the Orient meets the Occident at the Golden Gate, the MINING AND SCIENTIFIC PRESS is published at the cross roads of the world.

Time was when this paper looked only to local support and concerned itself only with local industry. During Mr. J. F. Halloran's régime the field of usefulness was enlarged so as to cover the Rocky Mountain region, but since he yielded control, in December 1905, the scope of the paper has been further enlarged so as to cover metal mining throughout the world. Nothing is alien to the MINING AND SCIENTIFIC PRESS that concerns the miner. The name lays emphasis on the mining and then on the scientific aspects of the great search for minerals. The paper was started when mining meant digging holes into the ground, and it has lived to see the application of modern science in every department of a world-wide industry. In 1906 a motto was adopted: "Science has no enemy save the ignorant." We may also say: Mining has no friend like Science.

In bringing science to the every-day aid of the miner, it has been the privilege of technical journalism to be the agent of transmission, to be the bearer of the knowledge that gives light underground and to carry the tools that give a tenfold strength to the hand of man. That has been the mission of the M. & S. P. for fifty years; that will be its mission in the years to come.

Our Motto*

A good wine needs no bush and a suitable motto should require no explanation. Nevertheless, it seems fitting at this time to give reasons for the faith that is in us. "Science has no enemy save the ignorant." It is a true saying and worthy of all acceptation. Time was when the mariner cut down the oak and made him a vessel wherewith to cruise the seven seas; he depended upon the fickle wind to propel his ship and he steered by the light of the stars. As he fared forth across the main and began to make traffic over the waste of waters, he found the need of something stronger than the old wooden boat, something more certain than the stars. His brothers took the iron from the earth and gave him steel to sheathe his ship, they dug the coal from which he drew the throbbing energy that furrowed the wave, they made him a compass whose trusty finger should point a path when the storm curtained every star. Navigation became a science and naval construction an art. So also to those who go down to the mine in skips; to them Science gave tools, energy, and a light wherewith to illuminate the dark places in the earth. The simple digging of ore was well enough so long as the miner did not penetrate far from the daylight, using pick and spade to move the mineral, applying his muscle to carrying the product of his toil and the sight of the ore as the guide to his advancement. But as he burrowed farther, these simple ways did not suffice, he harnessed the horse to his windlass and made a whim, he yoked the oxen to the cart that carried his ore, he compelled the torrent to turn a wheel and drain his hole in the ground. Then, penetrating to a depth greater than the height of the tallest trees, he found simple mechanical methods began to fail, he called on Science for help, for further he could not go alone. Aid was given abundantly. Steam replaced muscle, steel replaced wood, and engineering took the place of rule of thumb. Far from the day-light he penetrated into the adamantine heart of the earth, until he walked in galleries a mile beneath his dwelling.

But even that was only a beginning. Science sharpened his tools with the diamond and quickened his operations with electricity. And then with faithful hand and trusty word, she told the miner how to separate the waste rock from the valuable mineral, the dross from the metal. Metallurgy became an art. Nor was this the end, Science did more; in every department of his manifold operations she breathed a system which crystallized into a great industry, orderly as the arrangement of a crystal, smooth as the working of a machine. The prospector became a geologist, the miner became an engineer, the hole in the ground became the basis of a business that supported a vast community. And yet the story is not told, for Science became more than an aid to work, she became a companion in pleasure, a guide, a philosopher, and friend. As the piece of ore is converted to burnished silver, so the old common sense was transmuted to a trained intelligence ready to cope with every problem in life. Man went forth to conquer, first nature and then himself. Self-reverence, self-knowledge, and self-control led him to sovereign power. Therefore, as a child to its mother, as a patriot to his native land, so he who mines the ore, who wins the gold, refines the silver, or smelts the lead, turns to the fairy who has blessed his going forth and his coming home; he honors her ways, which are ways of truth, he follows her light, which suffers no eclipse; and to those that follow he says, "With this sign shalt thou conquer: 'Science has no enemy save the ignorant.'"

*From MINING AND SCIENTIFIC PRESS, July 7, 1906.

SAILORS have from the early days of mining in the West contributed their share to the growth of the art. The rope-splicer has always been in demand for hoisting works, and no one can repair a rope better than Jack Tar. The early ropes, of course, were all made of hemp, and the sailor was consequently dealing with familiar material. The Pompeian initiative in using the wire rope was not followed until comparatively recent times, after mines had attained great depths. Mr. Joseph McGillivray reminds us that sailors found much employment during the days of the Argonauts in the sewing of canvas into pipes for hydraulic mining. Though gold miners have taken to building fleets for dredging, the sailor has not found his training to have fitted him for service in their manipulation, but not long ago, when a gold dredge at Oroville needed radical repairs to its hull because of the wear of the stern against the ever present pile of sand-tailing it required a crew of sailors to show how easy it was to clap a caisson on the end of the boat, and renew the worn out part without stopping the work.

TWO pages from the first issue of the SCIENTIFIC PRESS, the predecessor of the MINING AND SCIENTIFIC PRESS, are re-printed in this issue.

TYPE used in printing this paper from 1866 to 1870, inclusive, was made by Faulkner & Son, and included the first font cast in California.

WITH this issue of the MINING AND SCIENTIFIC PRESS we will have furnished our readers with 67,554 printed pages. Their appreciation of the material that has filled those pages is indicated by the growth of the paper from 8 to 212 pages in size. Increase at the same rate through the next fifty years implies a volume of nearly 6000 pages for our Centennial number. This will involve difficulties which we gladly leave to our successors of that date.

MINE RESCUE work is likely to receive great impetus from the organization of the new Bureau of Mines. Mr. Frank Mondell, of Wyoming, has introduced in the House a bill appropriating $200,000 for additional stations for instruction of miners, and other similar bills are under discussion. The progress which has already been made in providing equipment for fighting gas and mine fires is vividly shown by the account on another page of the attempt in 1889 to fight a fire in the Idaho mine, by using divers' helmets.

EDITORIAL responsibility has been but lightly assumed in preparing this issue, and the blue pencil has been held back when the temptation was strong to bring all to conformity with the present style-sheet. Much of the flavor of the old pages lies in the form of expression adopted, and in reprinting them we furnish illustrations of the change in style that the years have brought. Adjectives, as bonnets, have their day of popularity and the style of writing of a half century ago is as archaic as the style of dress.

AMONG the papers formerly published by the proprietors of the MINING AND SCIENTIFIC PRESS was a *Ladies' Home Journal*. We are not informed that it ever attained the circulation of Mr. Edward Bok's justly celebrated Philadelphia publication of the same name, but we judge from certain paragraphs which strayed over into the columns of the PRESS that it was at least as interesting in spots. When the *Ladies' Home Journal* was a member of our family the editor of the PRESS could always fill awkward spaces in the forms with recipes for biscuit and other items important to bachelor miners, by 'lifting' copy from his associate.

THE CALL for an International Gold convention at Denver, in July 1897, mentioned in 'Concentrates' this week, brings to mind that this was the beginning of the movement which resulted in the formation of the American Mining Congress. The growth of the latter in membership and influence has shown that there was a real need for the organization. Plans for the Los Angeles meeting of this year are now being made and everything points to an unusually large attendance and an important session. The recent passage of a bill to create a Bureau of Mines at Washington is a distinct triumph for the American Mining Congress, which has been foremost in its advocacy.

ALASKA in 1860 was practically unknown to Americans. Mr. W. P. Blake's account of what he saw there in 1863 will, therefore, be read with special interest. His original report was reviewed in these columns at the time it was published, and in 1868, on the return to this country of Mr. W. H. Dall, a long account of the geography and geology of Alaska was published. The map printed on page 766 is from this account. The contrast between this and the maps now published by the United States Geological Survey is striking. In later years the MINING AND SCIENTIFIC PRESS has kept in close touch with Alaskan development, and aside from the special correspondence we have published from there, our readers will recall with especial interest Mr. T. A. Rickard's articles on the Yukon country and Seward Peninsula.

CONCENTRATES appeared as a department in this paper June 9, 1894. Long before that, however, short practical paragraphs such as especially characterized that department were a feature of the paper. At first they were used to fill out the pages following longer contributed articles. Later a special column was devoted to 'Coast Industrial Notes', under which heading were run miscellaneous news items, personals, commercial paragraphs, and the material now classified as 'Concentrates'. These notes were usually placed near the end of the paper. In 1893 they were given the title 'Mining Briefs' and placed next the Editorials, taking on at the same time something of the nature of editorial paragraphs. In the same year the names 'Tailings' and 'Slickens' were used for awhile, but eventually 'Concentrates' was chosen and has since been used.

ORE GENESIS is a subject of study that has made especially notable progress in the last half century, as will be realized by those who read Mr. S. F. Emmons' account in this issue of the prevailing theories fifty years ago. His article is but a portion of a long and valuable discussion of the development of theories of the formation of ores, that we expect to publish in full at another time. J. D. Whitney, to whom Mr. Emmons devotes considerable space, was one of the first great American mining engineers. His fame is indissolubly associated with both the Mississippi Valley and the Pacific Coast, and despite certain errors which have been much exploited by critics, his work was of high order and of basal importance. Joseph Le Conte, whose activities were in the period immediately succeeding that which is here discussed by Mr. Emmons, was also one of the men who did much to promote geologic work in California. It is worth while to recall that as early as 1871, in an article published in the MINING AND SCIENTIFIC PRESS, he announced his belief that veins were due to (*a*) deposition from solution; (*b*) that the solutions were hot; and (*c*) that they were alkaline; a quite modern theory of ore deposition. 'Professor Joe', as he was lovingly called, did little work,

however as a mining engineer and made his main impress as a teacher. To the men of the Geological Survey must be conceded the largest influence in developing the present theories of ore deposition, and among them Mr. Emmons, as for many years the geologist in charge of investigation of metalliferous ore deposits, was largely influential.

Stamp-Milling

No attempt has been made to review in this number the development of milling processes during the last fifty years. The evolution of the California stamp-mill has been lightly treated, merely to show the controlling influences. The fact needs to be borne in mind that the California stamp-mill was an adaptation to ores which as a rule contained coarse gold. In many cases the amount of concentrate available was entirely negligible, or the extra recovery by finer crushing was insufficient to warrant the added expense. Hence California practice settled down to moderately coarse crushing in shallow mortars, admitting of high capacity. The Californian, however, looked upon his mill as an amalgamating quite as much as a crushing device. This involved attention to the details of the 'splash', so as not to scour the inside plates, and that in turn made standard the 5-stamp battery, which admits of the most uniform distribution of the ore within the mortar, and of the least violent wave-motion of the pulp. At the same time it placed a limitation upon capacity. The high duty which, at first thought, one might anticipate with mills having a discharge height of from two to four inches was not obtained because of the need of maintaining conditions favorable for amalgamation. The great capacity reported from South Africa, reaching 9 tons per stamp per diem, could not, of course, be attained if inside amalgamation were practised. The California mill, doing its allotted work, often crushed 5 tons per diem, though $3\frac{1}{2}$ to 4 tons was nearer the average. This was accomplished by using screens ranging from 20 to 30 mesh, and stamps weighing about 800 pounds. On the Rand the screens used are as coarse as 12 mesh, and the stamps weigh from 1600 to 2000 pounds. There is no marvel in the Rand stamp-duty when these conditions are taken into account. It merely represents a change in method; the adoption of a two-stage instead of a one-stage crushing process. If it paid better to provide more batteries and crush finer, instead of to crush coarse for tube-milling, or if it proved more economical to crush coarse in one battery, and to finish in a second, that would be done. The modern African stamp-mill is probably more economical of power than are mills where inside amalgamation is employed. The great weight of the stamp results in less masking of the blow. The resiliency of the die is better realized, and crushing is accomplished less by abrasion and more by reaction after impact. Experiments, however, show no important variation in the screen analyses of the pulp produced under the two systems.

It is noteworthy that during this same period another distinct type of stamp-mill was evolved in Gilpin county, Colorado. The existence of ores heavy with pyrite, and containing free gold locked in the sulphides, necessitated either crushing for concentration only, or crushing fine for amalgamation. Transportation costs worked against shipment to smelter, and the Colorado miner discovered that by using a deep mortar a selective action was obtained, the gangue being promptly discharged, while the heavy sulphides were retained longer and became more finely crushed. This involved slow speed to facilitate settling of the heavy particles, and the high drop led to the use of light-weight stamps. A tendency today, when finer crushing is found advantageous in so many cases, and when cheaper power admits of the economic application of more energy than could be consumed in the past for crushing alone, is toward the deepening of mortars without reduction in the weight of the stamps. The stamp-mill, which is nothing more than the modernized primitive mortar and pestle, seems to be both elemental and eternal. It refuses to be displaced, and its evolution continues. It is not inefficient, and it is the most flexible machine for comminution of ores ever devised.

The American Mining Law

The complexity and diversity of the law relating to mines in the United States is comprehensible only by knowledge of the historic reasons underlying its growth and development. The original colonies inherited the 'common law' of England, and the general rules of law governing the operation of mines and quarries and their tenure became part of the jurisprudence of this country. The regalian doctrine that the crown was entitled to all mines of precious metals was of no practical importance to the original States, because comparatively little mining outside of coal and quarries has been carried on in them. Another cause operating to prevent the creation of a radical system of mining jurisprudence in those States was the absence of any 'public domain'. They and not the Federal Government owned all land within these original thirteen States.

As soon as new territory, owned by the Federal Government, was added it became necessary for Congress to pass laws providing for its control and disposition. The necessity for the enactment of mining legislation arose with the acquisition of zinc, lead, and copper lands on the public domain in some of the States of the Middle West. In the early part of the last century a system of leasing the mineral lands of the public domain was instituted, but in 1847 this was abandoned, the years of its operation having proved it to be 'radically defective'. The Acts of 1846, 1847, and 1850 provided for the outright sale of mineral lands, "and laid the foundation of a more substantial prosperity," to quote the Presidential message of the time.

With the acquisition of the vast territory included within California, Colorado, Oregon, Nevada, Idaho, Montana, Wyoming, Utah, New Mexico, Arizona, the Dakotas, and Washington, and through the discovery of the precious metals, a new era in mining began. It was here that the 'American Mining Law', so-called, had its birth. It was a unique growth, an in-

stitution that was characteristically American. It resembled in its origin the principles of democratic government that were the outgrowth of the old New England town meeting. Hordes of people of all nationalities, but predominantly Anglo Saxon, rushed to the new El Dorado. The Mexican law of mines previously in force had been abolished by military proclamation. Some sort of law was imperatively necessary, otherwise individual might, and continual shedding of blood in the lawless attempt to establish rights, would have been the inevitable result. It rested with the Federal Congress to pass such laws, since the mining took place on the public domain. But Congress was many weeks' journey distant. The States might have acted in the absence of Federal legislation, but neither the Federal Government nor the States saw fit to enact a code of laws. To fill the void the miners legislated for themselves; they organized mining districts, met in convention, and passed their own governing laws and rules. This was turning back a page in history to the parliaments held by the tinners of Devon and Cornwall, centuries previous. In time these rules came to have a remarkable uniformity. Later they were recognized by the courts and the legislatures of some of the States. From the discovery of gold in 1848 until the Federal Act of 1866 the acquisition, control, and mining of mineral lands in the West was carried on entirely in accordance with the rules and customs of miners as established in the mining districts.

Various acts providing for the control and disposition of the mineral wealth of the West have been suggested from time to time. There was a plan to lease on a royalty basis, and the idea of paying off the enormous public debt inherited from the Civil War by this means met with great favor in the East. The long failure of Congress to act on this question was probably due to a fear on the part of the Western interests as to what the legislative mill might grind out if the question were advanced for final settlement. Finding, however, that there was a strong tendency to enact some sort of legislation which might perhaps prove detrimental to the mining interests of the West, Senator William M. Stewart, of Nevada, aided by other Western Senators, drafted the Act which is now known from the year of its passage as the Act of 1866. This Act, strange as it would seem from the early importance of placer mining, applied only to lode-claims. This was probably due to the fact that placer mining was on the decline and lode-mining had received a powerful impetus by reason of the discovery of the Comstock Lode. The Act of 1866 was in large part a codification of the miners' usages and customs, which had by that date become crystallized into a fairly homogeneous set of rules. It recognized what had previously been but a right of possession by sufferance, and declared the mineral lands of the public domain to be "free and open to exploration and occupation." The lode was the main thing granted, and the amount of surface territory incident thereto, and necessary for the convenient working of the lode, was left for determination in the individual cases as they arose. It also granted the right to follow the vein on its dip into adjoining ground. The Act of 1870 provided primarily for the acquisition and patenting of placer claims. Both this Act and that of 1866 to a large degree still left the manner of locating mining claims to the local miners' rules and customs.

The Act of 1872 is mainly concerned with lode-claims. It prescribes their exact maximum limits, provides for parallelism of end-lines, and contemplates the granting of a piece of ground enclosing a vein and including all other veins found therein, and thus it subordinates the importance that the single vein assumed in the Act of 1866. These modifications were to remedy the imperfections of the Act of 1866 as demonstrated by practical experience. The Act of 1872 was so much more complete in every way that it largely did away with the necessity for the existence of the miners' customs and rules. They had served their purpose in the evolution of our mining law and were now embodied in permanent legislative form. Since the Act of 1872 there has been no general Federal mining legislation of great importance. The mining laws have been extended to Alaska with minor modifications. A new code has recently been enacted for the Philippine Islands. This provides for the vertical boundary system for lode-claims, doing away with the extralateral right as far as these islands are concerned.

The complexity of our mining jurisprudence has been increased by State legislation. Each of the mining States and Territories has from time to time enacted codes regulating the details of location and tenure of mining claims. These supplement the basal Federal law, but are far from being uniform in character. The statutes of each jurisdiction must be consulted to ascertain the nature of its particular enactments. There are few who will not admit that our system of mining jurisprudence has many imperfections. As we look back from the vantage-point of the present, many possible improvements may be indicated, but when we consider the adverse conditions which surrounded its origin and realize that it was the outgrowth of the enactments and experience of the miners themselves, it compels admiration. Instead of being a code of rules imposed by men unfamiliar with the conditions to be regulated, as many unthinking critics have assumed, it proves to be the crystallization of the very customs and usages which were created by those most vitally interested, namely, the miners themselves. It is one of the most democratic products of our whole scheme of American jurisprudence.

The most unique feature of the 'American mining law' is that granting the owner of the apex of the vein the right to follow the vein to any depth on its dip, even though it pass beyond his vertical side boundaries into adjoining land. This extralateral right has provoked severer criticism than any other provision in the law, but the fact that the miners themselves originated and codified this idea in their local district conventions and followed it in practice for more than a decade prior to the passage of the first Federal act which recognized and perpetuated it, should cause the critics to pause. It is questionable whether at this late date the advantage many think would result from the adoption of the vertical boundary system would not be far more than offset

by the added confusion and uncertainty which would result from having two inconsistent systems of tenure in virtual operation side by side, since extra lateral rights already acquired and vested could not be abolished by subsequent legislation. Evasion of the requirements concerning annual labor, and the acquisition of 'association' placer claims on the wholesale plan by individuals, are abuses that should be corrected. Far more threatening and imminent is the so-called 'conservation' idea which is sweeping the country. While metal-bearing lands have not as yet become seriously involved in the revolutionary legislative changes which are now being proposed for governing the disposition of lands valuable for coal, oil, gas, phosphates, and water-powers, yet there are many who would include even these. There is no way of foretelling what this radical change of national thought may bring about, and the reservation by the Federal Government, and the leasing of mineral lands on a royalty basis, may be seen in the not far distant future.

Mining is attended with great uncertainty, and the prospecting for and development of ores and other minerals should receive every reasonable encouragement in the future as in the past, and the element of security resulting from a fee simple title should not be lightly sacrificed.

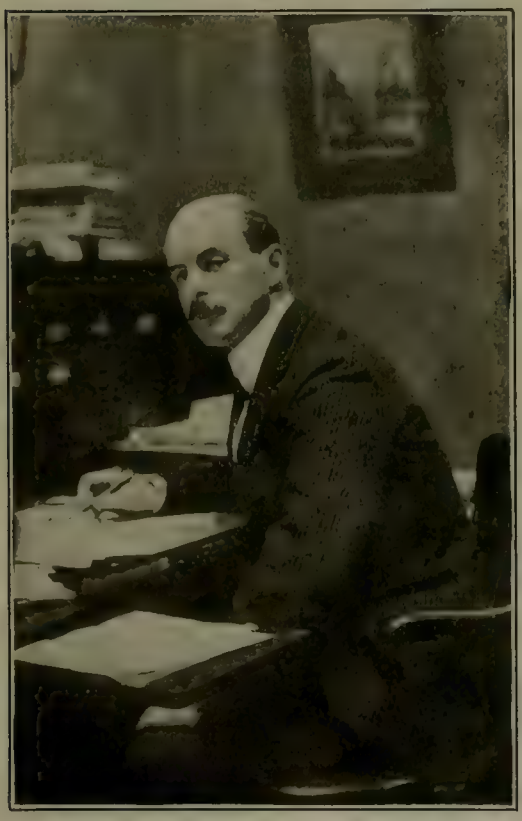
Gold and Prices

In modern times three distinct golden ages are recognized. The first was in the colonial days and was due to the placers of South America. The height of production during this period was reached in the middle of the eighteenth century when the average was more than twenty tons of fine metal per annum. That was four times as much as the annual production in 1492 when Columbus made his first voyage of discovery. The second gold age was in the middle of the nineteenth century. It was no coincidence that the MINING AND SCIENTIFIC PRESS was founded in the midst of this period of mammoth production. It was the need of an organ for the mining industry, stimulated by an annual output of 200 tons of gold, that called the paper into existence. On the other hand, it certainly is a coincidence that the golden jubilee of the PRESS occurs at the time of another wave of phenomenal output. Between the extremes of this fifty-year period the curve of production lay far below the maximum of 1859 and 1860. Even as late as 1890 the yield of gold in the United States had not risen to thirty-three million dollars. Last year it touched $100,000,000, representing the culmination of a growth that had been steady since 1893.

In 1860 the population of the United States was 31,450,000; in 1910 it will be approximately 85,000,000. During the same epoch the gold production of the country has expanded from about $48,000,000 to $100,000,000. So far as the United States is concerned the quantity of gold won has not been in proportion to the increase in population. Reliable figures for the population of the earth as a whole during these fifty years are not accessible, but it will be conceded that the growth of the United States has been at a greater rate than the rest of the world. On the other hand, the consuming power of the individual for commodities has enormously increased through elevation of the standard of living. In Africa alone within ten years it is estimated that 50,000,000 negroes have abandoned the simple Adamic costume for garments made of imported cotton. In all parts of the world the demand for staples has increased at an enormous rate. The annual gold output of the world has risen from 200 to 950 tons in 50 years, constituting a ratio of 1 to 4.75. Mere figures of population are of little value for comparison with the gold output, since the demand for gold in exchange depends upon the consuming power per individual. This has risen both absolutely and relatively among nearly all races. The growth of this consuming power in the world has certainly been as great as the increase in population in the United States during the last fifty years, and that has been at the ratio of 1 to 2.7. The wheat crop has increased in the last forty years in the ratio of 1 to 2.4, while the ratio of population-increase has been as 1 to 2.18. In the same period the pig iron production has grown in the approximate ratio of 1 to 8. This is a measure of the increase in the production of other metals as the output of wheat is a measure of agricultural development. The disproportion sustains the contention we have previously made that high commodity-prices are a result of inadequate growth of the agricultural, as compared with the development of the mineral industry. This is emphasized by the enormous increase in the price of agricultural products and the low price of metals at the present time. Were high prices due in any degree to a reduced purchasing power of gold because of its abundance, the elevation should be horizontal. It is not, and the argument is fair that the present output of gold is needed to effect exchange in the hugely expanded business of the world. In 1860 the bankers were in trepidation and the economists were sounding dire warnings of evil because of the golden floods pouring out of California and Australia. But gold did not lose its value in exchange. The development of continents was stimulated by it, and all that could be won found place and need. At the close of another fifty years, confronting a remarkably similar situation, we predict that the subduing of new lands in the enormous areas yet untouched in Canada to our north, and in Latin America to the south, the reclaiming of enormous areas of swamp and wooded land in the Southern States and of desert land in the West, and the opening of Africa to colonization, will produce effects analogous to those following the great gold output of half a century ago. While the world has opportunity for pioneering no fear need exist of a surplus of gold, and he who has traveled thousands of miles through the almost unpeopled areas of South America, with its tens of millions of acres of rich but unused lands, has a strong impression that pioneering will not be over even in several epochs of fifty years. The economist who undertakes to explain so complex a phenomenon as the present high cost of living by charging it to the medium of exchange has not penetrated deep into the problem.

Almon D. Hodges, Jr., Editor 1869-1871.

Charles G. Yale, Editor 1871-1894.



T. A. Rickard, Editor 1906-1909.

J. F. Halloran, Publisher 1894-1906.

Twenty-Three Years a Mining Editor

Written for the MINING AND SCIENTIFIC PRESS
By CHARLES G. YALE

It was merely force of circumstances not choice, which made me become an editor of the MINING AND SCIENTIFIC PRESS in 1871 though I continued to hold that position for 23 consecutive years and until the old firm of Dewey & Co. sold the paper. I was really being trained to become a mining engineer, when the death of my father necessitated my seeking immediate employment in the city, so my active mining career ended.

Among others to whom I then applied for suitable work was Albert Hart, librarian of the law library. He knew W. A. Skidmore, who was at that time acting as California assistant to Rossiter W. Raymond, the United States Mining Commissioner. Mr. Skidmore mentioned to Mr. Hart that Dewey & Co., publishers of the MINING AND SCIENTIFIC PRESS, were looking for a young man "who was college bred and knew something of mining," to act as assistant editor. I called at the office, was accepted, and went to work at once; all without the slightest possible knowledge of an editor's duties. This was the force of circumstances I speak of, that stopped my career as a mining engineer before it really commenced, and fixed me on the editorial tripod 'for keeps'. I have been an editor on various technical and daily papers ever since, besides following other occupations connected with mining. It was only on January 1 of this year that I finally laid down the editorial pen and retired from that field, after inflicting many thousands of columns of all sorts of printed matter on an unoffending public. In palliation I may say, however, that I probably blue-penciled and condensed, or 'killed' altogether, more pages of manuscript than I ever wrote.

In looking back now it seems to me I have been all my life in the midst of a great mass of manuscripts and 'exchanges', clipping into some and cutting into others. There has always been more of that kind of work to do than actual writing, as far as my experience shows. My old friend Arthur McEwen, one of the best writers ever on this Coast, after all sorts of vicissitudes, finally became managing editor of the San Francisco *Examiner* at a large salary, but resigned the position after three or four months. I remonstrated with him for his foolishness, and he gave me as the reason that he thought he was put into the world to write, which, as an editor he had no time to do. Instead he had daily to put out of existence, by his blue pencil, column after column of what others had written. It went against his conscience, and he became a free lance on the weekly and daily papers with much a smaller income.

When I became assistant editor under Warren B. Ewer he had been editing the MINING AND SCIENTIFIC PRESS and the *Pacific Rural Press* both for a month or two, and was glad to get an active and energetic young 'sub', though an inexperienced one. A. D. Hodges, Jr., his very capable assistant and virtually the principal editor of the MINING AND SCIENTIFIC PRESS had shortly before resigned and they had not been until then able to find a successor. It was with some fear and trembling that I took his place, knowing his superior acquirements and facility with the pen but there was no choice. I had to do it. Mr. Ewer set me to work clipping the exchanges, making up the mining summary, reading proof and hunting up things and on the second week I proudly presented to him my first carefully written editorial. I do not now remember its import, but I recall that I used a Latin expression to show my erudition doubtless. This he promptly cut out, explaining that mining people did not understand Latin, and it was bad form anyhow to use it in ordinary newspaper work. That settled my Latin quotations forever after.

The MINING AND SCIENTIFIC PRESS was in those days a very different paper from what it has been of late years and is now. In the first place there were only 16 pages weekly, including advertising matter. Moreover, there was very little original matter of a technical nature printed, the editors depending almost entirely on scientific journals published elsewhere for material of that class, and printing it under classified heads or departments. These departments were made up by Mr. Ewer, and consisted of condensed articles on different subjects, but none of them original. Some were re-written from clippings, but there was no pretense of original investigations. It is to be remembered in this connection that the PRESS in those days catered to the working miner and not at all to the engineer or skilled superintendent. California was filled then with men who were prospecting or mining, and there were comparatively few incorporated companies with large works and plants, and not one-tenth of the men working for wages that there are in these times. One of our most popular departments was 'Domestic Economy' wherein were given receipts and hints on cooking and such matters, all much appreciated by the hundreds doing their own domestic work in the mining camps. It took several years hard urging later on to get Mr. Ewer to abandon this department as too undignified for a technical paper, but it served its turn in its day, as was noted by the complaints from certain old-time subscribers when it was finally dropped.

For a number of years after I joined the paper, they continued the custom of sending the made-up forms outside to a job-printing office for printing. The man came for the forms with a hand-cart at 7 a. m. every Friday, and they just had to be ready for him sharp on time. This occasioned strenuous work late on Thursday night of each week, and we usually did not leave the editorial rooms before 2 or 3 o'clock on Friday morning. Often we remained until the man came for the forms. The force in the composing room was comparatively small, with a smart foreman and one good 'ad' man. Dewey & Co. issued other papers, notably the *Pacific Rural Press*, and work on the 'Scientific' as we always called it, was often put off pretty late. In those years a large part of the income of the paper was derived from the delinquent sale advertisements, resulting from pub-

lished assessments of the Comstock and other Nevada mines. Some of these sale 'ads' took up one or two or three pages of small type and they often came to the office late on Thursday afternoon, so that work upon them had to be done in the composing room at night. They were put in hand at once and often not a stick of type was set on editorials or mining summary before 10 p. m. on the day prior to the forms being sent to press. The reading of proofs and revises therefore, on the 'second' or editorial forms was necessarily done at night. I have, times without number, gone to the office at 7 a. m. on Thursday and left at the same hour the next day. I can see now that this was not necessary but the system, or lack of it, prevailing called for these duties at the time. It was some ten years after I went on the paper before plans were adopted which did away with night work in the editorial and composing rooms.

The firm was not in a position, or thought it was not, to pay for contributions to the columns of the paper except on rare occasions. The editors had to depend on occasional contributors, or on the 'traveling correspondents' sent out into the mining camps to obtain subscriptions and advertising. These men sent back letters describing the camp and the mines which had generally to be re-written entirely in the office. One of the first things I was set at when I came to the office was to put in shape a dozen or so long letters from the Montana mining districts written by W. H. Murray who was a 'rattling good' solicitor but a poor letter writer. Mr. Ewer had dodged editing this so-called manuscript. The notes were written on all sorts of paper, and sometimes all around the white margin of a newspaper. I had to take a map and follow Murray around to fix 'where he was at' while writing. He got lots of subscribers, but it was hard to make readable matter out of his 'stuff'. Murray is still alive, and still in the same old business in another State.

Another solicitor who wrote many letters in his day was the late L. P. McCarthy who was with the firm of Dewey & Co. many years. He called himself a statistical writer, his statistics usually consisting of stating the exact distance of a camp or town from San Francisco, from a railroad depot, the number of inhabitants, and so on. A mine was so deep, had so many feet of drifts, tunnels, etc., employed so many men, and was discovered at such a date. The compositors used to say that they had to 'sort up' their cases with capital I's when 'Mac' was on the road, he used the personal pronoun so often. He was on one occasion sent to write up in the old-fashioned way the Comstock Lode and its mines. An arrangement had been made with Adolph Sutro, of tunnel fame, by which he had placed the Gargantuan order of 10,000 copies of the M. & S. P. for this series of letters, and they had to be done pretty well to satisfy him. As soon as 'Mac' left on his mission I fortified myself by obtaining all the literature available about the Sutro tunnel and the Comstock mines. Then, when his manuscript arrived I found it had to be all re-arranged and virtually re-written. I simply wrote the letters in the office, using such of his facts as I could, and offering the subject in as fair shape as might be. 'Mac' was always proud of those letters, and never in any way resented the liberty taken with his manuscript. Another 'outside man' we had later was an Englishman with a decided thirst, who in about every so often would go on a spree for several days. He was a very useful man, and Mr. Dewey did not like to discharge him. He was finally made to sign an agreement with the firm that if he got drunk again in the State of California he would forfeit $500. After keeping straight for a longer period than usual, he disappeared and was not found for a week. He turned up in Portland, Oregon, where he had gone by sea for his regular spree, but as he did not have it in California, he forfeited nothing. Mr. Dewey was much astonished at being out done by this unexpected ruse.

Perhaps the most annoying thing in connection with my editorial work for many years after joining the paper, was the trouble about obtaining engravings. We had to have at least two illustrations each week, and it was always hard to get one good one. Engraving then was all done on wood, and electrotypes made from the wood-cuts for use on the press. I can never remember a time when we had engravings for two issues ahead. A three-column cut cost somewhere near $100, and we seldom had any made when we could obtain them from catalogues, or other sources. New mining machinery and inventions were our strong suit, and the inventors or manufacturers paid for their own cuts. We also obtained many plates from Government publications, the American Institute of Mining Engineers, and others, but the idea of illustrating as fully as is done now was never dreamed of. We were forced to use all sorts of things for illustrations, many of them being entirely out of keeping with the character of the publication. It was not until about the nineties that we began to get many decent illustrations. Notwithstanding this difficulty in the matter of engravings Mr. Dewey was constantly starting new publications, most of them being illustrated. He had an unfortunate fad of starting new papers or buying out old ones, greatly to the financial detriment of himself and the firm, and to the annoyance of the editors. He seldom got a new editor for these papers, so those of us already there had to take the added task. I gave at my home in Oakland a dinner to the 'office' on the occasion of the twentieth anniversary of the firm of Dewey & Co.,—not the paper—and arranged a souvenir composed of headings of all the papers Dewey & Co. had started up to that time—that is, all I could find. The list surprised even Dewey himself, and 'there were others'. Many of these were papers devoted to the interests of fraternal orders and with one exception—*The Watchman*—they were all more or less unprofitable.

The most detested of these papers to me was the *Mechanics' Fair Daily*, printed for a month or six weeks of each year during the continuance of the annual fairs given by the Mechanics' Institute. Its contents consisted mainly of 'write-ups' of exhibits, and it was hard work, indeed, to get up a paper like that every day for a month or two and to make it in any way interesting. In fact that was impossible, but the paper was a pet of Mr. Dewey, and some-

times made money. I had to edit it in addition to my ordinary duties, and in fact, I had often to neglect the ordinary duties. Another rather unpleasant duty weekly was to 'write up' the foundries and machine shops of the city. I had to visit these in rotation, interview the proprietor, and describe anything of interest in their shops. With a big piece of machinery I would often find part in the molding room, part in the machine shop, and part still in the draughting room. Taking the specifications and seeing such parts as I could, the descriptions were made. We derived a large income from foundry 'ads', and this advertising of the shops was gratuitous on the part of the paper. We obtained much that was new, and kept in advance of mining machinery orders in this way. Moreover, we obtained also the first call on many 'cuts'. I became rather skilful in this kind of work, so much so, that in later years, when the large foundries wanted machinery described in the daily papers, I was often employed to prepare the articles, and was paid for it. This sort of writing was also useful when I had to prepare specifications for a year or two in the patent department of the firm later on.

It may be here noted that San Francisco was in the seventies and to some extent in the eighties, the principal place in the United States for the manufacture of mining machinery, especially for large plants. At that period it had no rivals. Agents for 'ready to use' mining machinery were hardly known. This city had for a market the States of California, Nevada, Utah, Colorado, Oregon, Washington, Idaho, Montana, and Arizona. The mechanical ore-feeders, originated here, as did the hydraulic nozzle, the Pelton water-wheel, and a dozen other notable things, and the best quartz milling practice was known to be that of California. Mine pumping-plants were also important things for the local foundries. Mining men from all parts came here to obtain what they wanted for their enterprises. For these reasons the foundry business had an intimate connection with the publication of the MINING AND SCIENTIFIC PRESS. The foundries and machine shops all advertised in it, and all considered it their special journal. For some years a special column of 'Foundry Notes' was run, containing items of special importance.

It may be mentioned, incidentally, that shortly after I came on the paper as assistant editor, Mr. Ewer dropped all editorial writing, and never took it up again. I had to write the editorials, make up the mining news summary, edit correspondence, provide engravings, edit manuscripts, make up the market reports, and those on stock transactions, and do all the work on the paper with the exception of the 'departments' which Mr. Ewer continued to carry on. There was no assistant, and when I wanted a vacation I had to provide a substitute. That substitute was for many years the late Dr. Henry De Groot, well remembered by all old California mining men. He was a frequent contributor to our columns on mining topics. He was a pioneer miner, and was the first newspaper man to interview Marshall, Wimmer, and others at Coloma after the discovery of gold in California. He did this as correspondent of the New York *Herald*. Dr. De Groot was the best posted man on general mining affairs, who could write, that I ever met. He had been to all the 'excitements' on the Coast, and had visited all the mining camps. He was a keen observer and could describe what he saw excellently. For many years he wrote for various papers on mining topics. The late Almarin B. Paul was another who wrote often for the MINING AND SCIENTIFIC PRESS. He had a fad on saving fine gold, among other things, and he wrote much on that subject. Charles H. Aaron, author of several books on assaying, which were published by Dewey & Co., was a frequent contributor to our columns. So was the late Henry G. Hanks, the first State Mineralogist, who wrote on the assay of gold, gold in black sands, borax, minerals of California, etc. Melville Attwood, the geologist and noted gold miner, was a frequent caller at the editorial rooms, and often wrote for us. Amos Bowman, who preceded Mr. Hodges, a former editor of the M. & S. P., sometimes sent in articles. W. A. Goodyear, author of 'Coal Mines of the Western Coast of the United States'; Guido Küstel, author of 'Concentration and Chlorination'; C. A. Stetefeldt, inventor of the Stetefeldt furnace, and J. S. Phillips, author of 'The Prospector's Companion', were also occasional contributors to our columns.

The prestige of the MINING AND SCIENTIFIC PRESS was great in the mining communities of the Pacific Coast, and many attempts were made to dislodge it from the place it had attained. I can recall a dozen or more mining papers which were started in San Francisco to take away the business of the PRESS and take its place. None of them ever succeeded. They thought the PRESS too old-fashioned and conservative, and that its proprietors had no enterprise. This was to an extent true, but the MINING AND SCIENTIFIC PRESS had established itself firmly in the favor of the mining communities where it circulated and could not be displaced. In this connection I may say that I confess to surprise that the paper did not lose caste entirely for a period during the agitation about hydraulic mining, and when injunctions were issued which resulted in closing down mines of that character in the drainage basins of the Sacramento and San Joaquin rivers. This question brought about a very decided antagonism between the miners and the farmers of the State. The firm of Dewey & Co. published the *Pacific Rural Press* as the organ of the farmers, and the MINING AND SCIENTIFIC PRESS as the organ of the miners. Obviously there was a difficulty in this situation. Neither paper had much to say on the subject and indeed ignored it as much as possible. I was given strict orders by the head of the firm to write nothing on the subject of hydraulic mining, to put in the paper only 'official news' about it, and to show him any items about to appear. Here was an unpleasant situation for an editor, to be muzzled on the very topic most of all interesting to the community that his paper was supposed to represent. Many a savage letter did I get, and many a personal growl from prominent mining men, for the course I was taking. For hundreds of these men knew me personally and did not know either Mr. Ewer or Mr. Dewey. The latter dominated the firm and its policies, Mr. Ewer being something of an in-

vertebrate, with no opinions opposite to those of Mr. Dewey, or at least none that he advanced. He was a kindly old gentleman and an excellent associate, but he often aroused my anger by his way of dodging questions and of taking no side nor giving an opinion. Mr. Dewey's sympathies were with the farmers, so the MINING AND SCIENTIFIC PRESS was suppressed as far as hydraulic mining was concerned.

The position taken by the paper on this subject injured it materially, no doubt, for the suppression of hydraulic mining resulted in the closing of many such mines, and almost the entire depopulation of some small camps and communities. It was not until the paper was sold to Halloran and Holman that its editor was allowed to speak freely on the question of hydraulic mining. Just about that time a convention was called by the miners of Placer county, at Auburn, to take some steps for the rehabilitation of hydraulic mining, and I was sent to report the proceedings. I was one of those who drew up the appeal to the people of California and to assist the hydraulic miners, and I happened to be the only mining representative from the city of San Francisco to the convention. I was by that body appointed a committee of one to try to organize the movement in San Francisco, and to get the daily papers in line to help the miners again. On my return to the city I was fortunate in getting the active assistance of my young friend William C. Ralston, and between us we managed to arrange a meeting of a few prominent mining people and we organized the San Francisco Miners' Association of which I have been the perpetual secretary. We also got the daily papers to accept articles which I wrote on the subject of the condition of the hydraulic mining industry. The result of these efforts was the organization of the California Miners' Association. At the first convention of that body I, as editor of the MINING AND SCIENTIFIC PRESS, was appointed to represent the miners, and Robert Devlin to represent the anti-débris men, and we together drew up the memorial to Congress adopted by the convention, which resulted in the passing of the Caminetti law permitting hydraulic mining to go on under certain conditions. The law has not had the good effect hoped for, but it certainly permits hydraulic mining where it was not permitted before.

I was allowed by the proprietors of the paper to say whatever I thought should be said about hydraulic mining, and I was not curbed in any manner. I took this chance to put the 'old Scientific' back into its proper place as a friend of the miner in this State, which it had almost lost by the policy adopted by the former proprietors.

Among other departments which used to be in vogue with us was that of 'Answers to Correspondents'. This was a big nuisance to me sometimes, as conundrums were propounded which it took a good deal of looking up and running around to answer. As I had succeeded Mr. Hodges as editor of the paper, so I had succeeded him as secretary of the California Academy of Sciences, a position I held some 16 years. On scientific topics, therefore, I had good advisers. On mining topics, geology, mineralogy, and those connected with machinery, etc., there were plenty of able men I could consult with. It turned out, however, that a large number of the questions related to mining laws. A new mining law was passed by Congress, May 10, 1872, and we have it yet. Before that everything was done under the crude law of July, 1866. My father, Gregory Yale, had written the first treatise on mining law published in the United States, 'Legal Titles to Mining Claims and Water Rights in California'. To that work I had contributed some Spanish translations, and a glossary of mining terms, the first of that sort published, I think. When the law of 1872 came into effect the miners were puzzled by its terms, and it became one of my editorial duties to answer questions on the subject. I had to make mining law a study, and consult books and lawyers so that I became quite expert on that subject, and was considered rather an authority, though a layman. I did not have any Judge Curtis H. Lindley to help the paper out on mining law questions in those days, so I had to make a study of it myself.

It may be confessed, however, that the paper during the period while I was its editor, never became the authority it has since, nor was it at all to be compared in literary or technical excellence with its present standing. Mr. Halloran improved it in many ways, and may be said to have 'put it on its feet' financially and to have made it valuable. T. A. Rickard, however, bringing to it his editorial genius, his wide knowledge, and his acknowledged standing in the mining world, has done more to make it an authority in a scientific way than any man connected with it since I knew it. There is no comparison between the paper now and what it was twenty years or more ago. Its present editors and proprietors are men whose names alone would give it standing equal to any others did not their work every week prove this beyond doubt. It is now a world paper, whereas in my day it was quite a provincial one, confining its activities to a limited sphere and not employing technically skilled men to conduct it. While I was the editor of the MINING AND SCIENTIFIC PRESS for the long period of 23 years, and have since been connected editorially with other technical journals, I should now hesitate some time before accepting a chair in its editorial rooms were I asked to do so.

The editors have asked me to write some reminiscenses and I have done so hurriedly, as is my wont. I am told that your old foreman, my good friend John Young, said when told I was to contribute to this special edition: "You'll get Yale's stuff if he promised it, but you' ll get it late"; and he was a true prophet. He has had experience of me in the old days. But we always went to press on time, even if my yachting and other sports unduly interested me, and I never made him wait for 'copy'. If this copy is written late and comes late it is only through my usual habits of long standing; and such habits give no time for revision or for careful writing.

Quick Time.—The steamship *Rising Star* arrived in New York on the 8th inst., with passengers from San Francisco, Nov. 19th—the passage having been made in the short time of 19 days and 21 hours!—December 14, 1867.

Rambling Recollections of an Old Sixty-Niner

Written for the Mining and Scientific Press
By A. D. Hodges, Jr.

It was the golden age of California when, in 1869, I became junior editor of the Mining and Scientific Press. It was the age of simple, comfortable living, hopeful happiness and unstinted hospitality. The mines were yielding annual dividends of 25% or more. At least, when a mine was offered for sale, if the examining engineer could not report that it would probably return the purchase price in four years, his clients refused to buy. This was the general rule among those whose regular business was mining.

There was a class of these mining operators, with headquarters at San Francisco, which is now extinct. They could be seen any week-day on Pine street, dabbling in stocks and ready for a good mining investment. The majority had worked in the mines where they had accumulated a capital sufficient for their wants. When one receives 25% interest, a large capital is not needed for the simple life. Many of them had pleasant homes across the bay, and it was their custom to invite thither, to spend Sunday, half a dozen to a dozen guests, who were then regarded as members of the family and given the freedom of the place. Did you desire to give a ride to a charming young lady, whom you, perhaps, had met for the first time, it was merely necessary to order the hostler to harness up a rig. Everything on the place was at your disposal. With these men it was "easy come and easy go," and they generally spent all their income in free-handed hospitality. They lasted until the days of the Bonanza stock speculation which wiped them out. Pre-eminent among those practically engaged in the extraction of gold from the ground was the drift-miner. What a brave, generous, independent optimist he was! How capable and intelligent! The whole tribe of miners was fine, and it was a joy to sojourn with them in the wonderfully beautiful Sierra region. But the drift-miner excelled.

Many of the Argonauts were still on deck, and their achievements had inspired the later comers. Some of them lived chiefly in the past. These were the ones who were wont to lead you to a street corner and, pointing to a large building, tell you how they had once owned the land there, and if they had only held on to it, instead of selling it for a song, they now would be rolling in wealth. A much larger number was prosperous, vigorous, and enterprising, and welcomed heartily those who had come to aid in the development of the Coast. The pioneers, while proud of the commonwealth which they had builded, still retained strong affection for their native hearths; still talked of going 'back home' to live—some time. Emperor Norton was still existent, but in rather a decadent state. No longer could he sell his bonds, redeemable when he should be seated on his throne in Mexico. Every morning, dressed in his plumed hat, brass-buttoned blue coat, and gray trousers, bearing a bottle of beer which some still loyal subject had given him, he entered Sorbier's restaurant, laid a 'short bit' on the counter and was served with a full meal, the regular price here being a bit a dish. The Gutter Snipe still prowled about the streets, refusing to accept anything which had not been first thrown into the gutter whence he extracted it. And those two large dogs, Bummer and Lazarus, still had the freedom of the city.

San Francisco had the best cheap eating houses in the world. There were excellent French, German, Spanish, Italian, and American restaurants, each with its specialty, where dinners of at least three courses cost 25 to 50c., wine included. The swellest places, the Poodle Dog and the Maison Doré, as well as the first-class hotels, charged one dollar; and for $10 a week the best hotels offered four meals daily: breakfast, from 6 o'clock a.m. to about noon; lunch, from noon to 2 or 3 p.m.; dinner, from 6 to 10 p.m.; and supper, from 10 to midnight. If hard up, or very economical, you could get a clean, abundant dinner at the What Cheer House for ten cents, the payment of which sum entitled you also to the use of the comfortable, well-stocked library where you could read, chat, and smoke until midnight. A bedroom, with clean sheets, was obtainable here for 25c. a night. The flower-girls were a feature of the restaurants. At dinner time they came around with their bouquets which cost two bits; unless holding a camellia, when the price was four bits. These girls did not verbally solicit custom, but a new-comer or a regular customer often found a pretty flower laid silently beside his plate.

As a rule wages were good and the number of house-owners in San Francisco was remarkably large. Old lame John, waiter in the two-bit Clay Street Restaurant, confessed to owning two houses, which he rented, besides the 'shack', as he called it, where he and his wife resided. The poorest paid individuals seemed to be the laborers in the fields of literature and art. San Francisco was not then a literary or an artistic paradise. It was related of a certain rich man, who was building a large and expensive residence, that he and his wife declined to purchase some genuine 'old masters' because they "didn't care to have any second-hand pictures in their new house." There was no public library (the Mercantile Library, however, was most liberally administered) and no art museum. In addition to the many bright journalists, there were artists, who, failing to sell their pictures which were not then in demand, contributed articles on all subjects to the papers whenever they could get them accepted. Thus the market was overstocked. My primary wage was $16 a week, sufficient to enable me to live decently and put something in the savings bank. When I finally received $150 a month, my income exceeded that of all but a few of my brethren. Nevertheless it was a bright and jolly brotherhood, a genuinely Bohemian brotherhood of the pen and the brush. Anyone writing the early history of the Bohemian Club of San Francisco would needs tell how many members, in the days of which I speak, paid their dues in the shape of witty entertainment and artistic production.

A. T. Dewey was manager of the PRESS during my term of service. He had an ambition to be known as the publisher of many papers, and accordingly launched numberless ephemeral publications with the general result of crippling the resources of his chief journal. He was also prone to changes in the make-up and even the name of his papers. Yet he clung tenaciously to certain features inappropriate to a technical journal. He was a newspaper man of experience in small towns, but as manager he failed to take advantage of the opportunity to increase the influence of his best publication. However, he had many fine qualities, and I hold him in affectionate memory.

The senior editor was W. B. Ewer, a charming associate. He had been in journalism from youth, and had edited papers in both the East and the West. He had lived in the mining regions and understood well the mining conditions of the Coast; but his greatest delight was in agriculture, and he had always desired to edit an agricultural paper. When at last his wish was fulfilled and the *Pacific Rural Press* was founded, he devoted himself to this paper and turned over the charge of the MINING AND SCIENTIFIC PRESS to his junior. My predecessor was Amos Bowman. I have often wondered how he was able to abandon the profession of journalism to which he seemed so well adapted. He was a man who knew something of everything, and had been in many parts of the world. At one time he was a reporter on the New York *Tribune*. Then he spent a year or so in Russia as an attaché of the American legation. He studied mining for a year at Freiberg, Saxony, and art for a year at Munich, Bavaria. When I arrived in San Francisco I found him on this paper. The State legislature met that winter and he was engaged by the Sacramento *Union* to report the proceedings in full. He invited me to hold down his editorial chair during the legislative session. When the session ended he decided not to resume his position here, and I retained the place. George H. Strong, graduate of Dartmouth and mechanical engineer, was at the head of the patent agency owned by Dewey & Co., and closely affiliated with the papers. While not officially on the editorial staff, he was constantly aiding the editors in the subjects of mechanics and mechanical engineering. He was our most valued 'special contributor', although he did not bear any such label. Perhaps the term 'cheerful contributor' would have been more appropriate, for his presence always brightened the editorial rooms. Dr. William Barstow was in charge of the department of Mechanical and Scientific Progress. He was a full-fleged M. D., and those who knew him, considered him a very skilful practitioner. But he abounded to such an extent in kind-heartedness and diffidence that he was never able to render a bill for services performed, and hence was obliged to seek other sources of income than his professional practice. He was a scholar in a wide field of knowledge, and his work on the paper—at ten dollars a week—was excellent.

Of all those connected with the paper, McCarty and Murray had the most numerous acquaintances. They were our canvassing agents for the interior and traveling correspondents. McCarty was irrepressibly optimistic as to the power of the press when he was soliciting. He once promised that, within a year or so, we would have a railroad built up through Mendocino, Humboldt, and Trinity counties, to places where at the time there was only a weekly stage, and that uncertain; and our circulation in those regions increased mightily. Had we done all that McCarty declared we could do, we should have built a network of railroads throughout the Coast and crushed the Central Pacific. I had frequent discussions with him, but his enthusiastic imagination was unrestrainable.

Murray was quieter and steadier but equally persuasive in his work. He once landed in a camp, where few, if any of the miners could read. Not daunted by this he showed them the pictures and induced a number to subscribe on that basis. He was a faithful correspondent and sometimes his letters in spots ran thusly: "Mr. Editor: I arrived last Monday in this district which is favored so wonderfully by the God of Nature. I have been surprised to find, in addition to many developed mines, such an abundance of brilliant prospects which, through the efforts of the highly intelligent miners, are bound within a very short time to pour out a steady golden stream. You may rely—say, old man, you've been here and seen this place. So whoop her up the best you know how. Every miner in the vicinity has subscribed, some for two years, and all have paid in advance. Hank Smith, who runs a *first-class* hotel, has taken six copies. He says he knows you and I think you really ought to give him a bang-up mention." Murray occasionally dropped into poetry, and the editing of his stanzas, which he sometimes requested, strained the resources of the staff.

We sought to make our editorial room a centre of the mining industry of the Coast, and succeeded in a measure. The principal miners and engineers visited us occasionally and told us of their operations. They were all very busy men and it was extremely difficult to obtain written articles from them, but now and then fortune favored us. Almarin B. Paul, Guido Küstel, C. H. Aaron, Charles A. Stetefeldt, and Dr. Partz were, I think, the most frequent contributors. Whenever Mr. Stetefeldt and Dr. Partz met in the sanctum, we expected an earnest and entertaining discussion, carried on in characteristic German fashion in the German tongue, as to whether that certain mineral was designated properly Stetefeldtite or Partzite. The editors of papers published in the mining districts, with all of whom we exchanged, often made calls. And every man on the Coast with an eccentric wheel in his head came and showed how his machinery worked.

I had come to the Pacific Coast to be an engineer, not a journalist. I had come prepared to find the mining world eager to secure my valuable services, and I was uncertain whether to demand, say, twenty thousand dollars a year as my initial salary, or to be philanthropic and accept only fifteen thousand for the first twelve months. I was accordingly surprised to find that what I had considered my high qualifications—a college degree and a four-year

course at the best mining academies were simply disqualifications. I was treated kindly by those to whom I applied for employment at any salary (finally—but nobody needed me. People welcomed me to a seat at their generous tables, but not to a situation at their mines. As they expressed it when frankly confidential, what they wanted was "a practical man and no damn theoretical cuss."

They were right in part. They had suffered severely from glib-tongued imposters calling themselves scientists and pretending to be graduates of Freiberg. But they seemed to me rather too liberal to the extent of their condemnation. However, as I did not succeed in altering the country's custom in this respect, I decided to adapt myself to it, and at the first opportunity worked in a silver mill as pan-charger—at two and a half dollars a day and board. It was a strenuous job, twelve long hours daily, but I stuck to it. Before a full month had passed I was accepted as a practical man, and thenceforth my services were in demand.

THE IDAHO MINE FIRE

The attempt of the men in divers' armor to extinguish the fire in the Idaho mine was unsuccessful. They went down the shaft twice. At the 900-ft. level the candle went out and the electric light showed a thick smoke, but they found no difficulty in breathing, the supply of air through the hose and into the helmets being good. Near the 1000-ft. level the cage was stopped. The heat was very great and the helmets became very hot. The rubber around the wrists softened. The signal to hoist was given and the men were taken to the surface.

Several reasons are assigned by the men for their failure to accomplish anything. The pump which supplied them with fresh air was, unfortunately, situated at the mouth of the 700-ft. level, and consequently the air was vitiated and impure to such a degree as to be absolutely poisonous. Again, the provisions made in a diver's submarine suit for disposing of the air after it has been deprived of its life-sustaining properties are altogether regulated by the pressure of the water upon the rubber suit. As the surplus air expands the rubber the water pressure releases a spring, which opens a valve and allows the foul air to escape without admitting any water. In the Idaho mine the clothing of both Page and Tucker became bulged out with the impure air, the atmospheric pressure being inadequate to release the spring, and consequently both men were compelled to open the valve themselves and take chances on the poisonous gases which surrounded them effecting an entrance. Some idea of the heat experienced may be formed when it is known that one of the eyeglasses of Page's helmet was cracked. Had it broken, his life would have paid the forfeit. They are satisfied that their experiment will be of value, as it will cause scientists to endeavor to discover some material from which diving suits for mine fires may be manufactured. As far as possible air has been excluded from the lower levels. The stove plan for burning charcoal and generating carbonic gas has been abandoned and a furnace for the same purpose has been built. This comprises an iron shell six feet in diameter and lined with brick eight inches deep. At least a week will be required for surcharging the mine with carbonic gas. Then the gas will have to be expelled before workmen can go down into the depths. If bad caves have occurred many weeks will elapse before the 200 employees will again be at work.

MINING AND SCIENTIFIC PRESS, June 15, 1889.

TRAVELING FOR THE 'PRESS'

Written for the MINING AND SCIENTIFIC PRESS
By W. A. SCOTT

My connection with the MINING AND SCIENTIFIC PRESS began in 1896, when J. F. Halloran was at the helm. His ambition was to extend the circulation into all the mining States of the West, as well as those of the Pacific Coast. I began in Colorado, and during the six years of my connection with the publication under Mr. Halloran's management its circulation in Colorado, Utah, Idaho, Arizona, Oregon, and Montana increased until we were in the lead. Machinery salesmen, who traveled among the mines of those States, came back to their houses with the announcement that they saw it everywhere, and that mining men, millmen, assayers, and engineers were swearing by it. After that advertising came easier. Mr. Halloran was a ready writer, an enterprising publisher, and a diplomatic mixer. He possessed the adaptability necessary to 'jolly' the prospectors, advise with the mine operators, and fraternize with the machinery men. He and I each thought the other peculiar, but we got along amicably. He wrote me long letters filled with both approval and criticism. He was given to jesting, and sometimes would talk in parable. He visited me once in Denver and together we called on some of the prospective advertisers. Among others I introduced him to an ore-buyer, to whom he said in a soft voice which was not altogether natural: "If you have any advertising for us you'll have to talk to Mr. Scott, as I spend most of my time on subscriptions." In those days the Denver machinery houses were forging to the front and the most of them used the advertising columns of this paper liberally. Hendrie & Bolthoff, the Mine & Smelter Supply Co., Colorado Iron Works, Denver Engineering Works, and the Leyner Engineering Works Co. were among those who gave substantial recognition to the merits of the PRESS as an advertising medium.

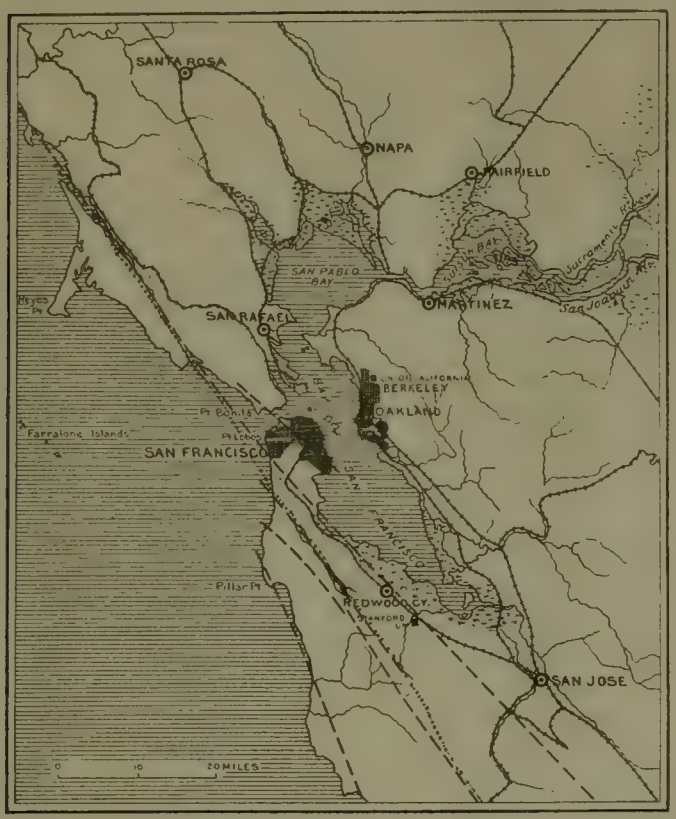
In 1898 I secured over 800 new subscriptions in the inter-mountain country. The list in Colorado rose from 60 to 600; in Utah it advanced from 30 to 300, and the increase was nearly in that proportion in Arizona, Idaho, Montana, and Oregon. Cripple Creek, San Juan country, Creede, Park City, Tintic, Mercur, Butte, Sumpter, Bisbee, and Clifton were each visited and at each many new subscribers were obtained.

In general I have observed a remarkable growth of technical journals since 1896, and have noted the constantly increasing number of those who read and loyally support them. Readers of those journals are becoming more exacting and critical concerning the matter they contain, which only serves to emphasize the necessity for high standards.

The Earthquake-Fire

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD

When the MINING AND SCIENTIFIC PRESS attains its centenary, and the editor at that later day turns back to the past record of a paper that in 1960 will be a growing educational force in a still more highly advanced community, he may mention my name as the man who happened to be in charge at the time of the earthquake of April 18, 1906. It was my privilege to be at the helm during a period of stress and trouble. Now that the horror of a great catastrophe is almost forgotten, I can look back upon those strenuous days four years ago and enjoy the retrospect. It was a great experience, and one that I would not have missed, however undesirous of repeating it. All experience that is not searing or debasing is enriching. Times of peril and periods of disorganization such as befell San Francisco in 1906 afford opportunity for an intimate knowledge of mankind, which is then tried as metal in the fire, exhibiting the pure gold of essential manhood freed from the slag of mere brutishness. We who dwelt on the Bay of San Francisco when the earth trembled and the fire raged had a chance to see human nature with the clothes off, to note the ape and tiger of the primeval savage, and to recognize the superman in his conquest of nature and circumstance.



Map of the Bay of San Francisco. The Dotted Lines Indicate Earthquake Rifts.

The story of the MINING AND SCIENTIFIC PRESS, and of the men associated with it at that time, may be told, in the interest of those who will be celebrating a centenary 50 years hence. To them the event of 1906 will be the mere tradition of an episode buried under greater events, such as the completion of the Panama Canal, the political regeneration of California, the municipal reformation of San Francisco, and the progressive development that shifted the industrial supremacy of the American continent from the Atlantic to the Pacific.

At 5:13 in the early morning of April 18, 1906, I was rudely awakened by the shaking of the bed in my home at Berkeley. At once I recognized the symptoms as evidence of an earthquake and assured my wife that it was "only an earthquake, and would be over in a minute." This was not a scientific statement, for a minute means 60 seconds and that is a much longer interval than I had in mind. As a matter of fact the heavy shocks lasted for 75 seconds—and it seemed a geological period. After the first series of pulsations there was a slight decrease in the violence of the tremblings, which were succeeded by a second series of stronger vibrations, culminating in a wrench that threatened to bring down the house. Our dwelling was one of those wooden houses characteristic of California; being lined with redwood there was luckily no plaster to fall upon us, but during the earthquake the groaning and squeaking of the timbers constituting the framework of the building was deafening; it reminded me of a storm at sea. I thought the house would collapse and be thrown into the street from the hillside on which it was built. However, the idea of death was absent, we remained in bed, and through the window I could see the trees rocking. Finally the vibrations ended, we jumped out of bed and ran for the children. One of the nurses had fainted, but the entire household was soon in the lower hall, ready to run out if further quakes started.

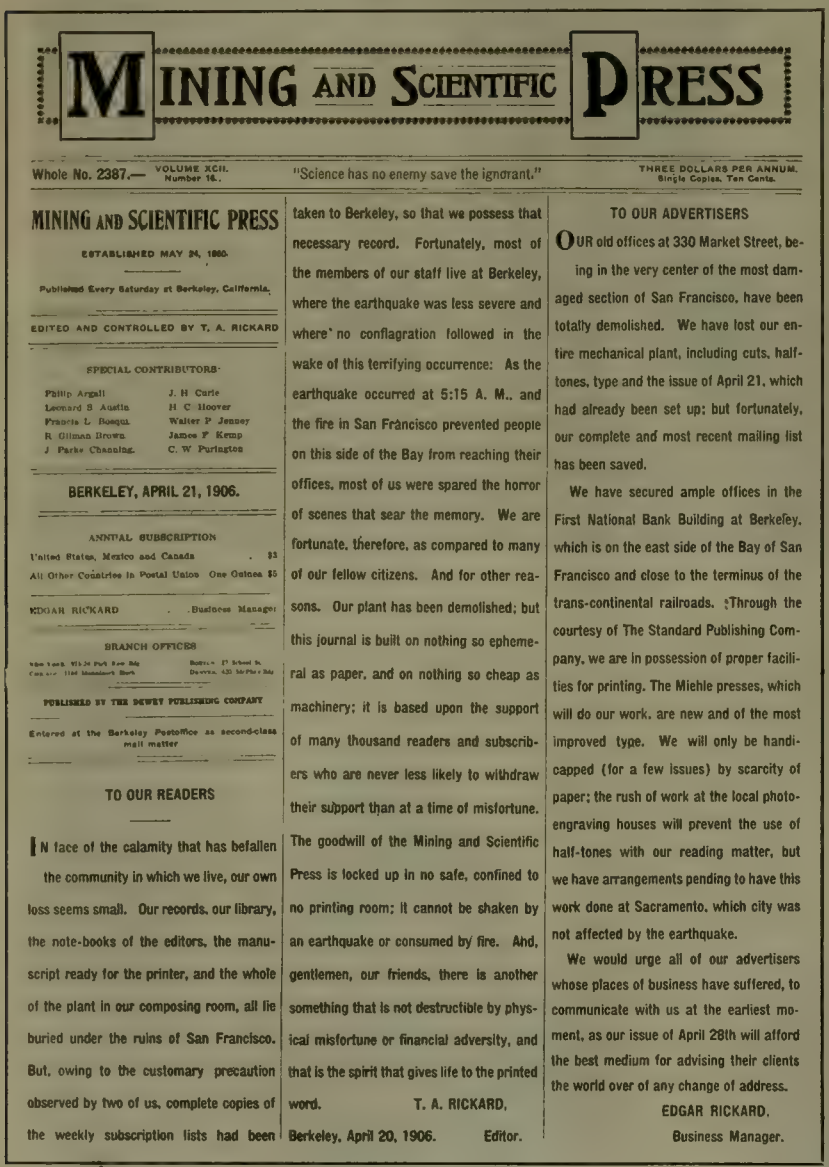
It was dawn; in the street were frightened men and women in night garments, talking in an excitable manner, as was natural. As no more shocks were felt, I returned to bed, and dozed until 7, my usual hour for rising. The magnitude of the event was not appreciated, but, expecting a busy day ahead, I deemed it well to get the usual allowance of sleep. Soon after rising—at 7 o'clock—we received a call from our landlady, Miss Rickoff, warning us not to light the kitchen fire, as the chimney had fallen. Luckily, we had a gas stove, which was intact. Both chimneys had been shattered and the bricks from one of them had fallen on the roof, upon an upper veranda, and then upon the wooden porch, and yet the racking of the timbers had made so much noise in the house that we were unaware that we had lost the use of our hearth. Moreover, the shaking of the house was so severe as to nauseate both children,

Portals of the Past.

A Glimpse of the Old San Francisco.

one, one and one-half, and the other five years old.

Breakfast passed off without incident; at 8:10 I went on the front porch to watch the cloud of smoke that now enveloped a large part of San Francisco. Evidently the earthquake had started several fires, as might be expected. While standing on the porch I *heard* an earthquake before the house began to tremble; the sound resembled a heavy blast four or five hundred feet underground. At 8:14 another shock followed, and caused sufficient anxiety to make



MINING AND SCIENTIFIC PRESS

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MINING AND SCIENTIFIC PRESS

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R Gilman Brown — James F Kemp
J Parke Channing — C. W Purington

BERKELEY, APRIL 21, 1906.

ANNUAL SUBSCRIPTION

United States, Mexico and Canada . $3
All Other Countries in Postal Union One Guinea $5

EDGAR RICKARD . Business Manager

BRANCH OFFICES

PUBLISHED BY THE DEWEY PUBLISHING COMPANY

Entered at the Berkeley Postoffice as second-class mail matter

TO OUR READERS

IN face of the calamity that has befallen the community in which we live, our own loss seems small. Our records, our library, the note-books of the editors, the manuscript ready for the printer, and the whole of the plant in our composing room, all lie buried under the ruins of San Francisco. But, owing to the customary precaution observed by two of us, complete copies of the weekly subscription lists had been taken to Berkeley, so that we possess that necessary record. Fortunately, most of the members of our staff live at Berkeley, where the earthquake was less severe and where no conflagration followed in the wake of this terrifying occurrence: As the earthquake occurred at 5:15 A. M., and the fire in San Francisco prevented people on this side of the Bay from reaching their offices, most of us were spared the horror of scenes that sear the memory. We are fortunate, therefore, as compared to many of our fellow citizens. And for other reasons. Our plant has been demolished; but this journal is built on nothing so ephemeral as paper, and on nothing so cheap as machinery; it is based upon the support of many thousand readers and subscribers who are never less likely to withdraw their support than at a time of misfortune. The goodwill of the Mining and Scientific Press is locked up in no safe, confined to no printing room; it cannot be shaken by an earthquake or consumed by fire. And, gentlemen, our friends, there is another something that is not destructible by physical misfortune or financial adversity, and that is the spirit that gives life to the printed word.

T. A. RICKARD,
Editor.

Berkeley, April 20, 1906.

TO OUR ADVERTISERS

OUR old offices at 330 Market Street, being in the very center of the most damaged section of San Francisco, have been totally demolished. We have lost our entire mechanical plant, including cuts, half-tones, type and the issue of April 21, which had already been set up; but fortunately, our complete and most recent mailing list has been saved.

We have secured ample offices in the First National Bank Building at Berkeley, which is on the east side of the Bay of San Francisco and close to the terminus of the trans-continental railroads. Through the courtesy of The Standard Publishing Company, we are in possession of proper facilities for printing. The Miehle presses, which will do our work, are new and of the most improved type. We will only be handicapped (for a few issues) by scarcity of paper; the rush of work at the local photo-engraving houses will prevent the use of half-tones with our reading matter, but we have arrangements pending to have this work done at Sacramento, which city was not affected by the earthquake.

We would urge all of our advertisers whose places of business have suffered, to communicate with us at the earliest moment, as our issue of April 28th will afford the best medium for advising their clients the world over of any change of address.

EDGAR RICKARD,
Business Manager.

The 'Disaster' Edition.

me undecided whether to stay at home with the family or go to the city and ascertain the fate of our offices. Just then came a telephone call from Edgar Rickard. He informed me that it was impossible to go to San Francisco.

Here I may explain that Berkeley is a university town on the eastern side of the Bay of San Francisco, which is reached by six miles of electric railway and six miles of ferry. Berkeley, Oakland, and Alameda are the bedrooms of San Francisco, from their suburban residences the businessmen cross the Bay daily to the metropolis of the Golden Gate. The office of the M. & S. P., which is known to its friends by these initials, was then at 330 Market street, at the crossing of Bush and Battery streets, in a six-story building belonging to the Crocker estate. Most of the staff lived out of town; Edgar Rickard was then at the Claremont Country Club, Oakland; H. F. Dexter at Alameda; but John J. Young's home was on Shotwell street, near Twenty-fifth, in the Mission district of San Francisco. These facts had an important bearing on subsequent events and will help to explain my narrative.

Now I revert to Edgar Rickard, who at 8:15 was at Berkeley mole; he telephoned, warning me not to try to reach the city, that the railroad and ferry service was stopped, that entrance to the city was forbidden, owing to a great fire, that he feared our office must have been destroyed, as it was in a a quarter evidently in flames, and that he would join me as quickly as possible.

He arrived at 2 o'clock. In the interval I first walked around our neighborhood and noticed that most of the chimneys were down; at the asylum for the deaf and dumb one tower had been overthrown and another badly shattered. All clocks had stopped at 5:13 or 5:14, but the damage in Berkeley was not as impressive as the big cloud of smoke that was now rising to heaven from the doomed city across the Bay. After a short stroll, however, I went into my little library and utilized the time in writing an article on earthquakes. This is the editorial that appeared in our issue of April 28. It happened that Vesuvius had been active early in March and only the day before I had received some excellent photographs of the flows of lava invading Italian villages; it was my intention to write on the subject, linking the events of a geological today with the evidence of similar occurrences in the remote past, with particular reference to the igneous rocks familiar to the miner. Thus I was primed to consider the subject of subterranean unrest and it did not take long to gather the neces-

San Francisco Burning.

Palace Hotel Burning.

Ruins of Our Office Building.

sary ammunition. Among my books was a compilation of most of the magazine articles that were published on the Mount Pelée catastrophe of 1902, a subject in which I had been keenly interested because it had been accurately described in the light of modern ideas of vulcanism. By the time Edgar Rickard arrived, I had written an article suitable for our next issue, the publication of which seemed just then most remote.

Edgar brought news. He had walked from the mole to Oakland and then through that town toward Berkeley; on the way he had been fortunate enough to meet Mrs. Charles Butters in her motor-car and had obtained a lift. It appeared that in Oakland the

earthquake had done much damage, all business was at a standstill, wild rumors were afloat that Los Angeles had been overwhelmed by a tidal wave, that Santa Rosa and San José were in ruins, that Denver had been destroyed, that Chicago was under Lake Michigan, and that the railroad system connecting San Francisco with the rest of the country was shattered.

Meanwhile the great mass of smoke across the Bay rose higher and higher into the serene sky until it reached 10,000 ft. vertically, for not a breath of air was felt and the peaceful beauty of nature seemed to deride the welter of destruction into which we had been plunged. Psychologically this was the most vivid moment; we did not know whether or not our local disaster was on the fringe of a cosmic catastrophe; it looked like the end of all things; we were prepared to hear that the rest of the American continent was in the throes of a worldwide horror, and we scarcely dared to ask whether any news had come from Europe. But we possessed an invincible optimism, coupled with a keen appreciation of the capacity for exaggeration possessed by our local newspapers, and so refused to believe the weird tales that had a brief vogue amid an anxious community.

We had work to do; that was the best anodyne. One of the first things Edgar told me was that the mailing list was saved. My readers will know that this is a printed list giving the name of every subscriber, with the address and the date at which each subscription expires. We had only taken control of the M. & S. P. four months earlier, Edgar having become business manager on December 1, 1905, while I assumed the editorship on January 1, 1906; but it was our custom, as it was that of our predecessor, J. F. Halloran, to take home a copy of the mailing list as a safeguard against a fire in the city. Edgar had just returned from a visit to New York, and in his absence I had adopted the same precaution. Thus I had the mailing list for the week ending on April 14, and he had the list for the current week—brought home the evening previous. The point is worth explaining, for it was vital. I turned to him and said: "Well, if the rest of creation is not wiped out, we are all right; we want an office and a printing press; the rest we can manage, for the Lord knows there is news enough." Just then Miss Lie, the typist, arrived and confirmed the destruction of our offices. She had crossed on an early ferry, before communication was cut off, and had been able to go up Market street far enough to see that our building was doomed. We could not telephone to Mr. Young but we were soon in touch with Mr. Dexter. Thereupon Edgar and I went down town, that is, to the business portion of Berkeley, in search of offices and printers. Fortunately a six-story building had just been erected by the First National Bank, and being a steel structure and thoroughly well built, it had survived the earthquake intact; only a little plaster had been shaken loose. Being a new building there were many rooms vacant, and we hastened to take a lease of five on the top floor. Of the two Berkeley newspapers, the *Reporter* had presses large enough for the M. & S. P., which, it must be remembered, was then printed on a 32 by 46 in. sheet, the pages being 11 by 15 inches. It was not until the July following that we reduced the pages to their present size. An arrangement was made with the manager of the *Reporter*; no terms were specified, but he promised "to take care of us." He did! Thus Edgar, as business manager, had leased offices before 3 o'clock and had secured printing facilities before 5 o'clock on the first day of the fire. We bought temporary furniture, mainly kitchen tables, and engaged a number of refugee girls to address envelopes. Already a headquarters for refugees had been opened at Berkeley to take care of the crowds fleeing from the city across the Bay. We realized that the postal service would be so glutted as to prevent acceptance of second-class mail and arranged to send our emergency sheet by letter postage. Foreseeing a rush, Edgar bought the entire stock of stamped envelopes for sale at the Berkeley post-office.

Returning home I found that our neighbors, Mr. and Mrs. William E. Colby, knowing that our chimneys were down, had invited us to dine with them. We dressed as usual and found a party of a dozen people, including the veteran geologist, G. K. Gilbert. As the twilight darkened the flames across the Bay became vivid, and we stood in the window discussing a disaster the full extent of which was still unknown. Our host was a lawyer with an office in the Mills building, on Montgomery street, San Francisco, and as yet the fire had not reached that quarter, although the worst was feared. Those who lived in the city or had crossed early in the morning had been able to reach their offices before the fire spread, but it had availed them little, for in most cases they had failed to foresee the extent of the impending conflagration and had deemed it enough to place their papers in safes that proved useless as a protection against the fierce fire raging on the two subsequent days.

Soon after we had taken our seats at the dinner table, at 7:15 a severe shock was felt and my wife was on the point of hastening to our children next door; but the tremor was brief and we had become accustomed to such happenings, so that the dinner passed pleasantly. It was the last quiet evening most of us enjoyed for many weeks, for during the succeeding days the destruction of the business portion of San Francisco threw the community on its beam ends and created manifold anxieties. As we left our kind hosts and walked the short distance home, Mr. Gilbert was with us, and when we stopped to comment upon the spreading of the fire across the water, he said: "Do you feel as if you had been fiddling," the reference being to Nero's performance while Rome was burning. I answered unhesitatingly: "No, there was nothing we could do, this is a brief interval before days of consuming anxiety, and the quiet evening spent among friends has done good to all of us." He acquiesced. We knew not what was ahead, but we did know that there was lots of work to do.

Next day dawned beautifully. People talked afterward of earthquake weather; it is a fallacy. The day on which the earthquake happened and those that followed were worthy of the best that California gives to her children: without a cloud, without a breeze, not hot, but serene and calm, as if Nature

were lulled in a siesta it was a glaring contrast to the calamitous event that culminated in the destruction of a beautiful city and the paralysis of a highly organized community. From the Golden Gate San Francisco lifted an ashen face to the blue of a pitilessly perfect sky.

Ready to Begin Again.

By the next day the rumors of general disaster had been contradicted, we learned that the tidal wave at Los Angeles was a myth; the destruction of a large part of Santa Rosa and San José was confirmed but the loss of life was small. Denver and Chicago were still on the map, the railroad was in operation and was taking thousands of refugees from the stricken city. From there the news was worse; the fire was spreading, the water pipes were broken, the gas escaping from mains had been ignited by short-circuiting electric wires. San Francisco was doomed. All the lower part of the town was already gutted by the flames; the Palace Hotel was gone, the St. Francis was threatened, and the Fire Department was helpless, for the chief of the department had been killed during the earthquake. Modern man, in the midst of the complex civilization he had himself created, was more helpless than a savage in a primeval forest.

The earthquake was on Wednesday; on Thursday our staff began to foregather. All were on hand except Mr. Young, from whom we had received no word. On the preceding afternoon D'Arcy Weatherbe, who was then on the editorial staff, had found his way into the city and gathered notes for the vivid article published in our issue of the 28th. On Saturday Weatherbe and Edgar obtained permits, penetrated into the smouldering ruins, and eventually found Mr. Young, whose house was badly shaken but had just escaped the conflagration. As soon as he had seen to the safety and temporary housing of his family, he came to Berkeley and stayed at my house for we were all keen to rehabilitate the M. & S. P. On the very day of the 'quake Edgar had telegraphed to our agents informing them that we had secured quarters and printing facilities at Berkeley, and instructing them to procure new plates or 'blocks' from our advertisers. I wired to our regular correspondents telling them to send their letters as usual, and at the same time I had sent telegrams to those whose articles were in the issue of April 21, which was going to press on April 18, and was therefore destroyed. I asked the contributors to that issue to send me copies of their articles. In consequence of these steps we had plenty of good material for the issues of April 28 and May 5. In place of the number for April 21 we printed a single sheet—our 'disaster' issue, as we now call it. A facsimile of it appears on another page. The copy was prepared on Thursday, April 19, and went to press in the evening of that day, so that the issue of the M. & S. P. for April 21 appeared at 5 o'clock on April 20, and was promptly mailed in stamped envelopes that had been addressed by refugee girls who were paid by orders on the grocers. Thus the M. & S. P. appeared before the San Francisco fire had stopped spreading. The subsequent issue, that of April 28, was full of interesting accounts of the earthquake, well illustrated, and with plenty of advertising matter.

Opening a Safe in the Ruins.

We did not lose everything in our San Francisco office. Early on the morning of the earthquake John J. Young, the chief of the composing room, and

Philip F. Sage, a clerk, had gone to the top of the six-story building, already racked by the tremors and further endangered by the rapidly encroaching conflagration. Fourteen times did they go up and down the uncertain stairway. Fortunately another tenant in the building, Charles E. Townsend, a patent lawyer, had procured a light wagon from a personal friend, with the purpose of saving his library. An arrangement was promptly made whereby Young and Sage were to help him in moving his books and records, while he would give them the use of the vehicle for transferring such papers and material as they could save from our offices. It was impossible to hire any conveyance at this time. After two hours of hard work the wagon-loads of stuff were taken to the Central market, in the basement of which it was stored. But this building was soon threatened by the advancing fire; Townsend secured another vehicle and hurriedly moved his own belongings, and ours also, to a safer place. To make a long story short, he had to make six hasty removals, losing a few things each time, until finally he buried the lot in a hole dug in a vacant bit of ground near the Hollischikie Club, the members of which helped him to store everything under a safe cover of sand, together with the pictures and other articles of value belonging to the club. There it remained until the fire had spent itself. We supposed everything was lost, but on Friday (April 20) we received a telephone message from Miss Strong, the daughter of Mr. Townsend's business associate, telling us that some of our papers were saved, and on Saturday we heard from Young how it was done. A week later the salvage was disinterred and brought to Berkeley. Among the things that were saved we found the bulk of the contents of the editor's desk, the business manager's 'follow-up file', correspondence covering the last six weeks, an almost complete set of advertising contracts, and the monthly statements ready to be posted to advertisers.

On the ruins of the building that was formerly 330 Market street we found our safe, with a big hole in the side; evidently the iron sheathing had been punctured in falling and the cement lining was mere rubble. As soon as it was cool the safe was hauled to the water-front, where a stream of water was turned into the hole so that the cinders were washed out. These were panned in miner fashion and in the concentrate was found $55 in coin and a medal. This last had been awarded to the M. & S. P. at the Chicago Exposition; it was in an aluminum case, of which the plush covering was now represented by soot, but the aluminum had protected the bronze medal itself so that it was but slightly oxidized. I am glad to say that the gold medal won by the paper at the St. Louis Exposition was saved, for I had given it to Mr. Halloran at the time he resigned control. Of course, all the paper currency and account books in the safe had vanished in smoke.

For ten weeks, until a new addressing machine arrived from Chicago, all the copies of the paper were addressed by hand. Prompt notification to the postmaster at San Francisco caused our mail to be redirected to Berkeley and on the Monday following the earthquake we began to receive letters. This also meant a resumption of revenue, so much needed at a time when the banks were closed, and postal orders served as efficient currency. While the banks of California were officially closed for a couple of months, we had no trouble in arranging for financial credit, at first, and for ordinary exchange, later. Our stock of paper with Blake, Moffitt & Towne was consumed in the fire, but this old firm showed plenty of enterprise and we were soon supplied with excellent paper, furnished to us without extra charge. This was one of the few examples of fair dealing and of a refusal to take advantage of the disaster that had befallen the community. Our other experiences were less pleasant. The manager of the *Reporter* made us pay three times the usual rate for printing and then, assuming that we were helpless, he charged extras until the imposition became intolerable. The presses were in demand for the regular evening edition of the newspaper and a heavy demand for job printing at high rates offered lucrative returns. Moreover, the management of the *Reporter* was in a chaotic condition most of the time, owing to divided control; thus it can be understood that we had to suffer frequent delays and hindrances of an acute kind. The situation was precarious, and we did not know from week to week whether the M. & S. P. would appear or not. Just in the nick of time a printing establishment—that of the Stanley-Taylor Co.—was opened in San Francisco, so we bought a motor-car and sent our 'forms' across the Bay, a distance of 12 miles of land and water. This entailed delays, of course, but it enabled us to escape from the *Reporter*. After the earthquake our composition was done at the printer's, but by the end of June our plant, ordered from Philadelphia, arrived; we equipped a composing room of our own in a building on Addison street, and despite the lack of 'sorts' we managed to do pretty well. In April of the following year we moved to San Francisco, and the general offices were once more under the same roof as the composing room, at 667 Howard street. In January, 1908, we installed a Mergenthaler linotype outfit and ceased setting type by hand, except for display advertising.

But I have gone ahead. In preparing for our issue of April 28, which was the first regular issue after the disaster, we reproduced 8 pages of advertisements by zinc-etching from our issue of April 14, and a number of illustrations were made from photographs showing the fire and the effects of the earthquake. This work was done at Oakland, Sacramento, Fresno, and Los Angeles. In order to have good half-tones I sent a number of photographic prints to Chicago. Another sample of unrestrained commercialism was afforded by the Oakland *Tribune*, which charged us five times the usual rate for a few zinc plates that we needed in a hurry for the issue of April 28. Our experiences were like those of others, we saw how small men can be when greedy to make money, but we also had plenty of opportunity to note the enlightened unselfishness of the better element in the community. The refugees from San Francisco know what that means, for the whole of America was so stirred by horror and sympathy as to elicit an astonishing expression of good-will in the form of supplies of food and clothing, accompanied by the most generous out-

Earthquake Rift in Made Ground, East Street Near the Water Front.

The New San Francisco, Palace Hotel, Monadnock, and Call Buildings.

pouring of friendly interest. As I have said, for a time we saw human nature with the clothes off. For two or three weeks the community, with rare exceptions such as I have noted, acted and spoke as if they had the fear of God in their hearts. As normal conditions supervened, they reverted to their old ways, but while the effect lasted it was strong and intensely stimulating.

At that time the congestion of traffic on the railroads was tremendous, for the main lines were glutted with supplies for the refugees, and with every kind of material required by a community temporarily beggared. On the side-tracks at Oakland and Sacramento were thousands of cars consigned to people that had no warehouses and therefore postponed unloading as long as possible. At one time 14,000 cars stood on the tracks. Owing to lack of system, the confusion became so great that cars were lost; it took months to trace a consignment and receive material urgently needed. We suffered by the late delivery of paper, especially the 'cadet blue' cover-paper intended to mark the reduced size of the M. & S. P. from July onward. The issue of July 7 appeared in white, for the cover-paper, ordered four months previous and actually in California before the disaster in April, was not delivered until July, having been returned with 'empties' to Galveston, Texas.

Of course, we worked to all hours, especially Mr. Young, who made himself ill with overwork and devotion to duty. For five or six weeks we knew no intermission, no Sundays, no abatement of the high pressure, but finally one morning I realized that we were "out of the woods", for I picked up my racket and went off at noon to the Country Club to play tennis. That marked the end of the crisis. And when the crisis was over we celebrated our deliverance in the good Anglo-Celtic way: by having a dinner. At that dinner the toast was: "It's the men behind the pulp that make the press."

The earthquake itself was almost forgotten in the devastating fire and the commercial upheaval that ensued. But the scientific aspect of the event has not been overlooked; never was an earthquake so diligently investigated or so thoroughly described. The report issued by the State Earthquake Commission, under the direction of A. C. Lawson, G. K. Gilbert, A. O. Leuschner, and other scientific authorities, was finally published by aid of the Carnegie Institution.

Briefly, the main facts may be stated as follows: The rupture in the earth's crust that was the immediate cause of the seismic phenomena has been traced from Point Delgada to San Juan, a distance of 270 miles. It follows an old line of dislocation and does not conform to the present topography. The plane of rupture is vertical; the vertical displacement was as much as 3 ft. and the horizontal displacement was as much as 21 ft., with an average of fully 10 ft. The zone of destructive effects reached for 35 miles on each side of the fault. Nearness to the fault determined the intensity of the earthquake shocks, but the character of the foundation was also a larger factor in modifying the effect on buildings. Alluvial tracts and filled ground were much more severely shaken than the solid rock. The maximum effects were felt near Bolinas and Inverness. On the Shafter ranch the fault-crevasse entombed a cow, the earthquake-rift marked by a natural trench 6 to 8 ft. wide.

It is recorded that rumbling, as of a train or rushing wind, preceded the big shock. Visible undulations, more than a foot high, were seen on the surface of the ground. Persons were made dizzy and nauseated. Horse and cattle showed fear just before the earthquake and many of them were thrown by the commotion of the ground. Horses whinnied and cattle bellowed in fear, but the noises made by human beings were more varied and more sustained. The shock was perceptible from Coos Bay, in Oregon, to Los Angeles, in California, a distance of 730 miles; laterally the vibrations were felt as far as Winnemucca, Nevada, a distance of 300 miles. This indicates the limits to which the vibrations were sharp enough to appeal to the senses, but the earth-waves pulsated round the entire globe and were recorded by the seismograph in every civilized country. The financial reverberations are felt even to this day. The total loss of life in California was about 1000; the loss of property in San Francisco is estimated at $500,000,000. But the city by the Golden Gate, "the warder of two continents," true to the prophetic words of Bret Harte, rose, "serene, indifferent of fate," from her ruins, imperturbably victorious over Nature and instantly responsive to the energy of her citizens. San Francisco survived; the MINING AND SCIENTIFIC PRESS survived. It was a great episode.

FARROBAMBA COPPER PROPERTY

This property is situated some 60 miles east of Cuzco, Peru, which is the terminus of a railroad line from Molendo. A report was made on the property for English clients by Gordon Firebrace, and the statements made in this report are absolutely stupendous. The holdings of this group of claims consist of six different properties, only two or three of which have been reported on by Mr. Firebrace. He states in his reports that the principal one of these is the Farrobamba on which there is an outcrop of 1000 metres long, 300 metres wide, and 100 metres high which apparently is solid ore. Shots put in various parts of the outcrop give an average of 8%, which assays from 2 to over 20%, the ore being sulphide. In a supplementary statement which he made for the chairman of the company, he states that there are about 400,000,000 tons of 8% ore. In addition to the vast quantities of ore, it is stated that there are about 125,000 hp. available in the river which flows through the property. On the strength of Mr. Firebrace's report, the company has appropriated ₱25,000 for carrying on a campaign of development by means of open-cut and churn-drills. They have purchased a Keystone drill in this country which is about to be shipped to Peru and they are engaging a drill runner. In addition they have employed a man who was formerly in charge of the open-cuts on the Dunderline iron mines in Norway. Claude Vautin is now on the way to the property to investigate metallurgical conditions.

Copper Through Fifty Years

Written for the Mining and Scientific Press
By James Douglas

The copper industry of the country since the middle of the last century presents many points of interest. It has been subject to the usual vicissitudes of trade and finance. It has tried the experiment of high protection and of no protection at all. It was at one time controlled by an agreement of the large producers but during the longer period has been subjected to unlimited and untrammeled competition. And yet it has prospered. In production we have grown from almost the most insignificant among the world's contributors to being the controlling influence of the world's market. For our report of our monthly output the copper market waits with bated breath.

In 1850 the rank of the world's copper producing countries was as follows:

WORLD'S PRODUCTION OF COPPER FOR 1850

Country	Pounds	Per cent of total.
Great Britain	29,648,000	26.8
Chile	25,000,000	22.9
Russia	12,000,000	11.8
Austrian Empire	6,660,000	6.0
Cuba	6,800,000	6.3
Australia and New Zealand	7,000,000	6.4
Scandinavia	4,000,000	3.7
German States	2,800,000	2.6
Rest of Europe	2,000,000	1.8
Turkey	2,000,000	1.8
Asia	6,000,000	5.4
South America (except Chile)	2,400,000	2.2
Africa	1,200,000	1.1
United States and Canada	1,300,000	1.2
Total	109,708,000	100.0

In 1909 the position of most of those mentioned above is strangely reversed:

WORLD'S PRODUCTION OF COPPER FOR 1909.

Country.	Pounds.	Per cent of total.
Algeria	224,000	0.01
Argentina	1,120,000	0.06
Australasia	98,560,000	5.22
Austria	2,800,000	0.14
Bolivia	6,160,000	0.32
Canada	51,520,000	2.72
Cape Colony	15,680,000	0.83
Chile	84,000,000	4.51
Great Britain	1,120,000	0.06
Germany	44,800,000	2.37
Hungary	224,000	0.01
Italy	7,840,000	0.41
Japan	115,280,000	5.56
Mexico	125,440,000	6.64
Newfoundland	4,480,000	0.23
Norway	22,400,000	1.18
Peru	44,800,000	2.37
Russia	50,400,000	2.66
Sweden	3,360,000	0.17
Spain and Portugal	116,480,000	6.16
Turkey	2,240,000	0.11
United States	1,099,840,000	58.23
Total	1,888,768,000	100.00

The United States stands first with a production of 1,099,840,000 lb., or 58.23% of the world's production, and Great Britain's production has become a negligible quantity. Spain does not appear in the old list but today takes second rank. Australia has risen to third place, followed by Chile, which during the seventh decade of the last century rose to first place. Chile then declined through the exhaustion of rich mines but is again coming to the front. During that period Venezuela became prominent mainly through one great mine the New Quebrada but another has never been found and the country has disappeared from the list. Peru, on the other hand is in the ascendant. Africa's contribution during the half century has been from the coast mines of the Cape Copper Co., but may, now that the interior is being reached by rail, become a large factor. The rise or decline of a country's production, or even of a single large mine, may sensibly affect prices, as the volume of the world's copper production is comparatively small. This has been conspicuously shown by our own experience.

From 1857 to 1861, during which year our mines increased their output from 10,700,000 lb. a year to 16,800,000, copper was on the free list and the world's price virtually regulated ours. With the breaking out of the war the Morrill tariff act was passed, which taxed everything on which revenue could be raised, and copper was stricken from the free list. The duty first imposed was 2c. per pound, and from 1864 to 1869 2½c. was the rate. Our production increased from 16,800,000 lb. in 1861 to 28,000,000 in 1869. This rapid rise was due to the development of the Calumet & Hecla. The effect of the 2 and 2½c. duty was immediately felt in the higher price of copper here. In 1863 the price of Lake ingot in this country was 4c. above the price of Chile bars in England. Though this difference was not maintained, the average for a time was about 3 cents.

The tariff tendency—steadily upward till checked—was of course taken advantage of by the copper industries, and therefore they demanded more. The demand was acceded to and the duty on ingots was raised to 5c. in December 1869. And at 5c. per pound it continued till 1882, except during 1872 and 1873, when it was reduced to 4½c. Meanwhile the annual production of the country had risen from 28,000,000 to 90,600,000 lb., and great changes had occurred, disturbing the balance of powers as it existed during the supremacy of the Lake mines. From the time when Calumet & Hecla commenced its phenomenal production, say in 1868, till 1881, the percentage of production by Michigan had never fallen below 80% of the country's total, and had risen as high as 95.7 in 1872. During that period our production had begun to exceed our consumption. There was even a small balance of 102,821 lb. for export in 1864. In order to secure full advantage of the duty under these circumstances some combination by the copper companies had to be devised. The producers outside of Michigan up to that date might be neglected. The Lake companies alone were therefore included in the several plans which were either proposed or carried out. The MINING AND SCIENTIFIC PRESS, in its issue of July 20, 1872, said: "The copper ring has contracted at a stipulated price for the product of the prominent Lake Su-

perior mines for a certain length of time, reported all the way from six to twelve months." The scheme miscarried, for English holders of Lake copper who had bought large quantities of the metal the previous year, took advantage of the higher American price to unload their unused stock on the market, though the original buyers had pledged themselves not to re-export. The final attempt to create a copper trust commenced in 1879 and ended by decree of the Court in 1885. The story is told in the 'Tariff Reform' Pamphlet Vol. III. No. 2, page 440.

"The combination was formed by the following mines: The Calumet & Hecla, Atlantic, Quincy, Central, Allouez, Franklin, Pewabic, and Huron: the Copper Falls and Conglomerate companies were admitted later. It was agreed that all the sales of copper should be made by the sales agent of the Calumet & Hecla. The aim was to keep up the price of copper in this country to the limit allowed by the tariff of 5c. per pound. The surplus produced over the consumption in the United States was to be exported and sold on the condition that the buyers would not re-import it. This plan continued till 1883, when the sales agent of the Calumet & Hecla died. Thereupon, written contracts were made by all the mines mentioned above, providing that all the copper produced should be pooled and sold by the Calumet & Hecla either in this country or abroad. Ten per cent of the receipts from the sales of copper was to be retained for use either to buy Lake copper in the markets when they should become glutted, or in case it was thought best to hold the copper for a considerable length to assist the weaker mines to continue their operations. This contract was drawn October 13, 1883, to continue in force one year. On February 14, 1884, new contracts were made to continue the arrangements till January 1, 1885, and the third and last contract was drawn up and signed August 20, 1884, to continue the pool one year longer, from January 1, 1885. These contracts gave the Calumet & Hecla complete control over all the copper produced in Michigan to sell when it pleased and at what price it pleased. In the last contract the following provision occurs: 'It is the purpose of the Calumet & Hecla Mining Co. to make a large sale of copper for export at the best price obtainable, from 12,000 to 17,000 tons.' The sale was made and the copper was to be delivered in three installments in November, December, and January, and the price agreed upon was an advance of £4 per ton (equal to 0.86c. per pound) above the average price of Chile bars for those months. The Quincy company objected to this and proceeded to sell its copper for export through certain brokers in New York, who succeeded in getting more than a cent per pound above the price obtained by the Calumet & Hecla.

"The Calumet & Hecla, for itself and the other mines in the pool, applied for an injunction from the Supreme Court of New York, to stop the independent sale of copper by the Quincy company. The Sixth article of the complaint is as follows: 'Acting upon the faith of and in full compliance with said agreements, said Calumet & Hecla Mining Co. entered into an agreement and made a contract with certain European parties for the sale and delivery during the periods covered by said agreements of many thousand tons of copper. A part of the consideration of said last named contract with said European parties was the agreement made by the said Calumet & Hecla Mining Co., acting for itself and for all the other companies above named, that no more copper should be sold by said companies for exportation during said period, and the European parties agreed on their part that none of said copper should be reimported into the United States.' In answer, the defendant, the Quincy Mining Co., declares: 'For an answer and defense herein the defendant alleges that the contracts referred to in the plaintiff's complaint were executed by the several parties thereto for the purpose of carrying into effect agreements which they had made to combine with each other to prevent a free competition among themselves in the business of selling their productions of copper, and to enable the plaintiff, the Calumet & Hecla Mining Co., to control the amount of Lake Superior copper which should be put upon the market, and also to control and to keep up beyond what it would otherwise be, the price at which the same should be sold during the continuance of said contracts.' In January 1885, Judge Lawrence rendered his decision, refusing to grant the injunction on the ground that it was contrary to public policy."

Thus ended the only copper combine made by all the large copper companies who were in active operation at the time of its original formation. But in the interval between 1880 and 1885 natural forces less easy to evade than legal statutes came into play. Arizona had entered the field as a large producer in 1881, and Montana had followed suit in 1882, and these Western companies contained elements more difficult to harmonize than had been found in the little group of Michigan mining companies. The effect on production and on price was startling.

Year.	Production, lb....	Per cent of increase over previous year.....	U. S. price of Lake Superior Ingots, cents	Foreign price of Chile bars—2c. under price of ingots, cents...
1881	71,681,000	18.6	18⅛	13¼
1882	90,646,000	12.5	18½	14½
1883	115,526,000	27.4	15⅞	13¾
1884	144,946,000	25.5	13⅞	11⅞
1885	165,875,000	14.4	11⅛	9½
1886	156,735,000	5.5*	11	8¾

*Decrease.

The Lake combination was ineffective in sustaining prices beyond 1882, owing to the entrance of the production of these Western mines into the market of the world and the impossibility of incorporating them into any copper trust. The Arizona Copper Co., making bars which ranked as Chile bars and were worth about 2c. per pound under Lake ingot, might have combined with the Lake companies; for in those early days Montana made matte only, and it was all, or nearly all, shipped to Europe for treatment. An equitable agreement between the Michigan and the Western mines would therefore have

been difficult even if the personal element among the few men who controlled the copper trade had not erected a more unsurmountable barrier against co-operation than difficulties arising from discrepancies in values and divisions of quantities.

Soon after the appearance of the Western copper the law of supply and demand asserted itself. The enormous and rapidly increasing production of Montana, added to the notable but less phenomenal growth of Arizona's output, made the balance for export so large that the scramble for the protection of the home market became furious. As a consequence the duty soon became inoperative so far as the miner was concerned, and the price in this country fell to that of the world plus the cost of importation. This must inevitably happen with any protected article produced in excess of the home demand, unless some artificial method of making the duty effective is devised. The Anaconda output was in fact the principal factor in bringing about the drop in the world's price of copper in 1885, 1886, and 1887, which preceded the formation of the Secretan Syndicate. The fall in price was so grave as to tell on production, which, as the statistics show, fell off 5.5% between 1885 and 1886. The decline in price was such that Lake copper sold languidly at 10c., and the Copper Queen Co. made contracts for its bars at 8c., and at even a trifle under. The tariff gave the distressed industry no help, but M. Secretan came to its assistance, offering to buy the output of the mines for three years at stipulated figures. There was, however, no understanding or concurrent action among the American producers in their dealings with the French Syndicate. Some producers refused to sell, and with each of those who did sell there was an independent negotiation, and all by no means received a uniform price. The price paid was on an average 5c. per pound higher than had ruled for the two previous years. The effect on production is indicated by a rise of 15.4% between 1886 and 1887, and of 25.17 during the following year. On the failure of the syndicate, production was so far arrested that the figures for 1889 showed, for the whole country, an increase of only half a million. But this stagnation was only temporary. The syndicate stocks were rapidly absorbed or disposed of, and in 1890 the price of copper rose to 15c., and production increased 14.5% over that of 1889. But the terrible crisis of 1893 was at hand, and told disastrously on both production and prices.

In 1893 the situation changed. There was a decrease instead of an increase in production, and the average price for Lake ingot fell to 9.5c. Despite the staggering blow the copper trade rapidly picked up courage, and in 1894 showed a 7½% increase over 1893 and a rise in price of 1¼c. This resiliency, when the whole country was prostrate, may have been in spite of or may have been the result of, the self reliance which the placing of copper on the free list by the McKinley bill may have engendered. The plea for punishing the copper companies was that they had conspired with a foreign syndicate to artificially and injuriously influence prices. In fact, the companies which did sell to M. Secretan did individually what has been done before and since, namely, sold their production ahead to the highest bidder, at a most tempting figure, which raised most of the blighted concerns from despair into easy circumstances. So little benefit was derived from the tariff that when the trade was threatened by the complete removal of tariff protection the companies did not send a lobby to Washington or even protest. For years protection had ceased to protect. Every large company had opened its European sales agency and had secured its own customers, and therefore a market had been found for the total American surplus, no matter what it might be, if only the world's price were accepted. The removal of the duty therefore made no difference, but the financial crisis of 1893 did. Yet it was chiefly in the dividends. The price continued low till 1898, when a wave of high price developed, followed in 1902 by another decline. This lasted for three years, when a second wave within a decade of excessive price set in, followed by a relapse.

These serious vascillations in price doubtless create disturbance in trade and stimulate, even if they do not originate, speculative manipulation. The only remedy conceivable would be a vast combination, which would include both the mining and manufacturing interests, wealthy enough to absorb the existing companies by tempting the weak, and so omnipotent that no opposition could be started without risk of being crushed. The Secretan schemes were wrecked by not placating the manufacturers of the world, who unearthed unsuspected stocks of old and new copper of surprising magnitude. This remedy would probably be again administered. But assuming that such a world-wide combination in restraint of trade could be brought about with the view of securing stability of price, two consequences would follow. The price would inevitably be so high that the public would pay very dearly for the luxury of consistent uniformity in value. And as a result of high prices reduction in demand would follow. The supply can be controlled—the demand cannot, unless under rigid public control under State socialism. Past history showed a tariff without a trust to be powerless to create uniformity. A copper trust can no more be framed today than it could in the past. What we need more than a trust at present in this country is a large increase in consumption to use up the surplus that has been created during the past dull period. In this connection there would appear to be a great field for increasing consumption, if our copper mills would see their way clear to roll standard sizes of copper sheets for architectural purposes, and sell them to the public for roofing and such work as cheaply as copper wire is being sold at present. In the copper mills of Europe the difference between the price of wire and copper sheets is very much less than it is in this country, and this matter is well worth the serious consideration of our copper manufacturers, if they desire to retain this branch of their business for any long period.

During the past six years, 7920 wells have been sunk in the United States, and eleven and a half millions of barrels of crude oil produced.—Mining and Scientific Press, September 21, 1867.

An Early Opinion of Alaska

Written for the MINING AND SCIENTIFIC PRESS
By WILLIAM P. BLAKE

You have asked me for a few words about Alaska as I know it in the year 1863. A year or more in Japan gave me many friends among the officers of the Imperial Russian navy. Meeting the commander of the corvette *Rhynda* in Shanghai when I was seeking a vessel for America, he said (with the consent of the Admiral of the station): "Come with me. I am bound for your country by way of our Russian America." I accepted the invitation. Leaving Shanghai we steamed to Hakodate, Japan, and thence by sail, skirting the southern side of the Aleutian Islands and encountering the ice-cold currents from the Arctic seas until we reached the forest-covered shores of Russian America at Sitka. The opening of sealed orders revealed the fact that exploration of the resources of the country was intended. Two boat expeditions were organized, one to proceed up the Stikine river into the interior by whale-boat and the other to study the hydrography of the coast. I was invited to join either one, and at once chose the Stikine boat party as offering me the best chance to learn something of the then unknown land. We were frequently the guests of the Governor General of Russian America, Prince Maxsutoff, at his castle in whose halls I found large slabs of native copper from the 'Copper Mine' river; pieces that reminded me of our mass-copper of Keweenaw, Lake Superior. We heard also of the believed great copper masses of Medni island, one of the Aleutian chain, and the only island I believe reserved from the sale, later, by the Russian Government.

After a few days in Sitka the boat party of picked sailors under the command of Lieut. Perereleshin was organized, and we started for the interior. We rowed up the stream by day and camped upon the banks by night. The granitic and schistose rocks were in strong contrast with the generally volcanic shores of Japan, and had a familiar welcoming look, reminding me of old friends of my hammer in California. The banks and terraces carried some fine scale-gold, very light and evidently washed from far away sources in the northwest; probably from the Blue mountains of the interior. The first and most important discovery was that the upper parts of the Stikine followed a long interior valley parallel with the coast; its lower reaches cutting across what may be termed the coast ranges by a series of gorges and canyons. We had been told of 'mountains of ice' and soon found them to be glaciers of great extent, some of them with old terminal moraines crowding the river out of its course. Some were disgorged from hanging valleys. One I named the Popoff, in honor of Admiral Popoff.

Our progress up the rapidly flowing stream was slow, and for part of the way we resorted to towing by means of a long line from the boat to the shore. The ice of the headwaters of the Stikine was breaking up and huge cakes were floating down. The buds of the deciduous trees along the shores were bursting and the drumming of the grouse in the forest was a familiar sound as we passed under the shadow of the cliffs. A few hardy miners who had survived the terrors of an almost arctic winter were met on their way down the river to the coast with their hoards of gold, wrested by hard labor from the placers, and fortunate enough to escape death by freezing. From these miners I learned many interesting details of the low and high placers of the Blue mountains of the main range. It was evident that the ranges were gold-bearing, and from the general topography it was fair to conclude that the goldfields were co-extensive with the elevation and prolongation of the gold-bearing rocks.

I was not then aware of the negotiations for the purchase of Russian America, indeed the negotiations had begun so early, but when I reached Washington in 1868, returning from the Paris Exposition of 1867, the advisability of acquiring the region was under active discussion in Congress. Some thought it would be a foolish waste of money to buy such an utterly worthless wilderness—a region of ice, snow, and savages. W. H. Seward, Secretary of State, was urging the appropriation for the purchase, and hearing that I had been in that region requested an evening at his home to learn what I thought of it. At the close of this interview he asked me to give him the substance of my opinion of the country in writing, which was done. He sent it to President Grant, who at once made it a special message to Congress, and it was so published.* In that statement, opinion, or report (the first and only one at that time), attention was directed not alone to the value of the country for gold, but for copper. The opinion was expressed that the goldfields would be found to extend to the very shores of the icy sea, the full length of the country. Attention was also directed to the resources of the region for timber, for fisheries, and for furs. Some of my professional brethren may say that the gold I wrote of was not 'in sight', which is true enough, but the case did not permit of blocking out the ground and weighing the metal. Years must elapse before that can be done, but I submit that my opinion of Alaska has been amply justified.

Fuel required to thaw gravel may be estimated on the following assumptions: That a cubic yard of gravel in place contains 3000 lb. of solids with a coefficient of thermal capacity of 0.2, and 387.5 lb. of ice with an average coefficient of thermal capacity of 0.75; that the temperature is raised 50° F.; that a pound of coal contains 13,000 B. T. U.; that the boiler efficiency is 50%; that 75% of the heat leaving the boiler is absorbed by the ground. Then heat absorbed per pound of coal equals 4875 B. T. U.; heat required to raise 3000 lb. gravel 50° equals 30,000 B. T. U.; heat required to raise 3875 lb. ice 50° equals 14,531 B. T. U.; total heat required per yard of gravel equals 44,531 B. T. U. Pounds of coal per yard, 9.1345; cubic yards gravel per ton of coal, 218.8. Then, roughly, 8 tons of coal per foot of depth per acre are required to thaw the gravel. Roughly, the fuel required to thaw 'muck' is as 3 is to 2 compared with gravel; thus, 12 tons of coal are needed per foot deep of 'muck' per acre.

* House Ex. Doc. 40 Cong. 2 Sen. No. 177. Pt. ii. 1868.

Fifty Years of Advertising

Written for the MINING AND SCIENTIFIC PRESS
BY L. V. CORLETT

Advertising for the past fifty years has made large progress. A perusal of the columns of the MINING AND SCIENTIFIC PRESS in the sixties emphasizes this fact most forcibly. In those days the advertiser was entirely satisfied to announce in stilted form his place of business and what he offered for sale. No particular arguments were advanced as to why the reader should buy, nor were the merits of the product discussed. Illustrations were used in very few cases, but a new advertisement was the signal for the immediate publication on the first page of an extended description of the machine or device offered for sale, written in superlative terms and assuring the reader that the editor had never before known of quite so marvelous a contrivance. The editorial and business departments collaborated in those days, while now they are entirely separate, and the stern editor allows the business manager to speak only on special occasions.

The 'Scientific Press' of 1860 contained advertisements of all kinds. At its inception the paper was not devoted exclusively to mining, and the hardware store, the dentist, the patent medicine man, even 'drinking emporiums' carried cards in its columns. Dancing schools, the opera, sewing machines, hay presses, a patent mono-rail street car, an egg substitute, pain killers, monuments, clothing stores, Dan Rice's circus, undertakers, washing machines, even the Siamese Twins were duly advertised. This class of advertising soon disappeared. The patent medicine gave way to the ore crusher and the 'Household Hints' to the [illegible] real article, and within a year the paper developed into a journal particularly devoted to metal mining. Its advertising pages grew in number and improved in character. The advertiser began to advance reasons for buying his goods, and illustrations appeared. The era of specialization developed the trade paper, each industry having its own journals and offering through their advertising pages a medium to reach that particular trade. A maximum of efficient circulation was thus secured to manufacturers and dealers in each line.

Although many of the advertisers of those early days have disappeared, some of them are in business today, enjoying the confidence of the readers of the MINING AND SCIENTIFIC PRESS as they did then.

The oldest regular advertiser in our paper is the Risdon Iron Works of San Francisco. Under the name of Lewis, Coffey & Risdon they first advertised with us June 29, 1861. A most interesting picture of their boiler shop at Bush and Market streets in 1862 appears in their advertisement in today's issue, and it is hard to realize that what was then the location of their plant, is now the busiest part of San Francisco. We find in our issue of July 15, 1865, that Hungerford & Hendy advertised the Prater concentrator as having received a prize at the Mechanics Institute Fair of 1864. The foundation of this company was laid in 1858 by the late Joshua Hendy, who engaged in the sale of saw-mill machinery. Ever since then the name of Hendy has been identified

A Group of Pioneer Mining Machinery Men of San Francisco.

Standing, left to right: 1—Bob Kerr; 2—E. A. Rix; 3—R. B. Noyes; 4—Sam'l J. Hendy; 5 ——; 6—A. J. Kittridge; 7—John J. Hendy.
Seated, left to right: 1 ——; 2—Joshua Hendy; 3—Wm. H. Reynolds.

with the machinery business of the Pacific Coast. After the destruction of their works in the fire of 1906 they established a new plant at Sunnyvale and maintain general offices and salesrooms in San Francisco. Harron, Rickard & McCone succeeded Parke & Lacy, who first advertised in the MINING AND SCIENTIFIC PRESS in 1874. The present firm has advertised continuously since. The Union Iron Works of San Francisco was started in 1849 by James and Peter Donahue. They began advertising in our issue of November 23, 1861. The first iron casting made on the Pacific Coast was turned out by them and cost 50 cents per pound to manufacture. Some of our warships testify to their efficiency, and they are also important factors in the mining machinery business of the West. W. T. Garratt & Co., who are still in business in San Francisco, appeared in our issue of October 7, 1862. The Selby Smelting & Lead Co. have advertised since 1870, and as far back as 1872 we find Francis Smith & Co. and The Gutta Percha & Rubber Mfg. Co. using the PRESS. The San Francisco Plating Works started in business in 1867, and since 1870 they have kept before the readers of our paper. A. Van der Naillen, of Oakland, California, has advertised his 'School of Practical Mining' for 30 years or more.

One well known firm of today that is even older than this paper is A. Leschen & Sons Rope Co. of St. Louis, Missouri. They organized in 1857. Today their plant covers 33 acres devoted to the manufacture of wire rope and aerial wire-rope tramways. St. Louis is also the home of the Broderick & Bascom Rope Co. The economical transportation of ore owes much to these firms. Another prominent figure in the machinery business of the Coast is E. A. Rix of the Rix Compressed Air & Drill Co. of San Francisco. As far back as 1878 the name of Reynolds & Rix appeared in our advertising columns. Today Mr. Rix can give many younger opponents a keen match at golf. The Ingersoll Rock Drill was handled on the Pacific Coast by various agents as far back as 1875, and they advertised it extensively. Louis Falkenau, who now conducts the Falkenau Assaying Co., of Oakland, California, was associated in 1868 with Henry G. Hanks under the name of Pacific Chemical Works. Mr. Hanks was the father of Abbot A. Hanks. The Baldwin Locomotive Works first appeared in our advertising pages in 1871. Fraser, Chalmers & Co. advertised in 1875, and was later one of the companies forming the Allis-Chalmers Company.

Among the earliest dealers in assayers' supplies on the Pacific Coast were Justinian Caire, organized in 1851, and John Taylor & Co., founded in 1852, in San Francisco. The former concern was incorporated in 1895 as the Justinian Caire Co., with Mr. Caire's two sons as managers. An interesting circumstance is the fact that they are today located within half a block of their store of 1880, after various removals due to fire and other causes. John Taylor & Co. was succeeded by F. W. Braun, and in 1908 the firm of Braun-Knecht-Heimann Co. was organized. The Braun Corporation, an affiliated company, has its headquarters at Los Angeles. Gradually Eastern manufacturers began to advertise, realizing the power of a paper published in the territory they desired to reach.

The contrast between the advertisements of fifty years ago and those of today is remarkable. Today emphasis is placed on the possible buyer's needs and the firm's power to serve him. No more do the mighty slogans, 'we lead where others follow', 'we make the best', and 'satisfaction guaranteed', convince the wary. The cautious man is the desirable customer, and one insertion of an advertisement may not interest him, but placing it before him regularly, attractively, and at opportune times will certainly cause him to associate the advertiser's name with the product. The readers of a technical paper should remember that each of these advertisements represents more than the mere illustration and type. They are the result of the hardest kind of work from the time the device advertised is an indefinite idea in the mind of the inventor, through the tedious experimental period, to the time it is presented in a finished and practical form. Think of that when looking through the advertisements, and remember that the manufacturers can only give the most meagre information in their advertisements, but are ready to supply much fuller details should they be required. Trade catalogues and bulletins of machinery firms are splendid productions and full of information, and are published at great expense. They form an excellent reference library. No concern gets so well known that it can stop advertising, for its competitor will surely supplant it. Who remembers the names of the vice-presidential candidates with Bryan? They were well advertised for awhile. But Bryan has an 'until forbid' contract. Today the effective advertisement must talk like a salesman, not repeat itself —and keep everlastingly at it.

MANAGING SALESMEN

The letter printed below illustrates some of the difficulties involved in selling goods through traveling agents. It is a copy of a genuine letter and is published by the courtesy of Charles T. Hutchinson, of the Joshua Hendy Iron Works, though he assures us it was not sent to a machinery salesman. Since the letter is written in English, German, and Yiddish, there are parts which will appeal to all of our readers, especially those who have at times been compelled to make sales whether business was good or not.

Dear Salesman:

On the furst of the month ve wrote you for your expense account, und gestern hat es rein gekomen. Ve cannot make head nur tail mid it. You have used $90.14 and your sales were $16.00. Mitel be you call dat bizness. A salesman is a person vat sells guts und makes for his balbossen sum masumen. You make us mahula and my bartner is balt mashuga in his kopf from dis. When you come by us, die mispocha hat sur mir gesagen dat you were an actor, a gimbler und a volunteer fireman, but as we do not like a theater mit our guts, you will have to do more bizness mit weniger expenses, otherwise we cannot use you.

Believe us to be still in bizness vitout you.

Mining and Scientific Press in Early Days

Written for the MINING AND SCIENTIFIC PRESS
By ROSSITER W. RAYMOND

The notice of the fiftieth anniversary of the MINING AND SCIENTIFIC PRESS recalls vividly to my mind the early days, in which I first became acquainted with this journal, its work, and its editors. At the age of 28, after some years of technical study in Europe, other years of service in the U. S. Army, and a year of practice as a mining engineer and editor of the *American Journal of Mining* (now *Fire Engineering and Mining Journal*), I was, in 1868, surprised by an appointment as U. S. Commissioner of Mining Statistics for the States and Territories West of the Rocky Mountains, to succeed Mr. J. Ross Browne, who had been suddenly nominated as minister to China. Mr. Browne was not, and did not profess to be, either a mining engineer or a diplomatist; yet he filled with credit both the positions named, by virtue of his upright personal character and the general knowledge, tact, and insight acquired in a long and varied experience as traveler, author, and journalist. The two volumes of his reports as Commissioner, while they cannot claim to be classics of technical literature, are full of material, the historical value of which he instinctively recognized, and which a more pedantic observer would have overlooked. His son, Mr. Ross E. Browne, has achieved, as a mining engineer, an enviable reputation; but, whatever laurels he may win, he need never be ashamed of the pioneer work of his father.

As I believe, I owed my unexpected appointment as Mr. Browne's successor to the circumstance that certain articles of mine in the *American Journal of Mining* had attracted the attention of the two Senators from Nevada (Stewart and Nye), whose interest in the matter gave them a corresponding influence. Moreover, there was, at the moment, only a small sum remaining from the appropriation available for this work. Under the impression that no new Commissioner would be named until after Congress should have furnished the means for an adequate discharge of his duties, many persons, better qualified than I, had not been brought by their friends to the attention of the Secretary of the Treasury, who held the power of appointment—the office being simply that of a special agent of his department. Indeed, Mr. Hugh McCulloch, then Secretary of the Treasury, was inclined to take the view that it was not worth while to appoint a new Commissioner for the expenditure of so little money; but, after conference with my Senatorial sponsors, and a personal interview with me, he appointed me, upon the understanding that my first report, rendered with such slender financial means, should terminate my service, unless it commanded further Congressional support by legislation.

I recall these circumstances in order to acknowledge the generous assistance to which I was indebted for the success of an undertaking so adventurously and inauspiciously begun. It was after, in the ignorance of innocence, I had accepted a sort of forlorn hope, for which there seemed to be no competitors, that I found how many men were better entitled to the position, and might have accepted it, if the 'hope' had been less 'forlorn'. It would be unkind to name them, but the names of many of them will at once occur to the minds of those who remember the situation of that period. I may say, comprehensively, that I am thinking of men who were residents of the Pacific slope, already familiar with the exploration and exploitation of its mineral resources, and fully entitled by their past services to the recognition involved in a Government appointment. If further particulars should be desired by the curious reader, let him consult my eight reports as U. S. Commissioner of Mining Statistics, published from 1869 to 1876 inclusive, in which I think he will find the names of all these men, as generous contributors.

When I undertook that work, I was hampered, on one hand, by youth, inexperience, and the lack of means, and aided, on the other hand, by the cordial assistance of my old Freiberg colleagues; the correspondents of the journal of which I was the editor; and the men indicated, though not named, above. If I remember correctly, I had, the first year, $5000, and in no succeeding year of the eight during which I served, more than $15,000, to pay all salaries, traveling expenses, and clerical or other labor involved in my work. In any comparison of my reports with the volumes since issued by the United States Government upon economic geology, our mineral resources, our mining and metallurgical industries, this fact should be kept in mind. Yet I am not entitled to personal credit for the remarkable value of the books produced for eight years at so small an annual expense. This credit is due to the co-operation of many who could have commanded large sums for the knowledge and experience which they freely placed at my disposal.

In my annual journeys I encountered, of course, much suspicion and distrust, of the kind which the agents of the Census are still, in lesser degree, liable to meet among ignorant portions of our population. At that time the miners of the Pacific slope had previously settled their own laws and customs, and did not relish Federal intervention. The United States statute of 1866 had not disturbed them much, because it was, in fact, no more than a ratification of their own local system, coupled with an almost unlimited approval of whatever they might choose to enact, not inconsistent with the very liberal features of the Federal statute. But they did not care for further inquiry or further legislation. As I said in my first report, "the present law (the Act of 1866) is not operating at all; therefore the question of its benefits can hardly be answered." In fact, it accomplished little more than to legalize the existing customs of miners.

Gregory Yale, father of Charles G. Yale (long time editor of the MINING AND SCIENTIFIC PRESS) had then recently issued his treatise on 'Mining-Claims and Water-Rights', giving a clear, comprehensive statement of the existing situation, with a synopsis of local mining codes and an intelligent commentary upon the new Federal law. This book, which

Curtis H. Lindley, the most eminent of our publicists in that department,[1] characterizes as "the pioneer work on the subject of American mining law," has remained, ever since its appearance, a historic authority. In my first official report,[2] I acknowledged my indebtedness to this critical, comprehensive, and suggestive summary; and I acknowledge again with gratitude the cordial greeting and effective assistance which I received from Mr. Yale and his associates when, in the course of my peripatetic administration, I first visited San Francisco.

At that time I knew the MINING AND SCIENTIFIC PRESS only as an 'exchange' in the editorial sanctum: but I had recognized it as a technical journal, occupying the double position indicated by its title. In other words, it used to publish, not only really 'scientific' (and therefore disinterested) contributions, but also the statements, questions, criticisms, and crude theories of those who had 'axes to grind', or who were simply disinterestedly ignorant. In my judgment, this was, and still is, to a reasonable extent, the proper function of a popular technical journal, though it does not follow that editorial endorsement should be given to untried or manifestly unfounded propositions.

According to my recollection, the MINING AND SCIENTIFIC PRESS, while giving a hearing in its columns to many speculative, or even visionary propositions, always maintained editorially an attitude in favor of sane scientific methods and conclusions. In this way, I think, it served two great ends, of equal value, namely: the encouragement of suggestions, even from the ignorant, which might contain facts of importance; and the enforcement of the principles of science under which alone such suggestions could be suitably weighed and utilized. The history of technical progress has abundantly proved that the accredited representatives of science (that is, of the summary of facts and laws already generally accepted) cannot afford to despise the observations and experiences of those 'practical' men who are not scientific, because they do not know all that has previously been done by others. Such men should have a hearing. In many instances they have something to say which is worth notice. And a journal which records their (perhaps crude) statements and views is furnishing material for the science of the future. I am more disposed to emphasize and praise this feature of the management of the MINING AND SCIENTIFIC PRESS because I have devoted my life, for nearly forty years, to a technical society, organized upon the same principle. The American Institute of Mining Engineers, organized in 1871, has admitted to membership all respectable persons practically connected with mining, metallurgy, and related work, as well as those who held professional degrees. Its first President was 'Father Thomas', a dear, plain old Welshman, who claimed no 'scientific' standing whatever, but had been a pioneer in the manufacture of pig iron with anthracite fuel. Its membership has included common miners, mine-foremen, and others directly connected with mining or metallurgical work, though not the holders of academic degrees, or entitled to formal professional recognition. And the result of its work on these broad lines has been such as to challenge the criticism and command the admiration of the world. I do not enter here upon any proof of this assertion: for I cite the case merely in confirmation of the proposition that the great success of the MINING AND SCIENTIFIC PRESS is due to its skillful application of the same principle.

I may be permitted to say, however, without disparagement of its early managers, that its editorial force is, at present, more perfectly equipped for technical verdicts, and more disposed to deliver them, than it was fifty years ago. This is undoubtedly an improvement; yet it has had its incidental drawbacks. The new editorial boldness, born of conscious power and confidence, has exhibited itself in some utterances which I could not approve, though I did not question the right of the Editor to utter his conscientious convictions. But this need not prevent me from praising the general independence and high standard of the management.

When, just after T. A. Rickard had secured control of this journal, the earthquake and conflagration which devastated San Francisco overwhelmed his enterprise, with so many others, in apparently hopeless ruin, we were all thrilled with sympathy and admiration to see the MINING AND SCIENTIFIC PRESS emerge from that catastrophe, erect and undismayed; and we all join in congratulations upon its fiftieth anniversary, attended, as it is, with indubitable signs and omens of renewed and increased strength, and a career of continued usefulness and honor.

[1] "A Treatise on the American Law Relating to Mines and Mineral Lands, Etc.', 2nd edition, San Francisco, 1903, p. x.
[2] Washington, 1869, p. 218.

Nebraska.—A new and probably important mining region has been discovered in the western portion of Nebraska Territory. The discovery was made in September last by a party of some twenty miners, who were returning from the Bitter Root Valley Diggings, to Salt Lake. They collected about $50,000 in a few weeks, which they took to Salt Lake. This newly discovered mining district commences on Wind river, about 400 miles North-west from Fort Loramie, and embraces an area of about 200 miles in length by 100 in breadth. The deposits discovered up to the present time are of gulch gold, very similar in appearance and richness to those of the Feather river mines. It will assay at least $18 to the ounce. The region is the same as that described by Lieut. Reynolds, of the United States Topographical Engineers, in his report of 1859, in which he states that he discovered gold in all the streams embraced within a distance of some 200 miles. It lies at the eastern base of the Rocky Mountains, and is similar in its geological formation to the Salmon river and Bitter Root Valley districts, where rich deposits of gold have been discovered within the past year. The miners who discovered these new diggings unite in the opinion that they will prove fully equal to any ever discovered on the continent. The distance from Omaha to the Wind River Mountains, at the base of which the first discoveries were made, is about 900 miles.—February 9, 1863.

History of the Rock Drill

Written for the MINING AND SCIENTIFIC PRESS
By W. L. SAUNDERS

The percussion rock drill as distinguished from other types, is an American invention the first practical patents having been taken out by J. J. Couch, of Philadelphia, in 1849. He was assisted in building this drill by Joseph W. Fowle, later of Boston, their experiments being carried on during the year 1848. The Couch drill was a crank and fly wheel machine and its application to practical work was, therefore, limited to surface hole drilling. In 1848 Couch and Fowle separated, Mr. Fowle filing a caveat in 1849. This caveat describes the type of successful power rock-drills used today. The chief point was that he first showed a drill where the cutting tool is attached directly to the piston or to the cross-head connected with the piston. In other words, the bit heading into the hole was an extension of the piston rod. This important invention was described by Mr. Fowle in his testimony before the Massachusetts legislative committee in the contest with Burleigh in 1874, as follows: "My first idea of ever driving a rock-drill by direct action came about in this way: I was sitting in my office one day after my business had failed and happening to take up an old steam cylinder, I unconsciously put it in my mouth and blew the rod in and out, using it to drive in some tacks with which a few circulars were fastened to the wall."

The nearest approach to rock-drill inventions abroad was in the German work of Schumann, in 1854. Mr. Fowle being without means, but a genius in the true sense, his inventions remained in obscurity until Charles Burleigh purchased his patents and produced the Burleigh drill, about the year 1866. This drill was used in the Hoosac tunnel in 1867. Following these inventors came Haupt, De Volson Wood, and Simon Ingersoll, followed by Sergeant, Waring, and Githens; Githens being the inventor of the Rand drill. The Ingersoll drill was invented in 1871.

Simon Ingersoll, an ingenious, modest and honest mechanic, came to New York from Connecticut. Having a very fertile mind, he had conceived several inventions, models for which he made with his own hands. Being of a very confiding and loquacious disposition, he once, while riding in a horse-car in New York, described to a fellow-passenger the merits of his invention. One of the passengers in the car who overheard the conversation was John D. Miner, a contractor, who had a gang of men at work upon rock-excavation in what was then the upper part of New York. Mr. Miner broke into the conversation by asking Mr. Ingersoll why he didn't invent a rock-drill, something practical, something useful, instead of spending his time and his genius upon 'such traps'. Ingersoll asked him what he meant by a rock-drill, and what he wanted to do. Miner's reply was that he had a gang of men at work in New York striking steel with a hammer in order to make holes in rock for blasting, that they could only do about 10 ft. per day, and that he could not see why the work should not be done by machinery. Ingersoll said he could make a machine to drill the rock and would go at it at once if he had the money. Miner then and there gave him $50, together with his card, telling Ingersoll that, though he had never met him before, he had an honest face and he would trust him to spend that $50 in building a rock drill. "When you want any more," said Miner, "come to me and I'll give you another fifty."

Mr. Ingersoll made his drawings and models and built his first rock-drill at a little shop on the corner of Second avenue and Twenty-second street, owned by J. E. de Navarro, who operated it under the management and title of Sergeant & Cullingworth. Henry C. Sergeant came into the works one day and saw the patterns for the drill. The front head was attached to, and was a part of, the cylinder. Mr. Sergeant's fertility in inventions was never more marked than when he promptly told the mechanics that the head and cylinder should be in two pieces; and of his own accord he took a hand-saw and was in the act of separating them when the inventor Ingersoll arrived. "What are you doing?" said Ingersoll. "I'm making this thing practical," was Sergeant's response as he finished sawing off the head before Ingersoll could stop him. The result was the first row between Ingersoll and Sergeant, which afterward resulted in Sergeant's inducing Mr. Navarro to purchase all Ingersoll's rights and patents; but the drill was made with the detached front head, as it is today.

The success of the machine was soon apparent, and after Mr. Navarro had purchased the patents he organized a company called the Ingersoll Rock Drill Co., putting $10,000 in the enterprise. Mr. Sergeant was now in full control and through him many very important improvements were made. Litigation arose at once with Mr. Burleigh of Massachusetts, who owned the Fowle and other rights; but through Mr. Navarro's plentiful command of funds and his liberal nature, the suits were settled and all fundamental patents placed with the Ingersoll company. The $10,000 which started the drill business was shortly afterward paid back to Mr. Navarro, and eventually he sold his rights for $525,000. Mr. Sergeant having sold out because of friction with the management, went West, engaged in mining, lost his money, returned to New York about the year 1885 and started the Sergeant Drill Company.

Addison C. and Jasper R. Rand had early become interested in rock-drills through their connection with the Laflin & Rand Powder Co. Addison C. Rand formed the Rand & Waring Drill & Compressor Co., later controlled entirely by Mr. Rand and merged into the Rand Drill Co., established in 1871 and incorporated in 1879. J. C. Githens, manufacturing superintendent of the Rand Drill Co., was the inventor of the 'Little Giant' rock-drill and also the double-screw column with column arm, which made practical the application of the rock-drill for mining and tunneling. The Sergeant & Cullingworth Co., a manufacturing concern engaged in building the Ingersoll drill, the Sergeant Drill Co., and the Ingersoll Rock Drill Co. were merged into the Ingersoll-Sergeant Drill Co., and later on the Rand Drill Co. was added to this amalgamation, forming the Ingersoll-Rand Co.

The California Stamp-Mill

Written for the MINING AND SCIENTIFIC PRESS
By COURTENAY DE KALB

On the occasion of the golden jubilee, celebrating the fiftieth anniversary of the discovery of gold in California, the MINING AND SCIENTIFIC PRESS published an article by C. P. Stanford giving the origin of the California stamp-mill. He attributes the first improvement that led to the modern type of mill to his conception of providing a round stem, from which followed necessarily a similar shape for shoe, boss-head, and tappet. This mill was on Nathenas creek, in El Dorado county, and the date was 1851. This was by no means the first stamp-mill in the State. Mr. Stanford describes in his article an earlier stamp-mill erected by the Tennessee Quartz Mining Co. on the Cosumnes river, below the Union mine, which latter property belonged to him in conjunction with his brother and others. The original construction followed the model of the stamp-mills long used in the gold-belt of the Southern Appalachian region. He says of it: "The bed for the mortar block and battery frame consisted of layers of timbers crossing at right angles, tamped with sand, and flooded with water. On this was placed the frame of the battery, and between the posts was fitted the mortar block, not standing on end and deep in the ground, but lying on the ground, as did all the timbers under it. On the block was placed a low mortar, and the sides were built up of plank, and carefully secured with rods and bolts and screws. In the mortar stood five stamps, each consisting of a head 18 in. long by 6 in. square, without any shoe, and a timber 10 ft. long by 7 in. square. Through this timber was a slot wide enough to let the cam play freely through it. The upper end of this slot, when the cam stood on the die, was about on a level with the upper side of the cam-shaft, and was the point at which the cam took hold of the stamps to lift it up and drop it, the stamp being kept in place by suitable guides, top and bottom. The cams were much straighter than the tangent cams now used."

Medieval Stamp-Mill, After Agricola.

The troubles encountered are graphically portrayed. The amalgamator is still familiar with 'troubles'; he has so many of them as to think he possesses a virtual monopoly among metallurgists of this sort of thing. But the modern millman is not accustomed to find the boss-head, after a few hours work, worn to the shape of a sled-runner, nor to spend half of each day repairing the damages done to the plant by operating it the other half.

When round stamps were conceived the first trial was made with two pieces of round iron, 2¾ in. diam. by 12 ft. long. The success of these two stamps was so great that a full 5-stamp mortar was erected in February 1852, using shafting 2⅔ in. diam. The stems, however, were prevented from rotating. It was some time before the value of rotation was perceived, and it is interesting to note that the change was made by intention, not by accident. The honor for this is conceded to Isaac Fisk, a plain machinist who was connected with the company in which Mr. Stanford was co-owner. The first attempts were not eminently successful; the corner of the cam raked across the edge of the tappet, and it required considerable ingenuity to work out, in a rule-of-thumb manner, the proper curve for the cam so as to prevent excessive wear. This origin of the revolving stamp in the mill on the Cosumnes river is conceded by others who are in a position to know, among them being Almarin B. Paul, who also contributed an interesting historical article on stamp-milling to the golden jubilee number of the PRESS above mentioned. The gib-tappet, another improvement of immense importance, is attributed to Zenas Wheeler, who first introduced it in 1862, at Gold Hill, Nevada. This was further modified by casting the tappet with the gib in place, an achievement credited to Prescott, Scott & Co., the predecessors of the Union Iron Works in San Francisco. So far, the invention of the tangent-cam, of the high single-piece mortar, and of the deep vertical mortar-block, are unclaimed by anyone who has succeeded in validating his pretensions. The use of copper plates in amalgamation was known in 1853.

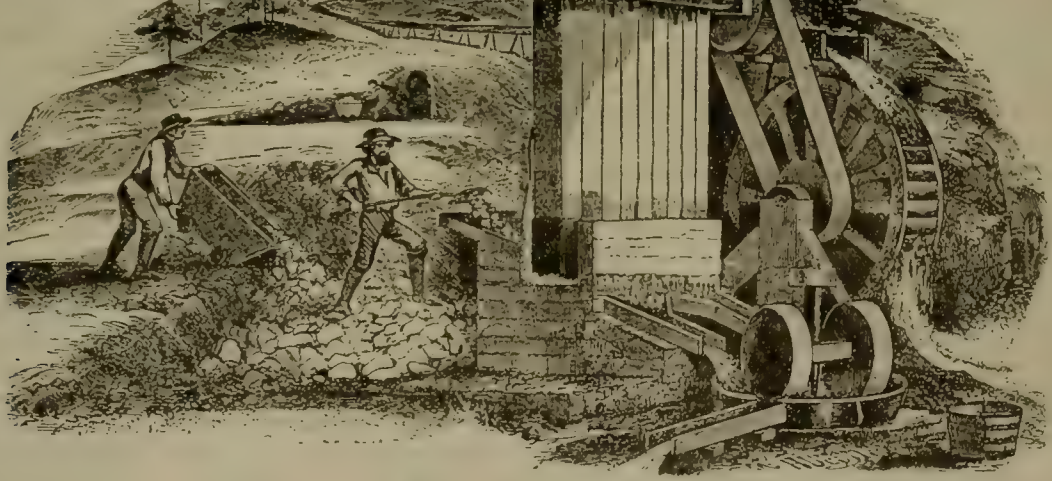
The early development of the stamp-mill seems to have been rapid in California. The leading improve-discovery of gold by Marshall at Sutter's mill. It discovery of gold by Marshall at Sutter mill. It

seems remarkable at first sight that so much was attained in so short a time on the Pacific Coast, which in the Appalachian States which furnished the models for the first Californian mills, the plans and specifications of Agricola were still being so closely followed. The differences between the ancient structure, used in Saxony and in other parts of Europe

Medieval Stamp-Mill With Mortar-Box.

as shown in the accompanying cuts from the famous classic 'De Re Metallica', published in 1546, and the early square-stemmed Californian mill also illustrated herewith, certainly is not material. The explanation of the phenomenon undoubtedly lies in the fact that the almost fabulous riches reported from California in those early days brought hither the more alert and capable and ingenious men—those fitted for the frontier not only by physical vigor, but by the genius for adaptation, which is a better word under the circumstances than invention. In the South the gold deposits were relatively small, although Georgia alone is acknowledged to have yielded an aggregate to date of more than $18,000,000 of the precious metal. Nevertheless this is insignificant compared with the output from the West. As early as 1850 it is estimated that 50,000 men were engaged in gold mining in California, and the number had doubled within a year. In the South Atlantic gold region the lands were mostly held in large estates, and were worked by slave-labor as an adjunct to agricultural pursuits. Under such circumstances the chances were few for directing much mechanical skill to the problem of milling.

According to J. Ross Browne, quoting Ashburner, there were 280 quartz mills in California in 1858, with a total of 2610 stamps, representing an investment in construction-cost of more than $3,000,000. Even then the common blunders, still so familiar in mining, were witnessed and decried; men insisted upon trifling with Providence by building a mill before they were certain of a mine adequate to feed it; and on the mechanical side the millmen were disposed then as now to use an excess of water in the batteries, and to feed quicksilver with too liberal a hand. Methods necessarily varied within wide limits, for such a thing as standard practice could not arise while there was no standard type of mill in vogue. The behavior of the pulp in a battery responds with astonishing delicacy to every adjustment of weight



An Early California Stamp-Mill.

of stamp, height of drop, number of drops per minute, height of discharge, and volume of water. If to these be added variations in the number of stamps in the battery the difficulties of drawing lessons from comparison of working conditions are rendered still greater. The 5-stamp battery was by no means the prevailing style, even twenty years after the first mills were erected on the California gold belt. Four-stamp batteries were perhaps more common, and the 6-stamp mill was often found. At Soulsby, Tuolumne county, a 20-stamp mill was running as early as 1867. The stamps weighed 500 lb. each, and made 60 drops per minute. The mortars were deep, and the height of drop was from 8 to 12 in. It is not absolutely certain how much reliance may be placed upon these early records of recovery, but in this instance J. Ross Browne is responsible for the statement, in his report to the Government on the Mineral Resources of the United States, that 90% of the gold content of the ore was caught inside the batteries, and 95% of the remainder on the first copper plate. Following the plates blanket concentration was employed, the concentrate being ground fine and amalgamated. The Hayward mill in Amador county is reported at the same time as crushing 80 tons per diem in two mills having a total of 56 stamps. The heaviest stamp recorded in the earlier days of the art of gold milling was at the Seventy-Six mine in Plumas county, which had 32 stamps weighing 810 lb. each, making 60 drops per minute from a height of 10 in. This plant was erected in 1865. There is a manifest disproportion between the factors going to make up foot-pounds of power developed per minute in this mill, and conditions were such as to suggest millmen's 'troubles'. It would be interesting to know details as to the character of ore crushed, and the recovery attained. Mr. Paul asserts that in the first decade or two after the gold-rush, the extraction in the Californian mills seldom exceeded 20% of the original assay value of the ore, and anything containing less than $20 per ton was considered low-grade.

It is evident that conditions were rapidly improving, and that the better examples of Californian mills had reached a higher state of perfection in construction and practice by 1870, when Dr. Rossiter W. Raymond prepared his most famous report on Mineral Resources. He states that prevailing custom had favored five stamps to a battery; two batteries were driven from one cam-shaft, and in some cases three. The standard stem was 3 in. diam., 10 to 12 ft. long, tapered as seen in the models used today. The 3½ in. diam. stem was also used, showing a growing tendency to gain efficiency through weight, the total being not less than 620 lb., to which the stamp-head contributed 200 lb., the tappet 70, and the shoe 95. At that time it was considered that a white-iron shoe should last six weeks, and a die 4 in. thick, weighing 60 lb., should have a life of five or six weeks. The worn-out shoe and die together weighed about 30 lb. According to this report the Princeton mill on the Mariposa Estate, using 500-lb. stamps, recorded a wear of shoes and dies of 1.54 lb. of iron per ton of ore. The California mill was practically evolved by 1870, only requiring modifications in detail.

Early Mining in California

Written for the Mining and Scientific Press
By Joseph McGillivray

After the discovery by John Marshall at Coloma, Eldorado county, the news readily spread, and the people nearest to the place rushed in—Mexicans who used the batea, Chileans also, and from the Eastern United States, the Georgians, who were familiar with the rocker. All these came with their special appliances. The galvanized pan from the first was readily put to use, and up to the end of 1850 there were not many improvements better than the rocker. This was in general use. In 1851 river beds were turned by wing-dams into cut channels, and also into flumes built of lumber sawed by whip-saw, carrying during low stage all of the water available in the rivers, permitting the washing up of the beds, where in many cases large amounts of gold were recovered. Also drift-mining was begun this season, and Bowie gives me credit for beginning that kind of mining. Water-wheels were also applied, raising water to mine the bars in long-toms. When the gold was on the bottom of creek beds the top material was stripped off by pick and shovel, and the rich gravel washed by long-toms, and in the following season, namely, 1852, ground-sluicing was commenced by getting a head of water on the top of the bank and sluicing the waste material down to the pay-gravel, when the bottom was shoveled into the sluice-boxes at the head of the long-tom. The first attempt at hydraulicking was made by a man near Nevada City, whose name I forget. He had quite a bank of deep gravel, I believe about 15 ft. He took some green beef-hides of which he made a hose by riveting with copper rivets, then took two pieces of wood, gouging a half-circle out of one side of each, strapping them together with hoops of iron fastened to the end of the hose. This was a success; it readily washed the bank of gravel down. Later sail-canvas, 22 in. wide, was sewed into hose of about 6 in. diam. with a copper shank and nozzle; the nozzles were of various diameters, from 1¼ up to 3 in. The canvas was woven very heavy, and as the pressure was increased so that the hose could not stand it, another hose was put over the first, and then rope netting was woven over the hose. Later sheet-iron ferules were put over the hose to keep them from breaking. This was continued until a head of 125 ft. or more was attained, when 7-in. galvanized iron pipe was used. This was generally employed with a short piece of strong hose attached to the nozzle. Larger pipes were next introduced, carrying water from an elevation into a cast-iron box or chest, with lugs on one side, to which short pieces of hose were attached, with their nozzles, giving a greater flow of water with which to wash the gravel. The 'gooseneck' came in about this time; it revolved on a circle, but did not have a second motion to elevate or lower the stream against the bank. Mr. Craig invented the machine which he called the 'giant' about 1866. It was followed by different inventors, each giving their improvement different names. While this development continued, larger ditches were constructed,

Theories of Ore Genesis of Fifty Years Ago

Written for the Mining and Scientific Press
By S. F. Emmons

The mining industry fifty years ago was in its early infancy. Up to that time no silver mines were known to exist in the United States, and hardly any deep mines in the modern sense of the word had been opened, most all the gold produced having come from the placers. It is true that the copper and iron deposits of Lake Superior had been worked for about fifteen years in rather a small way, and the lead deposits of the Mississippi Valley for a considerably longer period, and in even a smaller and more desultory way, a few mines of gold, copper, and iron had been developed in the Appalachian region, but the Great Cordilleran system which for centuries had produced untold wealth in silver for the Spanish miners in Mexico, was within our boundaries practically untouched. The years 1859-1860 were remarkable in the development of our mining industry, for in them had occurred the Pike's Peak boom which had resulted in the discovery of the first gold mine in Colorado at Central City on the extreme eastern border of the Rocky Mountain range, and in that of the Comstock lode, a silver mine comparable in size with the bonanza mines of Mexico, which was situated on the western border of that mountain system. Between them lay a belt of mountains and elevated valleys about a thousand miles in width, then, and for many years after, an unknown wilderness, marked on the map as the 'Great American desert'.

This period was notable also for an event of different order but of equally far-reaching importance. This was the founding, by act of the California Legislature of April 1860, of the Geological Survey of California and the appointment by the same act of Josiah Dwight Whitney as its Chief. There are undoubtedly wide differences of opinion as to the immediate value of the results of this Survey, especially in the State which was so generous and far-seeing in its original plans, and which was for many years divided by it into two factions, for Whitney possessed in a superlative degree that peculiar faculty which the well known artist, Whistler, has aptly termed the 'gentle art of making enemies', and during his official life built up a party opposed to himself and his work whose intense bitterness it is hard at the present day to conceive. It were unprofitable here to enter into any discussion of the merits of this controversy in which, like every difference between strong and earnest men, there were undoubted merits on either side. It lasted for fourteen years, and was ended by another act of the legislature in 1874, which not only finally legislated the Geological Survey out of existence, but so effectually prevented its resuscitation that Whitney was obliged to resort to private funds to publish his reports, and all subsequent efforts to establish another State Geological Survey in California have been futile.

Whitney was a man of wide reading, a remarkable linguist, and of undoubted ability as a writer and reasoner. he was the first American geologist to study vein phenomena in the schools of France and Germany and for a long time the only one to keep posted on the literature of that subject, which in the first half of the century was exclusively European. Up to the time of writing up the great results of the Survey of the Fortieth Parallel from 1873 to 1876, his private library was the only library in America in which could be found anything like a complete set of the various individual work and of periodical literature bearing upon this subject, the few public libraries of that period being singularly weak in that branch. From 1847 to 1850 he had conducted, under Government auspices, the first geological examination of a mining district, that, namely, of the copper district of Lake Superior, and during the decade 1850-1860, under State Survey auspices, he had made studies of the lead deposits of the Mississippi Valley. Early in this decade he wrote his 'Metallic Wealth of the United States' (Lippincott, 1854), which is a succinct but masterly review, not only of the then known ore deposits of this country, but also of the more important mines of the world, preceded by a discussion of the various forms under which the metals are found in Nature, and what was known at the time with regard to their genesis. His choice as Director of the California Survey was no less an evidence of the wisdom of those who planned the work than was the—at that time—unprecedented generosity with which it was endowed, $20,000 being allotted for the first year's field work and $6000 for the salary of the Director. It does not detract from the merits of the founders of the work that under subsequent legislatures there were considerable periods during which State funds were often absolutely wanting for the work, and it had to be carried on by money furnished by Whitney individually, or for which he considered himself personally responsible. His planning of the work was equally broad and generous and introduced many new and unprecedented features into geological surveying, as practised in this country, the most important of which was the preparation of base maps for the geology, which should show not merely the political divisions and the courses of the principal streams, but should figure the relief of the surface, or its topography, as well. As the fame of this great Survey of the gold-bearing Sierras spread throughout the scientific world, the opportunities it offered for a thoroughly scientific study of a new and most interesting field attracted geologists of exceptional ability from various parts of the world. From Germany and a geological expedition to New Zealand under the Austrian Government came Von Richthofen, better known in later years for his elaborate monographs on the geology of China, as published at the expense of the Government of Prussia. From France came the singularly brilliant young geologist Remond, who extended his studies on the Cordilleran system into South America, but died of consumption before he had had time to complete his work.

From the Sheffield Scientific School of Yale came Clarence King and his friend, James T. Gardner, who spent four years as volunteer assistants under Whit-

ney and Brewer on the California Survey. It was while engaged in this work that King conceived the idea of making a geological and topographical survey of the whole Cordilleran region to be opened up by the proposed transcontinental railroad, which should serve as a basis for the development of the great metallic wealth that his leisurely trip across the continent on an emigrant train in 1863 had convinced him must exist in that region. This idea carried into practical operation by the exploration of the Fortieth Parallel from 1867 to 1878 was the most important factor in bringing about the organization by Congress in 1879 of the permanent United States Geological Survey, of which he was the first Director. Thus to Whitney's reputation as a geologist was indirectly due the founding of this great Survey, which it is generally recognized has done more for the development of the study of ore deposits than any similar organization in the world.

Whitney wrote his 'Metallic Wealth' about the same time that von Cotta was publishing the first edition of his well known treatise on 'Ore Deposits', which for nearly twenty years was the only other book on this subject known in this country. (Prime's translation was published in 1870), so that between them they represent pretty well the average condition of technical knowledge on the subject. Both men had had a longer and wider experience in actual examination of working mines than any economic geologists who had preceded them, and Whitney had the advantage over von Cotta, in that he had seen the ore deposits of America as well as those of Europe, and had spent years in the continuous study of definite groups of deposits, while von Cotta had only given his summer vacations to relatively short visits. Von Cotta was writing a special treatise, however, to be used by his students, and with German thoroughness he had assembled not only all the facts known to him with regard to the mining districts of Europe, but also all the varied, and at times contradictory, views held by different authorities with regard to their mode of formation. In reading his work, it is difficult to determine which of the views presented he believes in himself, or even if he actually believes that any one of them offers a satisfactory explanation of all the phenomena he describes.

Whitney, who had spent years in the field study of types of deposits unknown in Europe—the native copper ores of Lake Superior, and the lead deposits of the Mississippi Valley—is equally non-comittal with regard to general theories of genesis. His theoretical chapters are more brief, more concise, and more systematically arranged than those of von Cotta, and, therefore, more easy to analyze. That he had made some advance on the ideas that he might have imbibed during his studies in Europe is shown by the fact that in his classification of ore deposits, unsatisfactory though it may appear in the present state of our knowledge, he had introduced some genetic conceptions as a basis of his greater subdivision. Von Cotta's classification was entirely dependent upon the outward form of the deposit, regardless of its possible origin. Thus, he makes two principle classes: those of *regular* and those of *irregular* form. The former is divided into *beds*, which include beds of coal, etc., together with placer deposits, and *veins* which take in most tabular or vein-like deposits. Under deposits of irregular form are included, first, *stocks*, which are sharply defined bodies—contacts, cave-filling, pockets, etc., and, second, *impregnations*, which are bodies without sharp definition. Whitney's classification makes three general classes. I. *Superficial* deposits, including all formed by surface agents, whether physical or chemical, such as placers, bog ores, etc. II. *Stratified* deposits, which includes (a) those constituting the mass of a stratified bed; (b) those originally deposited from aqueous solution but since metamorphosed; and, finally, this third great class of deposit, III, *Unstratified*, which includes the great bulk of productive ore deposits which, with one exception, would today come under the head of epigenetic deposits or those formed later than the enclosing rocks. This is a far more philosophic conception of the subject than von Cotta's, for it recognizes the three fundamental differences of origin in reference to their time relation to enclosing rocks. In subdividing his last great class he brings in, as did von Cotta, the distinction of form and he makes, like him, a *regular* and an *irregular* sub-class. The former is subdivided into, (1) *segregated* veins—that is, lenticular bodies more or less parallel with the apparent bedding of schistose rocks; (2) *gash* veins, which are confined to a given bed or rock-mass; and (3) *true* or *fissure* veins, which he regarded as the most important and permanent form of metallic ore deposits. Under *irregular unstratified* deposits, he grouped: (a) masses of eruptive origin; (b) disseminated ores in eruptive rocks; (c) deposits; (d) contact deposits, and (e) fahlbands. Deposits that come under the head of the last, or irregular class, he evidently had had few opportunities of studying and considered of relatively little value. It was the importance of evidence of vein structure of some kind in a deposit that he was evidently desirous of impressing upon the minds of his readers, as is shown in the following summing up: "(1) True fissure veins are continuous in depth and their metalliferous contents have not been found to be exhausted or to have sensibly and permanently decreased at any depth which has yet been attained by mining. (2) Segregated and gash veins and the irregular deposits of ore not included under the head of veins, and not occurring in masses as part of the formation cannot be depended on as persistent, and they generally thin out and disappear at a not inconsiderable depth; at the same time they are often richer for a certain distance and contain larger accumulations of ore than true veins, although not of the same permanent value."

This very decided dictum of Whitney's, which was after all only a concise statement of the then generally entertained opinion, is very likely in great measure responsible for the popular prejudice especially among miners and prospectors in favor of the supposed *true fissure* vein, which economic geologists of later years have found it so difficult to combat, and which doubtless, held back the development of many mining regions till after the remarkable wealth

and permanence of the Leadville deposits had demonstrated its falsity. On general theories of genesis Whitney touches but lightly. 1. The theory that veins originated contemporaneously with the enclosing rocks he says "may be dismissed at once as entirely at variance with all the facts and as unworthy of consideration." 2. The theory "that veins have originated in the filling of fissures by injection of metallic and mineral matter in a state of igneous fluidity from below" he likewise rejects "as entirely untenable" from a consideration of the facts observed. (3) "The theory of formation by sublimation, according to which vein-fissures were filled by the volatilization of metallic matter from the great centre of chemical action beneath—namely, the ignited interior of the earth", he considers of very limited application in regular fissure veins, although in contact deposits and some other irregular forms of occurrence—notably, in mercury deposits—he considers "that some form of sublimation was very probable." (4) Werner's theory of chemical precipitation from solutions which entered the fissures from the surface downward, he says "pre-supposes a number of impossibilities, and has ceased to have the weight which was once attached to it." (5) The theory of lateral secretion he considers "to be more in accordance with all the phenomena of veins than any other one yet proposed." Furthermore, he admits that "some ores and metals do occur in rocks of undoubted igneous character in such a way that they must have had an origin contemperaneous with that of the mass in which they are disseminated. But these deposits do not belong to the class of regular veins." If veins had been the result of igneous action, he argues, we should expect to find in them the minerals common in eruptive rocks, "such as feldspar, hornblende, augite, olivine, and the like." On the contrary, "the usual gangue minerals, quartz, calcite, heavy spar, etc., according to the researches of Bischoff and other eminent chemists, cannot possibly have been introduced into vein-fissures * * * in a state of igneous fluidity, or by sublimation." To the theory of ascension, or of deposition from hot spring waters, or to the origin of the waters which carried the metallic minerals in solution, he does not refer.

In his practical application of theories to the deposits he had occasion to study in the field, he was a little more definite. Thus, in 1855,[1] he had given a fairly correct explanation of the origin of the black band copper ores of Ducktown as the result of electro-chemical action that produced the oxidation and leaching down of copper-bearing pyrites by surface waters; thus correcting Tuomey, the State Geologist of South Carolina, who had wished to bring in the agency of heat to account for their formation. Whitney's idea was a secondary enrichment that was stopped at the water-level; his error was that he thought it was a black oxide of copper, and that it was the hardness of the zone of underlying ore that stopped the oxidizing action. Of the iron ores of Lake Superior and Missouri, which were described as dome-shaped deposits, or elongated ridges of remarkably pure iron oxide, he wrote in 1856: "They are simply parts of the rocky crust of the earth, and like other igneous rocks have been poured forth from the interior in the molten or plastic state." Of the magnetite bodies of northern New York, which he regarded as lenticular bodies included in and conformable with the enclosing gneissoid rocks, he said: "The facts seem to indicate that they are the remains of pre-existing igneous masses which have been broken down * * * * and deposited in the depressions of sedimentary strata in the process of formation." On the other hand, of the iron ore bodies included in quartzites which he regarded as interstratified, he says: "They * * * seem to have been of sedimentary origin, (and to) have been originally silicious sand which has since been metamorphosed." Their original presence in the quartzite, he would have brought about either as a precipitation from ferriferous solution, or as sublimation of metalliferous vapors coming from below. The eruptive origin of the iron ores of Lake Superior he maintained long after all other geologists who had studied them, except his pupil and disciple, M. E. Wadsworth, had come to an opposite conclusion. He was equally persistent and uncompromising in retaining the term Azoic for all the pre-Cambrian rocks, and rejecting Dana's term Archean, which was proposed as a compromise until further investigation should prove more definitely whether they really contained relics of organic life or not.

In his 'Metallic Wealth', in discussing gold in California, he still holds to Murchison's view that gold is found only in the older rocks, as old at least as the Paleozoic. "There is room for doubt," he says, "whether the great gold deposits of the world did not originate exclusively in the Paleozoic strata, since we are not aware that rocks which have been proved to be of Azoic age have been found to be auriferous." He later modifies this rather narrow view by remarking that gold "only becomes evident after the strata have been metamorphosed or invaded by igneous and eruptive rocks," and states that: "In general the quartz veins may be supposed to have originated at the time of the metamorphic action on the strata themselves; and where there are igneous rocks in the immediate vicinity the development of the metallic contents of the adjacent veins is usually ascribed to their presence, since it is so often found that the metalliferous deposits are intimately associated with eruptive masses. It is not necessary to suppose, however, that these phenomena throughout the world were confined to any particular geological epoch; on the contrary there may have been a repetition of similar conditions at periods of time very distant from each other." The wisdom of this modification of Murchison's theory later found confirmation in the discovery by one of his own assistants, Clarence King, of Jurassic fossils in the gold-bearing slates of the Sierra Nevada, thus proving that the gold must have been introduced into them at some period later than the Jurassic.

The lead deposits of the Mississippi Valley, whose study on the Wisconsin Survey he completed just be-

[1] Am. Jour. Sci., Nov., 1855.

[2] Am. Jour. Sci., 1856

fore going to California,[3] he regarded as formed contemporaneously with the limestones in which they occur, possibly somewhat concentrated or segregated by circulating waters in later times. Forchhammer had recently published his studies on the composition of sea water, which had shown, among other facts, that certain sea plants contain sulphur. Whitney conceived that the early oceanic waters contained metallic salts in solution, and that decaying organisms had evolved sulphuretted hydrogen in sufficient quantity to precipitate them as sulphides. It remained for Chamberlin, who made later and more detailed studies of this region, to attempt to explain why the deposits were localized in this region rather than any other by endeavoring to reproduce the topography of the region in Lower Silurian times and indicate the oceanic currents that would probably have collected masses of sea-weed in an eddy in that region, resembling the Saragossa sea. It is possible that this idea may have accounted in some measure for Whitney's persistence in regarding the copper-bearing rocks of Lake Superior as of Potsdam age, for if they were admitted to belong to the Azoic system, there could have been no organisms there to precipitate the copper in its native state.

It may appear that the preceding account of Whitney's work and opinions has been unnecessarily prolix, inasmuch as it is difficult to determine from it any definite set of theories and beliefs with regard to the origin of ore deposits that Whitney persistently held to, and he was a man pre-eminent for persistence in an opinion that he had once definitely adopted. It has, however, been intentionally made so, in order to show the very uncertain and tentative condition of the public mind on these subjects, a condition that the writer found to obtain with but very moderate improvement, except on the lines of general geology, when twenty years later he undertook his first special study of a mining district. Speculations and hypotheses were not wanting, but criteria had not been established, by actual study and demonstration, by which one could determine that one theory or view was applicable to a given deposit to the exclusion of all others. Hence, if one looks through the reports on mines made by mining engineers in that twenty-year period to demonstrate whether or not the deposit reported on is such as would justify the expenditure of a considerable amount of money for its development, he finds that most of them contain either no reference at all to the strictly geological relations of the deposit, or that such as is given is of a very perfunctory nature, confined to showing that it is a true fissure vein or bears some relation to one, and hence may be expected to continue indefinitely and probably grow richer in depth.

A rather exceptional report,[4] considering the ability and wide experience of the man, and the great importance of deposit, is that of F. von Richthofen on the Comstock Lode, made in 1865 for the Sutro Tunnel Company, with the object of showing that the ore would probably continue down to the depth at which it was proposed to cut it by the tunnel. Von Richthofen, evidently realizing that few of his readers would have any familiarity with matters geological, enters into somewhat elaborate explanations of quite fundamental matters. Thus, he gives the following characteristics of *true fissure* veins: (1) that they cut rocks of different kinds; (2) that they extend to an indefinite depth; (3) that they show evidence of dynamic action; (4) that they are ordinarily connected with the ejection of some eruptive rock; (5) that they are filled mainly from below and essentially by chemical action. He then says that various agencies have been advocated by different persons as the sole origin of veins, namely, infiltration from above, from the walls, from thermal action; but experience has shown that all these have been more or less simultaneously active in the filling of every true fissure vein. Thermal spring action would not explain the decomposition of the country for two miles to the east of the Comstock Lode; hence, the filling of the fissure must be regarded as the result of solfataric action, a solfatara being a vent for the violent emission of steam at or near an active volcano. Every solfatara passes through two stages: (1) one in which steam is accompanied by gaseous combinations of fluorine and chlorine; (2) by those of sulphur. A later phase, marked by the emission of carbonic acid gas, is no longer solfataric. In the Comstock silica was deposited in the first stage, and the fissure being opened again, the metallic minerals were then introduced as the second stage. As for the source of the water which furnished the steam and acted as a solvent, he says the ocean was too far away, but the waters from the Great Basin, which had a similar composition, penetrated to the heated region, thus furnishing the same source for fluorine and chlorine that they are supposed to have in active solfataras. "As for the source of the mineral substances", he says, "we have to look for the action of these elements on the surrounding rocks." This was the report of a professional geologist of the very highest standing and is, as before stated, a rather exceptional one. The average report at that time is better typified by that of A. Sutro on the same subject, in which he is endeavoring to persuade capitalists to subscribe to his tunnel scheme, and which is probably a paraphrase of that of von Richthofen. It says: "The Comstock Lode is a true fissure vein, * * * through which open fissure ascended steam and vapors, gases, acids, sulphur, chlorine, and fluorine, carrying with them silica and metallic particles in a volatile form, which, in course of untold ages, gradually filled up the fissure, and after undergoing many chemical changes, formed what is now known as the Comstock Lode." In the much more detailed and exact study made of the Comstock Lode by King and Hague in 1867-8, Mr. King declines to go into abstruse speculations with regard to the ultimate origin of the metallic contents of the Lode, it evidently being his idea that a greater accumulation of exact facts derived from exhaustive studies was necessary before such a discussion could profitably be entered upon.

[3] 'Upper Mississippi Lead Region', Albany, 1862, p. 406.

[4] 'The Comstock Lode—Report for the Sutro Tunnel Company', by F. B. Richthofen, Nov., 1865.

Pan, barba, kettle, cazo, fondon, and Washoe processes are identical in principle.—April 3, 1869.

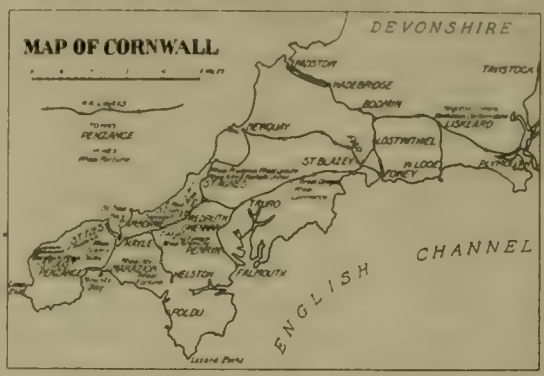
Reminiscence of Mining in Cornwall

Written for the Mining and Scientific Press
By Joseph Vivian

The rise of mining in this country appears only in dim tradition of the 'Tin Islands', as our native land was known to traders from the Eastern shores of the Mediterranean. Whether the Celtic natives discovered for themselves that many of our valleys were full of alluvial tin, or whether the enterprising adventurers of Phoenicia and Palestine made the discovery for them, it is beyond doubt that long before the Christian era a great trade existed in the export of the metal from 'Cornuwales', and that if much of it were shipped direct from Marketjew a considerable quantity found its way over land to the Eastern seaboard of Britain and across the strait to France and to that south of Europe where the tired Briton of today seeks the restoration of his vigor. Down through the ages tin has formed the staple product of the Western Peninsula, until copper became a rival and for a century or more took the first place. One is too apt to forget how, during the last hundred and fifty years, mine after mine became a great producer of copper, until Cornwall took the foremost place in supplying the world with that metal or the ore from which it was smelted. There was a time when the smelting was carried out at home, but by and by Cornishmen found it to their advantage to ship the ore to Wales, thereby making a great saving in freight on coal. Thus arose those great works at Swansea and elsewhere in the Welsh coalfields, which, now no longer getting their raw material from the Duchy which gave them birth, import their ores from the ends of the earth. But I have no intention of dipping further into a history which would naturally be the subject of great research and fill perhaps many volumes. My object is rather to relate, either from my memory, extending over about three-quarters of a century, or from the memory of those whom I intimately knew, whose experience extended back to the last quarter of the eighteenth century, events which may throw an interesting light on the spirit and achievements of an age which in the midst of the turmoil of today is in danger of being forgotten.

Camborne and the immediately adjacent parishes were from early times the home of a mining people some of whom attained to great wealth and founded families and estates which still testify to their energy and success. These were men of true and indomitable enterprise, who realized the possibilities before them and were not easily turned aside. Dolcoath had been eminently successful in the eighteenth century or before, but there came a time when partly, it is probable, through the difficulty of draining the workings, the mine was abandoned. But toward the end of the century Andrew Vivian, a man of dauntless resolution as well as of practical knowledge, entertained the idea that Dolcoath would pay to resuscitate. He placed his views before Lord de Dunstanville, the owner of the land and mineral rights, who was not slow to recognize the probability of profit to his estate by the re-opening of this old mine and not only granted Vivian the 'sett', but took a large interest in the company which was formed to work it. Great results came of this venture, the mine has worked continuously for more than a hundred and ten years, and the Tehidy family has reaped more than a million sterling from this mine alone. So much for the enterprise of Andrew Vivian and the readiness of Lord de Dunstanville to give him every encouragement. Before this, mining was for several years at a very low ebb, but the early years of the nineteenth century witnessed the flowing tide.

North Roskear was in the land of Mr. Pendarves. He granted the sett and followed the example of Lord de Dunstanville in embarking largely in the company of adventurers. Many people, however, formed a poor opinion of the speculation and there was considerable difficulty in getting the money paid up to carry on the work, when a well known firm of



merchants who held one-eighth of the shares had the mine inspected and on the report of their agent determined to relinquish their interest. This was, or threatened to be, a serious blow to the company. A meeting of the remaining holders was called, and it was generally thought that the mine should be abandoned. The purser, however, advised that before deciding on this step they might hear what the manager had to say. The manager was called and gave his report which did not appear to shake the resolve to give up the sett, until he said that if the shareholders had decided not to go on, he had a favor to ask from them, namely, that they would lend him the machinery which was only of small value, for a few months, when he would carry on the work at his own cost. He was a young man of moderate means as he explained, but was so confident of success that he was prepared to take the risk for a limited period. His confidence was contagious, the company there and then resolved to go on, and in three months from that meeting, and for many a long year after, North Roskear was a highly productive and prosperous copper mine, and Mr. Pendarves, as the owner of the dues and the largest shareholder, reaped a handsome fortune from it.

These discoveries in the first quarter of the century were, however, but the forerunners of many others which soon made the weekly copper Ticketings held at Truro, Redruth, Pool, and Camborne important meetings both to the miners and to the cop-

per smelters, and at Hayle and Portreath might always be seen many hundreds of tons of ore on the wharves waiting for shipment to Welsh ports by the coasting scooners which loaded back from thence with coal for the mines and iron foundries. It was then no uncommon thing to see the harbors of Hayle and Portreath crowded with these sailing vessels, where now hardly one is seen, the diminished traffic being mastered by half a dozen steamers. This brings to mind the well authenticated story that 30 of these coasters sailed out of Hayle on one tide and ran into such a fearful tempest that only one of them escaped shipwreck. This has been ever since called the August gale, as it occurred in that month.

To return, however, to our subject, the new spirit thrown into mining in a measure by the success of Dolcoath and North Roskear was rewarded by great discoveries of copper at such mines as Wheal Seton, West Seton, Wheal Basset, West Basset, South Frances, Crenver and Wheal Abraham, Carn Brea, North Pool, and several others among which may be particularly named Wheal Buller, the discovery of which reads like a romance. The manager of North Roskear having business at a mine meeting in Gwennap walked there, and taking a short cut across country passed over the downs on the high ground east of Carn Brea hill. There, engaged in cutting and faggoting furze, he found an old man whom he recognized as a former acquaintance and stopped to speak to him. While chatting he noticed among the roots of the furze stumps bits of gossan, and handling one or two remarked that they were very kindly stuff. "Yes," said the old man, "I do think they are." "What is the name of this place?" he asked. "Wheal Blackbird," was the reply. He then continued his journey and at the mine in Gwennap met among others Stephen Davey and Richard Davey, well known mining men of Redruth. He told them of what he had seen in the course of his walk and asked who was the owner of the land called Wheal Blackbird. They said Mr. Buller, whom they represented as mineral agents or 'tollers'. A few days after this interview Frank Pryor, who occupied a prominent position in mining circles, came to North Roskear and asked the manager if he could recommend a good mining sett. "Yes," he said, and told him of Wheal Blackbird. "Thank you," said Mr. Pryor, "I will apply for it." But when he made the application to the Messrs. Davey they stated they were going to work it themselves. This they did, forming a cost-book company in a hundred and twenty-eight shares of which they retained one-half. A call was made of £10 per share and before the sum total of £1280 was spent, a lode was opened up which gave a profit on copper of more than £300,000, and shares which cost £10 reached a market value as high as £1400 each.

After Dolcoath had held its own for some forty years as a copper mine, it began to show the sere and yellow leaf of exhaustion. The deeper levels were abandoned and under water, and the ore remaining in the upper levels would not pay for keeping the mine going. Then the question was: 'To be or not to be'. The advice of experts was sought, one on behalf of Lady Basset, the owner of the mineral rights, and another on behalf of the company that held the lease. These experts, strange to say, agreed in the advice to unwater the bottom and to re-commence working in depth. This advice was taken and justified by the immediate raising of tin, with the result that in a short time Dolcoath became the greatest tin mine of the county, surpassing every tin mine in the world except, perhaps, one. A few years ago, the present Dean of Grahamstown, then Canon Missioner of Truro, told me that he was making a visit to Tasmania and would be ashamed to own when he got there that although coming from Cornwall he had never been down a tin mine. The hint was taken, permission asked and granted with the unfailing courtesy of the late Capt. Josiah Thomas, that Canon Carter should go to the bottom of Dolcoath. And so it happened that when he reached Tasmania the Canon could tell of his visit to a mine more wonderful even than their own Mount Bischoff. Since Dolcoath became a great tin mine, the depth of its workings has doubled and is now considerably over half a mile and still it goes down from "deepest depths to deeper still."

The strange thing is that the change of the lodes from copper to tin in Dolcoath is only an example of what is found in practically all the mines of the district, and there are many of these old mines once rich in copper, but now derelict, which as tin is more and more wanted will hereafter be re-worked and then will be repeated the success already attained in a mine which was so near being abandoned. West Seton with a good lode producing a considerable amount of tin, but given up for the lack of a little more of the spirit of enterprise may be cited. South Tolgus, rich in copper for a depth of 140 fathoms, abandoned just as the lode was developing tin is another. Forty years have passed since this mine was abandoned and from that time to this the dumps have paid to work on tribute for tin, and a tributer, who worked in the bottom of the mine up to the last, sent up tinstone by which he got £40 for his last month's work.

There are, however, other districts which have not been explored to nearly the same depth as the Camborne mines. Gwinear on the west has had several rich copper mines, and one which is said to have produced silver to the amount of £80,000 but none of these mines have been worked to any considerable depth. And the parish of Perranzabuloe has had its West Chiverton on the east and its St. George and Wheal Leisure on the west, notable and profitable mines in their day, but the great part of the parish lying between has never been fairly prospected and offers today the probability, with a comparatively small outlay, of finding prizes equal to any of those which have gone before. West Chiverton was worked for lead and silver by a gentleman called Cookney. He died and left the property to his widow who determined to sell it. When it was known to be for sale, a syndicate was formed with the object of purchase. Negotiations were entered into with the London agent, and it was found that the price asked was £30,000. The syndicate tried to get it for less. In the meantime two other men thought they would like to buy it. One of them, a

Cornishman, had known Mrs. Cookney, and on the strength of this business acquaintance, they determined to call on her. They found however that she had changed her residence, and when after much enquiry they reached her door it was 9 o'clock at night. The footman who answered the bell, said Mrs. Cookney does not see visitors on business at this hour. But one of them wrote a few words on his card and asked the man to take it to his mistress. They were then granted an audience and told that the sale was left unreservedly in the hands of her solicitor, to whom, at their request she gave them a short letter of introduction. The next day they called at his office, and found that the other party had the option of taking the property up till noon on the next day. If they would call at that hour, he would, unless the others had accepted, be prepared to deal with them. Coming to his place the next day as the clock struck 12, they found that the property had not been sold, and without hesitation closed the bargain at £30,000. Going out fortified with a contract note, the Cornishman said to his friend: "Where are we going to get the money to pay for it?" "All right," said the other, "come along with me." They went to the office in the city of a man who commencing life as a barber in Cornwall had acquired considerable substance on the London mining market. "Well," he said, when they walked in, "what do you want?" "We want £30,000." "Indeed," he said, rather sarcastically. "Yes, and when you know on what grounds, you are going to let us have it." "Oh! of course," was the reply, "and what are these wonderful grounds?" "We have bought West Chiverton." "Oh, no! I know better than that." He was a member of the syndicate which was hoping to get the mine for something less. When, however, he was shown the contract and was told that if he would advance the money, that money should be the first charge, and that after that was paid they would all three share equally, he consented to the terms. The property was transferred, the purchase money quickly repaid, and each of the three gained more than £40,000 profit. This happened about forty years ago. Some people profess to think that the mineral resources of Cornwall have been pretty well determined. There are others who hold that much less capital than has been spent somewhat lavishly in re-opening deep mines, would, if devoted to prospecting new ground, have struck ore and met with rewards equal to Wheal Buller or West Chiverton.

The outlook for the petroleum industry in California is highly encouraging. Such flattering oil prospects have been obtained in Kern, Humboldt and several other counties during the year as denote for this industry early enlargement. Our oil-producing territory covers an immense area, and although the deposits generally lie deep and are somewhat scattered they offer great inducements for the inauguration of new enterprises and the investment of capital. —January 7, 1893.

Twelve and three-quarters tons of cinnabar ore, from Chapman's mine, 3½ miles south of San José, yielded 64 flasks of quicksilver.—July 13, 1867.

Early Smelting at Cerro Gordo

Written for the MINING AND SCIENTIFIC PRESS
By FRANCIS DRAKE.

Lead smelting in the early seventies was carried on in rather a different manner than it is today. I went to Cerro Gordo, in Inyo county, in September, 1874. The mines there had been producing what I have seen described as a 'flood of silver-lead'. They were owned by Egbert Judson and Mortimer W. Belshaw, as to one-half, and Victor Beaudry as to the other. The ore as it came from the mines was sorted, the galena and waste being picked out; it was then divided on the dump. One wagon load went to the furnace owned by Messrs. Judson & Belshaw, and the next went to the furnace owned by Mr. Beaudry, and so in turn the galena was weighed, but no such trouble was taken with the ordinary ore. I remember Mr. Belshaw defending the separate treatment of ore by saying that the rivalry between the two furnaces treating the same ore tended to make those in control put forth every effort. There certainly was rivalry. One of my duties was to try to find out the size of the other fellow's bullion pile, and if either of the furnaces was shut down longer than usual for the almost daily patching of its brick walls, there was gratification in the rival office.

No attempt was made to weigh the quantities of materials going into the furnace.* The fuel was charcoal and the quantity to each charge was a 'box' of indefinite capacity as it had only three sides and was unequally filled by the charcoal passer whose work was to fill the box from the charcoal heap and inject its contents into the furnace when told to do so by the feeder. The superintendent exercised some supervision over the number of shovelfuls of galena, quartz, and slag to each charge, also told the ore-wheeler what proportion of the different colored ores to wheel on to the charge floor; but the feeder put in as many shovelfuls of this ore mixture as he thought the furnace would stand and keep running.

The furnaces were of an oval shape at the tuyere level, being about 4 ft. 6 in. on the longer axis and about 3 ft. on the shorter one. They had five tuyeres, two on each side and one at the back, and were about eight feet from the tuyere level to the charging door. The superstructure commenced about four feet above the tuyeres, was of common brick, and was supported by four iron columns. The walls of the furnace below this superstructure were made of large radial bricks which were made of local fire-clay and crushed quartz. They were not burned and were excellent flux for the highly basic ores which were being treated. The production was on exceptional occasions as high as thirteen tons of bullion per day.

The level of the charge was kept as low as possible without having a flaming top, and large quantities of ore were blown out of the shaft and thrown over the dump as flue-dust. At the Belshaw furnace this flue was about six feet long and extended downward at an angle of about 30° from the horizontal,

*Weighing of the furnace charge was introduced at Cerro Gordo in 1878 by Fred F. Thomas.

from one side of the superstructure of the furnace to a brick chimney, which extended a short distance above the roof of the furnace building. The dust was taken out of a door at the base of this chimney. Probably someone will write in your centennial number of the wasteful methods of this generation, calling attention to the 25 to 30% of value which we allow to go to waste from our copper concentrating works.

Late in 1874, a water-jacket was introduced to take the place of the air-dried bricks. It was of the same horizontal section as the brick furnace, except that the inside was a foot longer and wider. This was to allow space for a lining which was made of air-dried bricks half as long as those previously used. It was thought that it would never do to run it without a lining. The jacket was made of the best wrought iron obtainable and all in one piece, that is, it was not sectional. It had large opening for the insertion of water-cooled tuyeres, and these projected through the jacket about six inches.

This jacket, if not the first, was one of the first used in lead smelting on this Coast. It was designed by Mr. Belshaw and William E. Goodrum, the latter being the furnace superintendent at the time, and made by Hinckley, Spiers & Hayes, of the Fulton Iron Works. It was made to stand a boiler pressure and had a cylindrical steam drum at the back, to which it was connected by two 3-in. pipes about 3 ft. long. This drum was connected to the steam drum of the boiler and the bottom of the jacket was connected to the bottom of the boiler. The level of the water in the boiler was somewhere in the pipes connecting the drum to the jacket. This arrangement caused some economy in boiler fuel and was in use until the jacket became leaky, after which it was run as jackets are now. Water in the furnace was not conducive to good smelting and besides we had to be economical with it as it cost a cent and a half a gallon. The water-jacket furnace was a great success in that it saved the suspensions of work to patch up the walls of the furnace. It had occasionally to stand the blame for faulty metallurgical work though, as freeze-ups were sometimes ascribed to a leak in the jacket when the cause was something else. As the bullion was sent to San Francisco an endeavor was made to make it carry as much silver as possible and as the ores of the furnace owners were ferruginous, quartz ore was bought from any one who liked to bring it in. On one occasion supply of this ore was short and barren quartz was used. The bullion carried just under one hundred ounces to the ton. Mr. Belshaw came up from San Francisco and asked us why we did not put in some silver dollars. He said that it would have paid well to do it as he got a much better price per ounce when the grade was above one hundred ounces per ton.

The bullion was sent to the Selby works at Black Point, where the silver was separated from it, and the lead refined. It is said that the Selby people had agreed to take all of the production during a term of years, under a contract to pay a certain royalty on the refining process the right to use which was owned by Judson & Belshaw, and they were much embarressed at the quantities that were being sent. Judson & Belshaw magnanimously agreed not to enforce the conditions of the contract.

The freighting of the bars to San Francisco was a problem. Local freighters were tried, and the result was accumulations of thousands of bars at Cerro Gordo and other points. At one time 42,000 bars, weighing from 85 to 87 lb. each, were on hand at the furnaces. Eventually the Cerro Gordo Freighting Co. was organized, with R. Nadeau, of Los Angeles, as the principal owner, and gradually the accumulations were reduced. The organization of this freighting company is worthy of a passing note. Almost all of the country through which the freighting had to be done was desert, and water was scarce and often of poor quality. Stations were established at intervals, water was piped to them from the nearest springs, in some cases several miles distant, and supplies of food stocked for man and beast. The teams were kept on each run the same as stage teams are, going in one direction one day and back the next. The wagons went straight through with their loads. At first the bullion went to Los Angeles, but when the railroad got over the Tehachapi pass it came to San Francisco by way of Mojave.

Since those days the waste and slag dumps have been picked over at least once, and I understand that the present owners propose to go through them again. One of the dumps was the cause of much excitement. In a gossan which had been thrown out as valueless, gold was found by an old Mexican woman. Soon the dump was alive with men, women, and children, and the amount of gold won is unknown. It reached thousands of dollars, as some of the pieces were very rich, containing ounces of gold to the pound of rock. Many fruitless efforts were made to find the place in the mine from which the rock came.

THE ARGONAUTS

By Joaquin Miller

Lo! when the last pick in the mine
Lies rusting red with idleness,
And rot yon cabins in the mold,
And wheels no more croak in distress,
And tall pines reassert command,
Sweet bards along this sunset shore
Their mellow melodies will pour,
Will charm as charmers very wise,
Will strike the harp with master hand,
Will sound unto the vaulted skies,
The valor of these men of old—
These mighty men of 'Forty-nine,
Will sweetly sing and proudly say,
Long, long agone there was a day
When there were giants in the land.

(Extract from poem 'Joaquin Murietta.')

An alarming report that the fleet of British war steamers, pretended to have been built for the Chinese Government, is now preparing for an attack on San Francisco, lacks confirmation.—February 13, 1864.

Looking Backward

Written for the Mining and Scientific Press
By H. F. Dexter

Of the early history of the Mining and Scientific Press, I can speak only from hearsay and what I have gathered from the files of the paper itself. The paper was founded on May 24, 1860, by J. Silversmith, who, in partnership with J. H. Winslow, printed the first number under the title The Scientific Press "A Journal of Science, Art, Manufactures, Chemistry, Invention, etc." the object of the paper being set forth in the prospectus contained in the reproduction from the first issue printed elsewhere in this number. On the front page of the issue dated June 9, 1860, a notice of the dissolution of partnership between Winslow and Silversmith

Alfred T. Dewey.

Warren B. Ewer.

was printed and the announcement was made that Silversmith would continue the publication of the paper. In the following issue appeared another notice to the effect that the paper would be published by J. Silversmith and edited by "An Association of Scientific Men." In the issue of September 1, 1860, it was announced that the paper would be published daily during the fair that was to be held in the Mechanics Pavilion during that month. It was also announced in the same number that owing to their growing importance the mining interests of the State would thereafter be the chief feature of the paper. On October 20, 1860, the name of the paper was changed to The Mining and Scientific Press and Mining Advocate. "The Association of Scientific Men" seems to have become tired of editing the paper very soon as in the issue of November 30, 1860, the name of J. Silversmith appears as both publisher and editor and continues so until October 7, 1862.

On January 19, 1863, W. B. Ewer joined C. W. M. Smith in partnership and they continued to publish the paper until December 14, 1863, when another partnership was formed consisting of W. B. Ewer, C. W. M. Smith, and A. T. Dewey under the firm name of Dewey & Co. Mr. Dewey came from La Porte, Sierra county, California, where he had been for five years publisher of the *Mountain Messenger*, and previous to that had been engaged in the newspaper business respectively in Westfield and Springfield, Massachusetts. This partnership continued until August 8, 1868, when Smith disposed of his interest to Dewey and Ewer who continued as partners until the Dewey Publishing Company was incorporated in December 1891.

The early owners of the paper seem to have been of a migratory nature; possibly they found it "cheaper to move than pay rent." The original office was in the Government House, corner of Sansome and Washington streets. On January 11, 1862, the office was moved to 522 Merchant street; on April 9, 1862, to the State Capitol building, or as it was afterward designated, the Federal building, corner of Battery and Washington streets; on September 21, 1863, it was moved back to the Government House; on April 10, 1865, to 505 Clay street; on August 8, 1868, to 414 Clay street; on October 1, 1871, to 338 Montgomery street, southeast corner of California street; on July 13, 1874, to 224 Sansome street, southeast corner of California street; and on July 28, 1877, to 202 Sansome street, northeast corner of Pine street, where it was when I joined the force.

When on the morning of May 1, 1878, I stood on the platform of a Silver Palace car passing over the summit of the Sierra on the Central Pacific railroad, gazing at the snow-clad mountains, for at that time the view was very much less obstructed by snowsheds than now, the railroad company depending

more upon snowplows than sheds to keep the track clear, I had no idea that thirty-two years later I would be helping to celebrate the fiftieth anniversary of the founding of the MINING AND SCIENTIFIC PRESS. As a boy I had a great desire to see California, and an opportunity had presented itself whereby I expected to earn enough money to pay my expenses for the trip and then I would return to New England and settle down for life. In a few hours we were down on the floor of the great valley which was carpeted with green grass and wild flowers, and late in the afternoon we arrived at the Market street station in Oakland, coming in by way of Stockton, Livermore, and Niles. This station has since been removed, the Overland route having been changed to that by way of Suisuin and Benicia. The day was bright and warm, and coming from the bleak climate of the Eastern States the transition seemed to me most beautiful. The next day I spent looking around San Francisco, visiting among other places of interest the celebrated Woodward's Gardens, which have now been out of existence many years. The following day I began my duties in the office. The business office was then in a three-story brick building, which was afterward torn down to make room for one erected by the Anglo-Californian Bank. The editorial, composing, and press-rooms were at 414 Clay street. As previously stated the MINING AND SCIENTIFIC PRESS was owned by the firm of Dewey & Co., publishers, consisting of A. T. Dewey and W. B. Ewer. They also established the *Pacific Rural Press* in 1871, the leading agricultural paper on the Pacific Coast. Affiliated with them was the firm of Dewey & Co., patent agents, composed of A. T. Dewey, W. B. Ewer, and George H. Strong.

There was at that time a great struggle between the miners and farmers over the débris question. This finally resulted in the creation of the California Débris Commission. The bitterness existing between the two factions was no doubt greatly ameliorated by the fact that the above mentioned organs of both were owned and controlled by the same firm, the members of which sought as far as possible to harmonize the interests of the two. The telephone was just being introduced and our office was among the first to have one installed, our number being 77. The following quotation from the MINING AND SCIENTIFIC PRESS of May 18, 1878, will be of especial interest: "The use of the telephone in this city has been marked by the character of enterprise which usually attends the introduction of progressive inventions among our wide-awake people. The American District Telegraph Co. has furnished a large number of the instruments to private parties, and has given the use of the telephone features which were original with them, but which from their plain advantages are now being introduced in other cities. Notable is the arrangement called the 'central system'. At their establishment on Sansome street, near California, they have a telephone department under the management of Mr. John I. Sabin. In this room each wire from the distributed telephones centers. If the owner of a telephone wishes to communicate with another owner in any part of the city he signals or calls the central office, and his wire is connected with that of the other party. There are now 100 firms centering in this office and each one can thus, at a moment's notice, be put in communication with any one of the 99 others. Thus any firm can communicate with another as man would speak with man, as the message goes direct without even the intervention of an operator. When a firm is called from the central office they are told the name of the party who addresses them by the central operator, so there would be no chance for the telephoners to impose on one another by calling wrong names. Each firm is furnished with a schedule of all the others which are in communication with the central office. As we have said, the manifest advantage of this centering idea is so great that the great cities at the East are thinking of following the example set them by the enterprising company in San Francisco." Out of this small beginning there has developed a system which now numbers nearly a hundred thousand telephones.

My work was at first in the engraving department. Several photo-engraving processes had just been invented and the firm had bought the right to use one from Leo Bok of New York. It was popularly known as the 'plaster process' and consisted briefly in photographing a line-drawing and printing the negative on a thin sensitized dry film of gelatine spread on a thin sheet of zinc. When immersed in water the parts of the gelatine not printed on would swell, thus forming a matrix from which a plaster of paris cast was made. Lye was poured over the face of the cast and allowed to dry thoroughly. A positive plaster cast or matrix was then made from the negative, the object of the lye being to prevent the two from adhering. A type-metal cast was made from the second matrix and mounted on a wood base, type high, when the figure was ready for the printing press. The weak point in the process was the difficulty of casting the type-metal plates from the plaster casts without cracking the latter. There was also difficulty in separating the two plaster casts when the shading was very fine. Another difficulty was that the printing of the negatives could only be done by sunlight, electric light not having come into use at that time, and in the prevailing cloudy weather in San Francisco, it was at times several days before any printing could be done. The process was adapted to such a limited variety of work that it was given up after a few months' trial and we returned to the use of wood cuts until the process of etching on zinc came into practical use.

In the meantime I had been called into the accounting department where I have since remained. At the time I first assumed my duties in the business department there were, as now, three kinds of money in circulation—gold, paper, and silver, but instead of being at par, each had its own value in the order named, gold being the highest, paper next, and silver the lowest. The difference between gold and silver was enough to drive gold out of circulation except where it was specially designated as being the medium of payment, hence nearly all prommissory

notes stated the amount due should be paid in gold coin. Checks for amounts less than ten dollars were rarely used. Nearly all ordinary bills were paid in silver. In fact many of our subscriptions were paid in silver, the coin being shipped to us by Wells, Fargo & Co.'s express. It was not until several years afterward that money orders and checks came into general use for small amounts. Occasionally payments for subscriptions were received in small nuggets or gold dust, as still sometimes happens in the case of subscribers in out of the way districts.

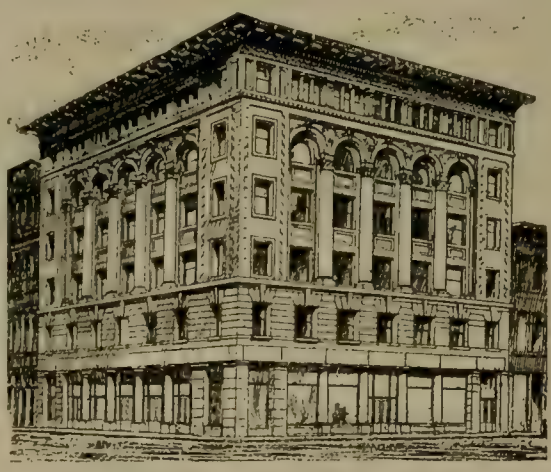
Old Capitol Building, Office of the Mining and Scientific Press 1862 to 1863.

In the fall of 1882 I went East on a visit and while there spent some time in New York trying to engage an engraver to come to San Francisco. There were plenty of engravers but none of them would undertake such a long journey. They thought it too far out of the world. In the fall of 1879 and during the year 1880 the firm published the 'Scientific Press Supplement', a semi-monthly which was intended to be to the MINING AND SCIENTIFIC PRESS what the "Scientific American Supplement' was to the *Scientific American*. It never was popular and was so poorly supported that it was soon discontinued. In February, 1881, the company assumed the publication of *The Californian*, a monthly magazine which had been founded the previous year by Anton Roman, who at one time was the leading bookseller of San Francisco. It was published in our office a few months and then turned over to the Overland Publishing Co. and the title changed to *The Overland Monthly* under which name it continued to be published for several years. It was afterward purchased by the Southern Pacific Company and the title of the magazine again changed to the *Sunset*, which name it still retains.

In October, 1881, the business office was moved to 220 Market street, on the northeast corner of Front street. This change was made necessary as previously stated, on account of the tearing down of the building at Sansome and Pine streets. It was a fortunate move, however, as the new location was more central and on the principal thoroughfare of the city. In the fall of 1884 the editorial ,composing, and press-rooms were also moved to 220 Market street, quarters having been fitted up in the basement for the press-room and additional space secured for the editorial and composing rooms on the same floor as the business office. The advantage of having all departments of the business under one roof was immediately realized. Even this arrangement had its drawbacks, however, as we were obliged to furnish our own power and assume the responsibility of operating an elevator. It was at the time when gas engines were first coming into use and we installed one to supply power, and I believe we had our full share of troubles. Afterward when electricity came into use we put in a motor, and from that time on had little difficulty.

Building at 202 Sansome Street, Office of the Mining and Scientific Press in 1877.

Interior of Office at 202 Sansome Street.



Building 330 Market Street, Office From 1897 to 1906.

In the fall of 1891 Alfred Holman bought a one-third interest in the business and it was incorporated in December, 1891, under the name of Dewey Publishing Co. In June, 1893, Mr. Dewey sold the remainder of his interest to J. F. Halloran and the latter became general manager. Mr. Halloran had previously had considerable experience as a newspaper publisher, and also some experience in the mines, he was, therefore, naturally interested in the development of the MINING AND SCIENTIFIC PRESS.

In April, 1898, Mr. Holman sold his entire interest to Mr. Halloran, who, with Mr. Ewer, continued to own practically all of the stock until 1905, when T. A. Rickard purchased a controlling interest in the business.

In June, 1897, the office was moved to 330 Market street, northeast corner of Bush and Battery streets, where it remained until the memorable morning of April 18, 1906, when the whole business portion of San Francisco made a very sudden move. The story of the earthquake and fire is told elsewhere in this issue by Mr. Rickard.

The entire business passed into the control of its present owners in the latter part of 1905 shortly after T. A. Rickard severed his connection with *The Engineering and Mining Journal*. With him was associated his cousin, Edgar Rickard. Mr. Halloran retired at that time. Early in 1909 T. A. and Edgar Rickard established in London *The Mining Magazine*, a monthly periodical closely affiliated with the MINING AND SCIENTIFIC PRESS. The initial number of this publication appeared September 15 of last year. The favor with which the new magazine has been received indicates that it will realize to the full the expectations of its promoters.

Of the men under whose ownership the paper has been conducted during my connection with it I may be permitted to speak briefly. Mr. Ewer was well advanced in years and did not take any very direct interest in the business after I came into the office. What he did do was in connection with the editorial department. Mr. Dewey was the active member in the business affairs of the firm. He had a consuming desire to become a publisher of many papers which led him into several outside ventures in the way of fraternal publications. He was ever ready to adopt anything new in improvements which would enhance the value of the papers as was evidenced by his pioneer efforts in the introduction of the photo-engraving process and in the adoption of new machinery and appliances for the mechanical production of the paper. He was ever ready to get in touch with the best writers of the day, and it was largely through his effort and those of Charles G. Yale who was associated with the paper as editor, that such men as Guido Küstel, C. H. Aaron, C. A. Stetefeldt, Almarin B. Paul, George Davidson, J. S. Phillips, Melville Atwood, Henry DeGroot, Henry G. Hanks, and other leading men of their day became contributors.

Of the present ownership and management I need not speak at length as they are giving evidence every week of their success in making the MINING AND SCIENTIFIC PRESS the best paper of its kind in the world. It is a great pleasure and satisfaction to have been associated so many years with men who have all had such high and honorable ideals. May the superstructure be worthy of the foundation already laid.

"'MALGAMATIN'"

[From MINING AND SCIENTIFIC PRESS, Sept. 24, 1904.]

'Malgamatin' on the pans
  Down the Golden Mile,
Mixers belchin' boilin' sands
  Swellin' someone's pile.
Heat and dust and KC'y,
Hot mud splashin' in your eye,
  Twenty pans rotatin';
Spin, you whirlin' devils, spin!
Can't hear nothin' for the din,
  'Malgamatin'!

Now the elevator's stuck,
  Twisted buckets jammed;
Never saw such purple luck,
  May the job be d—d!
For this flamin' dust is chokin',
Might as well in hell be stokin',
  "Bash those edges straight in!"
"Pass, oh pass the hammer here!"
'Taint all counter lunch and beer
  'Malgamatin'!

Chippin' mudflake off the edge,
  Hammer-head went plump!
Close up three-pound weight of sledge,
  Hear the muller bump!
Snatch the clutches out of gear!
Blazes! won't the foreman rear!
  Here's a lovely ratin'!
(Can't he give it to a bloke!*)
Bet a quid† there's somethin' broke,
  'Malgamatin'!

Boss says, "Clean up, Number Four!
  Get the tackle to her;
Lift the muller from the floor,
  Guess we'll have to shoe her!
Jam the bars beneath the dies,
Put some weight on, up they rise,
  Set those cogs gyratin'."
Pans on either side a-steamin'!
Lord! it ain't no place for dreamin',
  'Malgamatin'!

Lyin' thick between the dies,
  Cloggin' up the pan,
Don't it tempt a fellow's eyes,
  Man is only—man!
Half a hundred weight in this,
Ounce or two they'd never miss—
  Go to blazes, Satan!
While my girl's in me believin',
Haven't got no time for thievin',
  'Malgamatin'!

* Slang for 'one of the common herd.'
† Slang for £1.

Hydraulicking in California

Written for the Mining and Scientific Press
By H. P. Cornish

The history of hydraulic mining in California is most interesting, though little is known today out side of a few counties as to its present condition. The evolution of the art of mining auriferous gravels in California is the story of a beginning with the gold-pan, progress followed step by step to the rocker, the long-tom, the sluice-box, that terrible engine of destruction, the hydraulic giant, ending with the wonderful mechanism of the modern dredge.

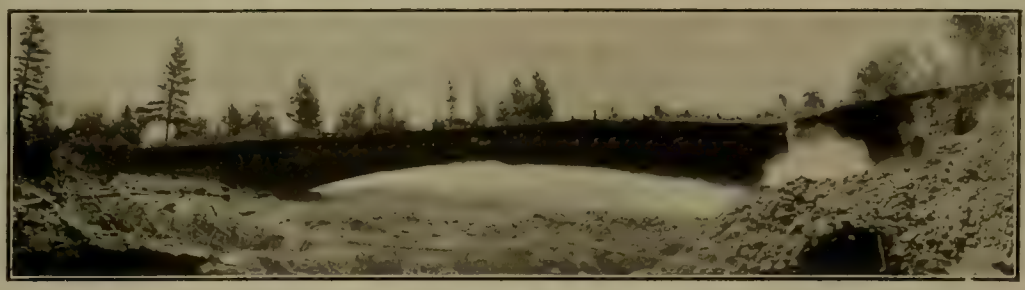
Gravel Elevator, North Bloomfield, California, 1893-94.

Hydraulic mining began in California in 1852; it developed because the rich surface deposits were becoming exhausted. Up to 1884 the gravels of California had produced $1,050,000,000 (see A. J. Bowie's work on hydraulic mining, page 283). About this time the anti-debris law caused all the hydraulic mines to suspend operation except in the northern counties, and it was not until the Caminetti law went into effect that hydraulicking was allowed to resume, and then only by mines that were so situated that they could impound their tailing or débris with restraining-dams of brush or masonry, and at present no brush or log dams are allowed, nothing but concrete or masonry being sanctioned, and very few mines are rich enough to afford such constructions.

Before the anti-débris agitation I had worked in hydraulic mines in Montana, and in Eldorado, Amador, and Calaveras counties, California, when the industry was at its best and booming; later I worked in Trinity, Del Norte, Nevada, and other counties of the State, and also in Alaska and in foreign countries. Mines in those days were not known simply as hydraulic mines; they had such names as Henry's Diggings, Slag Gulch, Indian Diggings, Fiddle Town, and Whisky Hill, the latter supposed to be at or near the place pictured by Bret Harte in his story 'The Luck of Roaring Camp.'

The hydraulic miners were the happiest in the State, and little did they dream that the iron hand of the law would soon crush them. When the blow fell, delivered by Judge Sawyer, hundreds of hydraulic miners entered into quartz and drift mining.

In 1893 I became foreman of the North Bloomfield gravel mine in Nevada county, which had been made famous as the mine against which the Anti-Débris Association had waged its bitterest warfare, and for over a year it was subjected to the closest espionage on the part of the anti-débris people. I have no doubt that there was a great deal of graft in that warfare, but that is all a thing of the past.



Echo Hydraulic Mine, Murphys, California.

At the present time hydraulic mines are not allowed to run tailing or débris into the rivers, so it is necessary to use elevators and to impound the tailing in some worked-out portion of the mine. The first elevator in use at this mine, which was previous

to 1893, was of the same style as the modern enclosed elevator of today, but the size of boulder that it could handle was limited to less than 15 in., the size of the throat. Later, the company used an open wooden elevator, which was nothing more than three or four sluice-boxes set on an angle of about 50°; the lower 8 ft. was lined on the bottom with manganese steel plates 2 in. thick, and above that were ordinary wooden riffle-blocks 13 in. thick. The lower sides were lined with boiler-plate iron and partly worn steel plates. Streams from ordinary hydraulic giants were used, the nozzles being set 2 in. from the bottom and on a line with the elevator, yet the friction was so great that the steel plates lasted only a month when running one shift per day. Above the 8 ft. of plates there was no friction to speak of, the wooden blocks lasting longer than in the regular mine-sluices.

I suppose more experiments have been made at this mine than at any other in the State; it was here that the idea of the deflecting nozzle first originated, and as usual in such cases, the men who evolved it never derived due credit or benefit in consequence. William H. Radford, who was manager, and a very progressive man, allowed me to experiment on the wooden elevator, with the result that between us we evolved the open steel-elevator, a view of which accompanies this article. It is an open trough, 4 ft. wide, and about 4 ft. deep, made of ¼-in. rolled steel plates, furnished by the Joshua Hendy Iron Works of San Francisco. The bottom corners are rounded, with a 20-in. board on the upper sides, set at an angle of 52°. The nozzles, 3½ in. diam., are set back 7 in. from the bottom of the elevator, this doing away with injurious friction. In experimenting with the wooden elevator, it was found that if the grade were varied 1° it would work 'heavy'; with 2° it would not work at all, that is, if given less pitch it would drag too heavy on the bottom, and with more grade, it would not fill, the water falling back and choking it. This is important to know, otherwise users will have trouble with this kind of elevator. There was 540-ft. water pressure through a pipe-line a mile long. I think the effective head was a little over 250 ft., but am not sure. About 1000 to 1200 miner's inches of water was used in the mine for 'piping', and anything that came through the sluices in the shape of boulders, pipe-clay, or stumps, went through the elevator without trouble; in fact it would not choke with any material, except by doubling up the water and sending it down with a rush. The view shows the elevator at a height of 54 ft., which was later increased to about 60. We used to keep a nearly round boulder, 22 in. diam., to send through the elevator for the benefit of visitors. It would be dropped in the sluices near the elevator, and in an instant it was out on the dump, then when the water was turned off would be rolled back ready for another visitor.

At one time this mine had been worked in benches but at this later period it was worked in one bench, and as the banks were just 300 ft. high it was occasionally quite dangerous. It would be a long story to detail the methods evolved for working this great mine; many years of experimenting by different managers, had given the knowledge of how to obtain the best results.

This mine had been operated for 30 years, and was good for 30 more, but the anti-débris law forced it to suspend. There was no room for storing tailing.

In all my experience in gravel mining, including Ecuador, Colombia, Costa Rica, Idaho, Montana, Oregon, and Alaska, I have never yet seen a territory that would compare in the value or extent of its mineral deposits with California, and some day it will be worked. It could be done without injury to the rivers, if the mine owners would form a powerful combination for reclaiming the tule and waste lands along the lower reaches of the river by diverting to them the débris from the mines.

COALINGA OIL DISTRICT, CALIFORNIA

A report on the geology and oil resources of the Coalinga oil district, in the western part of Fresno and Kings counties, California, by Ralph Arnold and Robert Anderson, has been published by the United States Geological Survey as Bulletin 398. The district described, which is about 15 miles wide and 50 long, stretches along the northeast base of the Diablo range and includes a band of productive oil land three miles wide and 13 long at its north end and a narrow strip of oil land along its southwestern boundary. The region includes about 550 producing wells, which range in depth from 600 to 4000 ft. and penetrate from 20 to 200 ft. of oil sand. The product ranges from a black oil of 15° Baumé to a green oil of 35° Baumé. The yield of single wells differs greatly, ranging from 3 to 3000 bbl. per day. The district is the leading producer in California and one of the most productive in the world. Its production in 1907 was 8,871,723 bbl., in 1908 it was 10,386,168, and in 1909, it was probably 15,200,000 or more.

The total quantity of oil thus far taken from the ground in the district to the end of 1909 was about 63,000,000 bbl. of 42 gallons each, leaving available a vast store of oil which has been roughly estimated as 2,737,000,000 bbl. Even if this great quantity of oil is in the ground it is not possible to state whether all of it can ever be obtained.

Pipe-lines connect the district with the seaboard at Monterey, 110 miles away, with San Francisco Bay, 200 miles away, and with other points. The report describes the topography, geology, paleontology, and oil in the Coalinga district, which have been in part described in an earlier report published by the Survey but not now obtainable. The present report includes a more complete discussion of the district and many new maps, sections, and other illustrations, besides a paper by Irving C. Allen on the chemical and physical properties of the oils. Many interesting points in connection with the history of the region in past geologic ages are brought out, and by means of careful descriptions of the formations a foundation is laid both for an accurate study of the occurrence of oil within this region and for the tracing of formations and oil horizons.

Fifty Years of Smelting in the Western States

Written for the MINING AND SCIENTIFIC PRESS
By L. S. AUSTIN

In the last few years of the decade 1860 to 1870, occurred a great development of the metallurgical works of this country, accompanied by the investment of much capital in mines and reduction works. In this article the development in lead and copper smelting especially, is discussed and comparisons made with present-day practice. Of the two kinds of ores those of lead are easier of treatment than those of copper. In White Pine county, Nevada, in the sixties smelting of pure carbonate ores was effected in little Mexican furnaces built of adobe, remains of which still exist throughout the West. On so small a scale this was too costly and was soon given up. By 1870 some fifty blast-furnaces were engaged in smelting lead-silver ores. In the main the oxidized ores were treated though sulphides were handled to some extent. The ore at Eureka, Nevada, contained arsenates and arsenical pyrite, so that the products of smelting were not only base bullion and slag but some matte and speiss. These by-products, because of the high percentage of lead carried in the charge, were poor and were thrown away. At Argenta, Montana, the base-bullion was cupelled and only the silver shipped, a method followed today in the remote districts of Mexico. Base-bullion in general carried $60 to $500 per ton in gold and silver. At the time silver had its full mint value of $1.2929 per ounce.

The earlier furnaces of the decade were 20 by 30 in., drawn narrower at the top with one or two tuyeres and had a capacity of 6 to 8 tons daily. By 1870 there were improved furnaces of two kinds, the rectangular and the round. Thus, at Eureka, Nevada, by 1870, Arents had put in a furnace 36 by 54 in. with side and end-boshes, and 78 in. square at the feed-floor. It had four tuyeres per side and two at the back, ten in all. A circular furnace 48 in. diam. was also built, 78 in. diam. at the feed-floor provided with 12 tuyeres. Both furnaces had a smelting height of 10 ft. and worked well, but the rectangular furnaces had 20 to 25% greater capacity than the circular one, say 42 tons daily. Today we find no other than the rectangular furnaces up to 45 by 160 in. with ten tuyeres per side and smelting a maximum of 250 to 300 tons daily. By 1870 the principles of slag formation had been clearly set forth and practised, particularly by Eilers, Hahn, and Raht, the so-called half-slag being preferred. It was then thought that for successful smelting the silicious ore should be crushed to about pea-size, though the carbonate lead ore was lumpy. It was feared that the hydrated iron ores would make iron sows. Indeed with the high percentage of fuel considered necessary there was this danger, and it was not until later, when fuel was cut to its lowest limit, that it disappeared. At Ogden, Dunn & Co.'s works, at Eureka, Nevada, litharge was added to a charge low in lead to hold silver from going into the matte. The fuel used was charcoal worth 15 to 34c. per bushel, some 22% of the charge being thought necessary. Coke was considered better, provided the low blast pressure could be increased. As a matter of fact, when freight rates allowed later, it was brought in and gradually substituted for charcoal. Today it is practically the only fuel. The blowers used were Sturtevant fans and Root blowers. The pressure then carried were 8 to 12 oz. per sq. in., today five times as much is common. Then a so-called No. 8 blower would take care of three furnaces and needed 20 horse-power to run it. Today a single blower delivers 400 cu. ft. per revolution at a pressure of 3 lb. per sq. in., using 550 hp. By 1870 the Arents siphon-tap now in general use was introduced, so that an outside well was in communication with the interior of the furnace. The old way to tap was to stop the blast, open the tap-hole (sometimes a hard job), run the matte, slag, and lead into a kettle set in the ground, stop the hole, and turn on the blast. Sows made often during the stoppage.

Roasting of ores containing galena was recommended. This could be done in stalls and heaps, but roasting in reverberatory furnaces was considered by all means the best. In the West this was early done in small Mexican reverberatories and the product was withdrawn slagged. It is interesting to note how long-bedded hand-operated furnaces have survived despite their expense and the small output. This had been due to the fact that in a mechanical furnace lead-bearing ores, by an accidental increase of temperature over the normal, may unexpectedly agglomerate and stop the operation of the mechanical stirrers. For lead-free ores, such as copper sulphides, mechanical furnaces have been an unqualified success. Reverberatory roasting formerly cost $4 per ton; today it costs $1.75. Mechanical roasters operating on self-roasting ores cost no more than 25 or 30c. per ton. By 1870 the water-jacket was only just about to come into use: the water-cooled tuyere was, however, used. After the jacket came in, the water-cooled tuyere was retained and used for ten years, but was finally abandoned. Today the cast-iron jacket is still to be found, but in copper smelting practice has been given up in favor of steel jackets. These can be of any desired size to 6 ft. wide by 10 to 12 ft. high. They are built so that no rivet heads are exposed to the fire. Today it is possible to handle even these large jackets with ease.

Blowing in was then a serious business and fuel was freely used. The furnace was filled to the throat with charcoal and this was set blazing. Lead was added in sufficient quantity to fill the crucible, followed by slag charges and finally ore. Today the lead is melted in the crucible. Then wood is added to the bosh followed by coke, slag, and ore. Fire is then set at the tuyeres and the blast gradually applied. In such case the presence of appreciable overfire may be noted and the consequent loss of lead by volatilization. In the early times no forehearth was used; the small amount of matte made was low in silver and was thrown away. The furnace was stopped and the hearth cleared out every 8 hours, while campaigns lasted three to six weeks. When accretions in the shaft became excessive the furnace was run down.

blown out, and in about a week was again ready for use. Today a furnace is expected to run for months. When accretions form they are cut off and the furnace is again running in 24 hours.

In the sixties inside men worked 8-hour shifts. Ten to twenty years later the time was increased to 12 hours. Today the 8-hour system has been resumed. The cost of production per ton of ore was $39 with 25% lead in the charge. This included freight by way of San Francisco to New York and expense of refining ($35 per ton of base-bullion). Examples of slag were:

	SiO_2	FeO	Pb	Al_2O_3	CaO
I (thin)	26.12	5.2	2.79	5.8	12.0
II (thick)	37.50	50.7	8.00	—	2.8
III	30.20	50.6	8.70	3.0	7.1

Today in Utah where it pays best to run silicious slags, the silica has been increased to 37 or 40%. For more rapid driving the type of slag, called 'three-quarters', is considered best. The recovery in silver and gold was 93%, today there is a plus recovery of gold and 97.5% of the silver; even more when the modern bag-house is used. The lead in the slags instead of going to the above-named figures is now under one per cent.

In Colorado the first works, those of James E. Lyon & Co., were ill arranged and poorly managed. In 1866 smelting for copper matte was practised and some 80 to 100 tons produced. The furnaces were later torn down and upward of 100 tons of rich matte found which had leaked into the foundation. N. P. Hill's works, a short distance below them at Black Hawk, were built by 1868, and were carefully managed. Reverberatory smelting was practised and the copper matte produced was shipped to Swansea, England, for final treatment. The copper in it paid the cost of freight and treatment and the profits came from the gold and silver. The difficulty at this time was that there was not a steady supply. For gold 20 to 50% of its value was paid, also 75c. per oz. for the silver; copper was bought at $2 per unit. In operating, the smelting reverberatories took a charge of two tons every 8 or 10 hours; say 5 to 6 tons daily. Today our largest reverberatories, 19 by 114-ft. in size, smelt 250 to 300 tons daily, and mining is done on so large a scale that at the Washoe works, Anaconda, besides the blast-furnaces, eight reverberatories are steadily operated. While at that time the matte was shipped away, now it is brought to the stage of blister copper on the spot, and this is sent to near its marketing point (New York or Baltimore) for electrolytic refining.

In California the showy oxidized ores of copper were in evidence particularly in the vicinity of Copperopolis, Calaveras county, while in lesser degree sulphides were to be found. Most of such ore, going from 8 to 15% copper, was shipped to Swansea. Some blast-furnace smelting was attempted, but the furnaces were so small, fuel so expensive, and campaigns were so short that it did not pay, and by 1870 practically nothing was being done. In blast-furnace work, Haskell overcame the troubles incident to burning out at the bosh by the use of water-jackets. He used pine charcoal costing $70 to $80 per ton, smelting 12% copper ore with a consumption of one ton coal to 8 of charge. Much of the impure blister of 80 to 96% copper contained $50 in gold per ton. The works at the Union mine, Copperopolis, had two blast-furnaces and four kilns for roasting. The two furnaces needed a 20-hp. engine to produce the blast necessary and each had a capacity of 8 tons in 24 hours. They obtained from ore averaging 8% copper a matte of from 40 to 80%, and containing $200 to $250 in silver and gold per ton. We may compare this with the practice of today where blast-furnaces with 4 by 22-ft. hearth dimensions put through 500 to 600 tons daily, or where the 4½ by 86-ft. furnace at Anaconda has a capacity of 2800 tons in 24 hours. The smelting of oxidized copper ores to produce blister copper in one operation has been kept up to within recent years. The difficulty has always been to obtain a clean slag, since with every care the average of the slag was 2 to 3% in copper, which, on low-grade ores, was prohibitive. At Price's works, Antioch, near Mount Diablo, Contra Costa county, California, in 1862 a reverberatory furnace of 8 tons capacity, 13 ft. 6 in. long by 6 ft. 4 in. wide, with a 65-ft. stack, was built to produce a matte of 50% copper. The furnace was run some time, using local coal, and had to be shut down for re-lining once in 15 days. The interest on money in California was then 18 to 24%, and hence the undertaking was not a financial success. The Selby lead smelting works was established at North Beach, San Francisco, in 1867. Besides these ventures in Colorado and California some attempts at smelting copper ores were made at Peavine, Nevada, at Rockland, in southwestern Oregon, and at Williams Fort, in Arizona. At the latter place the Great Central Mining Co. had works which turned out an 80% copper matte.

In those days the energies of the metallurgist were devoted to obtaining a product of base-bullion, of matte, or of black copper, expecting to ship it away for refining. He took no pains to effect a close saving in the slags or in the flue-dust. This was left to a later period. He was content to waste one fortune over the dump and a second in the air provided he could obtain a third to put into his pocket. The small capacity of his furnaces, his short campaigns, and the high price for labor and interest on money were against him. Also his ore-supply was small and uncertain and delays of various kinds ate up profits. Today furnaces are large, and with regular supplies of ore, can make long campaigns. Labor is assisted by mechanical appliances. One of the greatest aids to modern smelting operations is that the railroad reaches into the mining district, and it is possible to assemble fluxes, fuel, and supplies, and with abundant capital to carry them, so as to bridge over periods of unexpected delays due to washouts and labor strikes. Yet with all these advantages with the best of business and technical skill it is hard to bring and keep smelting works up to their full capacity.

Railroad to Denver.—The Omaha Pacific Railroad Company have notified the Government that they intend to construct a railroad from Denver to the main road, a distance of 102 miles, and have it completed, October next.—MINING AND SCIENTIFIC PRESS, March 21, 1868.

Keystone Consolidated Mine and Its Early History

Written for the Mining and Scientific Press
By William H. Storms

The mining annals of the West contain no more interesting and romantic story than that giving the history of the Keystone Consolidated mine at Amador City, California. One of the claims included was the scene of the commencement of quartz mining in Amador county, it being at the Spring Hill mine, early known as 'The Munsters' Claim,' that the original discovery of gold-bearing quartz on the Mother Lode in Amador was made. This was in 1851. The first mill built at this mine was not at once the success that had been anticipated for it. Arrastres were built, after the Mexican fashion, at some neighboring mines and considerable gold obtained. The arrastre, though undoubtedly a famous gold-saver, is nevertheless a device of extremely low efficiency, and although the selected ore generally crushed in the crude mills at that time contained about $100 per ton, the process was slow and not at all in keeping with the energetic spirit of those strenuous days; consequently, the arrastre as a metallurgical device was soon abandoned on the Mother Lode.

Although the early outlook for the quartz mines was promising, expenses multiplied in an unexpected manner when underground mining had progressed somewhat. Heavy swelling ground was encountered in the fissures and became the cause of so much trouble and expense that in a number of cases the attempt to work the ground was abandoned as hopeless. The owners of some of the mines, like Hayward and Chamberlain at the Eureka, became involved in debt, which, together with the numerous other troubles mechanical and metallurgical, resulted in closing not a few mines for a time. It is related that at one time the management of the Spring Hill mine purchased a quantity of hay from a rancher near Campo Seco, and the company failing for a long time to pay this account, the rancher employed the sheriff to watch the mill and seize the amalgam at clean-up time. The superintendent, hearing of the presence of the sheriff in the vicinity, suspected a coup of some sort, and took the amalgam down into the mine and hid it. The sheriff, not in the least disconcerted by this trick, went below to search for the hidden amalgam. The superintendent thereupon stopped the pump with a view to flooding the mine workings, and saving his clean-up, but the sheriff was too quick for him and soon appeared at the collar of the shaft with the amalgam.

In 1857, the Spring Hill was consolidated with the Granite State and Walnut Hill, which latter had previously been consolidated as the Keystone, and the combination was then known as the Consolidated Keystone mine. The several properties included in this consolidation were heavily in debt, and a mortgage had been given on the property which mortgage was foreclosed, but a prior judgment in favor of A. H. Rose and Philip Crusart took precedence, Rose eventually becoming sole owner of the property, which at that time was as unpromising an aggregation of mining ground as could be found along the Mother Lode. However, it was worked in a desultory manner, the mill being at times employed on custom ore, whenever any was obtainable. The shipments of bullion thus made reached many thousands of dollars. So, with many vicissitudes, the Keystone mine continued its unhappy existence.

Amador City and the Keystone Mine. From an Old Photograph.

On September 5, 1865, A. H. Rose sold the Consolidated mines to J. W. Gashweiler, John Henning, and H. N. A. Mason for the sum of $108,000. In December following this transaction, these men transferred the property to James McDonald, Andrew B. McCreary, and others. The consideration paid in this transaction I have been unable to learn, but the price, both in this transaction and the previous one, was considered exorbitant and entirely out of proportion to the actual value of the property. Mr. Rose was evidently well satisfied with his sale of the property, and presumably Gashweiler and his associates were equally glad to get rid of so 'bad a bargain'. It was commonly said that the returns on custom ores had been used by Mr. Rose in effecting the transfer to Mr. Gashweiler and his partners, though no such accusation was made in relation to the subsequent transfer. Mr. Rose, it is reported, was heard to say, "No child now living (1865) will ever live to see the Keystone mine a profitable enterprise."

Up to the time of the transfer of the property to

Messrs. McDonald and McCreary, but one vein had been worked. Some of the miners conceived the idea that there must be another and, perhaps, better vein back of the hanging wall. Accordingly a cross-cut was started easterly and at the first round broke into a vein actually bespangled with gold. Within the first month from the time of this discovery, over $40,000 was produced by the little Keystone mill. Month after month, this rate of output was maintained, until the Keystone mine came to be recognized as one of the most valuable gold mines in the world—one which could always be depended upon to yield monthly a large amount of gold at a handsome profit. The mine continued its heavy output of gold year after year until its production reached far into the millions. From official data the aggregate output to the present time is known to approximate $17,000,000.

When the Keystone workings broke into bonanza early in 1866, A. H. Rose, who had disposed of the property the September previous, was filled with great regret. After thinking the matter over for nearly three years, he finally evolved a remarkable plan by means of which he hoped to recover the property for practically nothing. There are few men who would dream of employing such a method as he devised to regain possession of property legally sold to honest men, and fewer still who would have the nerve to put such a scheme to the test. Mr. Rose had plenty of nerve and went about the execution of his plan without delay and apparently without fear of either failure, or of the consequences of detection. He contemplated nothing less than bribing a United States Deputy Mineral Surveyor to return a falsified plat of survey to the land office at San Francisco. Prior to the land survey, the land holders—mineral claimants as well as owners of agricultural lands—had no accurate knowledge of where their property would be found to be situated when the land survey had been completed. Rough surveys had been made, probably based on doubtful starting points, and it was commonly supposed that the Keystone Consolidated mines, the Original Amador, the Bunker Hill mines, and Amador townsite, were on the west half of Sec. 36. Mr. Rose owned a tract of agricultural land just east of Amador City and the Keystone mine, which tract was supposed to be on the east half of Sec. 36. When the survey was made in 1869, J. G. Mather, government surveyor, returned a plat to the land office at San Francisco, showing the mines to be situated, as had been supposed, on the west half and the Rose ranch on the east half of the section. Every section of Government land numbered 16 and 36 had been donated by the United States to the State, for the benefit of education, and such sections were known everywhere as 'school lands', and were usually sold as promptly as possible. No one thought strange of it, then, when application for a patent to the east half of Sec. 36 was made by H. Casey, A. H. Rose, acting as his agent. The patent was issued by the State and Mr. Casey promptly disappeared. Mr. Rose then came forward presenting deeds for his tract of land from the State of California, to the east half of Sec. 36, on which the Keystone and adjacent mines were really situated, and demanded possession of the mining property. Henry Casey had bought the east half of Sec. 36 for $400, and Mr. Rose now claimed not only the Keystone Consolidated mines, but the Original Amador, and Bunker Hill mines, and the townsite of Amador City as well. It is needless to say the demands of Mr. Rose were promptly refused and a new survey was made, which demonstrated the interesting fact that the mines and townsite were situated on the east half of Sec. 36 and that Mr. Rose's vineyard was on the west half of Sec. 31, adjoining. He insisted that as he had received a patent from the State of California for the east half of Sec. 36, he should be placed in possession. Fraud was clearly shown and his petition denied. He still fought desperately, and at great expense maintained a lobby at Washington and brought every possible pressure, political and otherwise, to bear on the Secretary of the Interior, but without avail.

The Keystone mine continued to develop year by year. The expense of mining and milling in those early days was much greater than now, accordingly only high-grade ore was extracted; the low-grade being left in the mine for those who came later, as has been done for a century or more in mines elsewhere. Had the ground been hard, this would not have been so bad, but it is not, and as a result, miles of the old workings of the Keystone property are now inaccessible and have been in that condition for years.

The Keystone mine, like most other great mines, is not without its tragedies. One of these occurred over 30 years ago. A large clean-up had been made and the amalgam placed in the retort in a brick building near the mill. For several hours, the fires were kept up vigorously and the quicksilver had been distilled, leaving a sponge of gold worth over $50,000 in the retort. For some reason, the superintendent decided to leave the gold in the retort until morning, placing a watchman in charge. A plot had been formed by a number of Austrians, to rob the retort, the presence of the watchman evidently giving them small concern. They first attempted to suffocate the watchman by means of chloroform, boring a small hole through the window frame for the purpose of introducing the drug, but it failed to have the desired effect. One or more of the men then boldly entered the retort room and quickly overcame the surprised watchman, preventing him from making any outcry by striking him on the head with a hammer. The blows rendered the unfortunate man unconscious and his death resulted in a few hours. When the watchman had been silenced, the murderers and would-be thieves turned their attention to the retort. Upon opening the outer iron door, they found the retort still very hot and were unable to remove the heavy cast-iron cover of the retort, not understanding how the key should be removed to release the cover. Failing in these efforts, the men became frightened and fled. Their crime was quickly discovered and pursuit commenced. In a short time several were captured and others killed by the posse sent out to apprehend them.

The Washoe Process

Written for the Mining and Scientific Press
By A. D. Hodges, Jr.

You Mr Editor, have asked me to describe the parentage, development, and metallurgical and mechanical limitations of the Washoe process. You have given me a task which deserves a volume. And you beg me to be brief. Under the circumstances the best I can do is to rehearse concisely certain facts, and let you draw what conclusions you can.

The father of the process was that energetic enthusiastic, and capable millman, Almarin B. Paul. He was the first to conceive and carry out the idea of treating the sulphuretted auriferous silver ores of the Comstock with the chemicals of the patio process in the pans which he had used in the gold mills of California. His project was received with general distrust, but he perservered, and on August 11, 1860, his Pioneer mill began successful work in Washoe. Paul's mill, constructed in San Francisco, hauled over the mountains and set up in Gold Canyon, all in the space of two months, was necessarily imperfect; but its success led to the erection of a host of others. These were built by the able mechanics of San Francisco and Washoe. The problem submitted to these men was to construct machines which would treat the ores economically and rapidly and extract an amount of the precious metals sufficient to pay dividends. They solved this problem well. But as the millmen were unversed in chemistry and never were allowed to know what percentages of gold and silver was extracted in their mills, the first development of the Washoe process of necessity was purely mechanical.

Interior of California Pan Mill.

Let me here mention that during my active experience in Nevada, I knew of only two silver mills treating unroasted ores in that State, which checked their work by proper weighings and assays and knew exactly what they were doing.

Louis Janin was living on the Comstock, and with him were associated his brothers Henry and Alexis, all of them educated mining engineers. They were the next persons to develop the process, which had halted with the rich ores holding simple sulphides. Investigating the chemical side of the question, they discovered that, by the rational use of certain reagents, the poor ores and the tailing (slime and sand), which held multiple sulphides, could be worked profitably. Henry Janin took out a patent for the use of dichloride of copper, but nothing was ever done with his process; for the employment, in proper amounts and proportions, of salt and bluestone was found satisfactory. Louis Janin purchased and ran with pecuniary success the Dayton Reservoir mill so long as he could obtain tailing to work.

The Lyon mill at Dayton copied Janin's methods and improved them. This mill had an excellent superintendent, George Langtry, who was a fine millwright. It also had an assayer who was in charge of the sulphuric acid, the bluestone, and the bullion departments. Careful tests on a working scale were constantly made. The pans and settlers were perfected. The process was watched with loving vigilance and modified whenever, and as soon as, a change was found desirable. Observers were fond of saying that the Lyon mill never ran the same for two consecutive days. This of course was an exaggeration, but it illustrates the close watch kept over operations.

The Lyon mill, in the period from 1873 to 1877, treated sand and slime holding from 3 to 20 oz. of silver and 0.05 to 0.25 oz. of gold per ton, and extracted in the shape of bullion 70 to 85% of the precious content, and paid continuous dividends. The percentage of gold obtained varied from 25 (in the poorest grades) to 60 (in the better material); that of silver, from about 80 to nearly 90. The variable extraction percentage of the gold *seemed* to be due chiefly to the varying nature, amount, and gold-content of the iron sulphides whose behavior was erratic. Many thousands of tons, averaging about 0.055 oz. gold and 2.8 oz. silver, were worked at a profit of about 75c. per ton paid in dividends. The tailing escaping from the mill held about 0.036 oz. gold, less than one-half ounce silver, and a negligible amount of quicksilver.

The liberal use of chemicals resulted in a very base bullion which, at this mill, contained on the average about 85% of copper. No one had ever succeeded in refining such material (which could be sold only at a very heavy discount) until the assayer of the Lyon mill devised a cheap and easy process,* whereby the copper was recovered in the useful shape of sulphate, and fine silver and fine dorée bars were produced, while the losses in refining were so small as to be imperceptible. This completed the development of the Washoe process on the Comstock Lode, so far as known to me.

About 1870 Alexis Janin went to the Meadow Valley mill in Pioche where he was associated with, and later succeeded by, Gardner F. Williams who was afterward the brilliant manager of the famous Kimberley diamond mines. Janin and Williams introduced the Washoe process at Pioche, modifying

*Described in the Trans. of the Amer. Inst. Min. Eng., XIV:731.

it to suit local conditions, and ran it for years with great success although the ore contained noteworthy amounts of lead and other troublesome constituents. Mr. Janin published an interesting and instructive article which appeared, if my memory serves, in one of the reports of the United States Commissioner of Mining Statistics.

In 1886 mill tests of the Washoe process were made at Cerro de Pasco, Peru, in a broken-down mill, on *rosca jo* ores holding from 12 to 18 oz. silver. The exact mineral composition of these ores—an ever varying composition—has never been determined. But here is an analysis which is fairly representative of a very large class:

	Per cent.
Silica	73.00
Alumina	6.50
Iron peroxide	13.50
Iron protoxide	0.50
Iron pyrite	2.00
Lead carbonate	1.25
Copper	0.05
Zinc	0.50
Silver	0.042
Antimony	0.37
Arsenic	0.03
Manganese peroxide	0.70
Lime and magnesia carbonates	1.50
	99.942

Gold occurs in mere traces. Thallium has been detected in some ores.

Tests for the condition of the silver have given diverse results. Charles A. Stetefeldt, to whom large amounts were submitted for lixiviation experiments, found 25 to 30% as chloride, about 20% in the native state, a slight amount in undecomposed pyrite and in lead carbonate, and the remainder in an unknown combination. The numerous tests made at the Cerro on samples representing thousands of tons indicate 50 to 60% in a metallic condition and as a chloride, the rest held in combination with sulphides, antimonides, arsenides, and lead carbonate in ever varying proportions. The ores tested in the mill yielded, with mercury alone, in fine bullion, 50 to 60% of the silver, equalling the results of the patio process. With the addition of salt and bluestone, such ores as the one whose analysis is given yielded 85%, but the bullion was very base.

To me amalgamation is the most fascinating of all metallurgical processes. It is neat and clean and speedy in its returns and full of alluring mysteries. It was my dream for years to have a large mill with a well equipped laboratory wherein the constantly occurring problems could be investigated. Perhaps if the Comstock merger be effected, my dream may be realized for somebody else. Until then I know not how the question of the possibilities and limitations of the Washoe process can be settled.

The metallurgical works of San Francisco have always formed a prominent feature of our local home industry. The recent addition of argentiferous ore to the auriferous, has opened a new and profitable field, which has lately been occupied by the Ophir Works, situated at the foot of Taylor street, North Beach.—June 30, 1860.

PRIMITIVE MINING

We reproduce below from one of the early issues of the MINING AND SCIENTIFIC PRESS, a wood cut illustrating methods of mining in California in the days when the industry was young. The two part-

ners, with only pick, shovel, and pan, are typical of the men who laid deep the foundations of American mining. Such pictures help to make clear how much early mining depended on muscle.

The pioneer ship of a Japanese coal fleet has arrived at this port from Kuchinotzu. She is the British ship Aigburth, and made the passage in the smart time of 33 days. Other vessels, coal-laden and consigned to E. C. Evans, agent for the Japan mines, and on the way, are the American schooner Puritan, the American bark Mt. Washington and the British ships Bandaneira and Lord Downshire. Some of the coal is in pressed bricks, but the most of it is destined to enter into competition with the cheaper grades of coal prevailing here.—December 16, 1893.

Concentrates Re-concentrated*

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling and smelting.

It is believed that the present (April 1896) number of stamps in operation in this State aggregates a little over 4,000.

Salt cake is a commercial name given to crude sodium sulphate and is an intermediate product in the manufacture of sodium carbonate from sodium chloride. It is employed in glass making.

When drilling in sandstone the drill-bit should be tapered somewhat and then flattened instead of drawn to a cutting edge. If a chisel-bit is used in drilling sandstone the bit will wear very sharp, and the hole will frequently become fitchered.

All borax contains more or less water of crystallization. Borax glass used in assaying is the borax which has been heated until the water is driven out. If the crude borax is introduced with the charge in a crucible it is likely to cause the charge to boil over, thus destroying the accuracy and value of the assay.

Where A owns a patented placer claim, B cannot go upon it and locate water, no matter how long disused. If a water right was at one time taken up on A's claim, and the water has not been used at the point to which it was originally taken or elsewhere, the water may be re-located at some point below or above A's claim under the laws governing the relocation of water rights.

It is held in California and Nevada that if one abandons tailing from his mine or works and it flows down stream and becomes deposited on the lands of another, it belongs to that other, and if tailing accumulates on unappropriated public land it has been the custom to recognize the right of the first comer to appropriate it by proceedings analogous to the location of placer claims.

In 'rawhiding' ore in British Columbia cowhides are used just as taken from the carcass; inch holes are cut one foot apart around the edges, the hide laid flat and the ore piled in sacks thereon; the ends and sides are drawn together by a rope passed through the holes, the neck in front, and fastened to a singletree. A mule is the motive power, and fast time is made down the trail, a rough lock, consisting of a log chain, being used in steep places.

The call for the International Gold Convention, to be held in Denver in July, has been received. It is stated that the objects are to secure such national legislation as may be calculated to promote the business interests and development of the resources of the mining industry in North and South America; to bring together mining men and investors; to increase reciprocal trade among them; to discuss such questions as are naturally suggested by its objects; to cultivate acquaintance, fraternal feeling and hearty co-operation among the various mining, commercial and labor bodies represented; and especially to take under advisement the importance of the creation by Congress of a department to be known as the Department of Mines and Mining, thus securing a Cabinet officer who represents an interest which affects more than one-third of the people of the United States.

Ground mica is used in some quantity in making the coarser grades in mica bronzes and paints and also as an absorbent for explosives. Ground mica also forms an ingredient in some heavy lubricants. The finest ground mica or mica flour finds a considerable market with the manufacturers of high grade wall papers, the lustre obtained by the use of the muscovite dust having the advantage of both permanency and brilliancy.

It is the aim of Concentrates to answer questions relative to the economies of mining and metallurgy and cognate sciences, to mining law, and questions concerning geology and mineralogy. All questions should be clear as possible, that it may be known what is wanted. Questions cannot always be answered in the issue following their receipt, as it is sometimes necessary to wait some time to secure an answer, and also because other questions previously received take precedence.

The best gold story of the week comes from Utah, where, a telegraphic legend asserts, a young school teacher and his pupils, while engaged in geologic research, found gold galore in the San Juan river. The regular 'three old California miners' were on hand to take charge, and the result of the first day's work in the bed of the stream yielded $2300. The next best comes from the Pichaco district, a long letter stating that "white gold" has been found there which "sells readily for $24 an ounce."

Civilization is rapidly advancing in the Yukon region, Alaska. Forty-Mile City is the largest camp and contains 98 buildings, including miners' cabins, two large stores, one music hall, five saloons, one billiard parlor, one tin shop, two blacksmith shops, two assay offices, a mission church and one shoemaker. Provisions of all descriptions and clothing are sold at very reasonable prices. Canadian rye, British Columbia rum and high-pressure brandy are selling at the reduced rates of four bits a glass, $8 a bottle, or $36 a gallon. This reduction is owing to the large quantities now in transit to Forty-Mile creek.—June 9, 1894.

In chlorination, lead in the ore occasions an extra consumption of chlorine, though, of course, a heavy galena percentage in gold ore concentrate usually indicates considerable accompanying silver, which in chlorination, is not wholly satisfactory. Unless a chloridized roast is used, lead, even in considerable quantity, does not materially affect the fineness of the precipitate, but the addition of even a small amount of salt to the roasting ore converts large quantities of lead into chloride, which, being dissolved and finding its way into the gold tanks, is there thrown down as sulphate, to the great deterioration of the gold precipitate, the result being a very base bar.

*From the files of the MINING AND SCIENTIFIC PRESS.

Ancient Correspondence

Letters from special correspondents giving the news of days gone by. From the files of the MINING AND SCIENTIFIC PRESS.

GRASS VALLEY, CALIFORNIA

Pike Flat. — Boston Ravine. — Massachusetts Hill. — Gold Hill Mill.—Eldorado County News.

I have walked through and around this pleasantest of mountain towns, and find every evidence of substantial and enduring prosperity around on every side. In the town itself numerous brick buildings—stores and dwellings—are going up, while in the outskirts I saw many pretty cottages in process of erection. This is by all odds the liveliest and most agreeable of all interior towns that I have visited—its people are genial and hospitable—its society is good—its climate salubrious—its soil is wealthy in agricultural as well as mineral productions—its aspect inviting in nearly every respect. As I stood on the ridge-road leading to Nevada, to-day, I could not help sorrowing that Pike Flat, which lay stretched out to the left of the town, should have been so torn up. Once the glittering gold lay buried beneath its verdant bosom, (hence named Grass Valley), but the ruthless pick and shovel have disemboweled it and Pike Flat looks like the skeleton of its former self. But for the

Sutter's Mill, Where Gold Was Discovered in California.

bare "bed rock," heaps of boulders, and gaping holes about Grass Valley, it would indeed seem like an enchanted spot. The mines here are, on an average, paying well, with prospects of doing better. I have been down to Boston Ravine and on Massachusetts Hill—a mere flying visit though. On my way I visited the Gold Hill Mill and ascertained that it is working with its usual success. The Massachusetts Quartz Mill works steadily along—the lode continuing to pay as well if not better than heretofore. In the latter are employed 130 men. The Mill reduces from 125 to 150 tons of quartzose rock per week. From 2500 tons of rock recently crushed, nearly $20,000 worth of gold was extracted and sent to San Francisco—an average, you see, of $80 to the ton.—July 6, 1861.

We have been permitted to examine a few specimens of ore from the Blue Lead at Spanish Flat. This ledge is owned by Varozza, Wimmer and others. Edwards and Pasqui have a contract to sink a shaft on the ledge from the old tunnel. They are now down about 50 feet, where they have a ledge from 5½ to 6 feet wide. Assays of the ore has ranged from $80 to $100 per ton. There are now about 100 tons of ore on the dump. The samples exhibited to us sustain the above reports as to the quality of ore. Under the superintendence of Dan C. Wickham the Church Union mine three miles northwest of El Dorado is developing into a splendid property.—July 22, 1876.

QUINCY, CALIFORNIA

Light's Canon.—American Valley.

Returning from a trip to Honey Lake Valley, I called at the copper mines in Light's Cañon, and spent two days among the different mines. The Superior mine is opening very fair; it is destined to be one of the very best mines in the State, though the Eclipse ledge is undoubtedly the great parent vein of that district, and will in a very short time eclipse all other veins in that section. They are going ahead with their work with a spirit truly commendable. There are the Superior, Summit, Northern and Southern Superior, Eclipse, Lincoln, Mammoth, and four or five others, that are worked with energy, which probably will be shipping ore within a few months. The Superior has about $5,000 of first class shipping ore on hand, besides having wasted more than one-half that amount in the last three months time. The mine can be greatly improved, I think, by different management. The other ledges it is understood, are to be worked in a different manner, but let that be as it may, that section of our State is bound to speak for itself in a very short time, for there never has been as good copper mines discovered in the United States before. I am now spending a few days in the Argentine district, near American Valley, Plumas county, and I find that the Howard Silver Co. have struck it very rich in their tunnel. They are about 200 feet below the surface, and have gone into the vein ten feet, finding the rock completely mixed with sulphurets of silver. I have just made an assay of one pound of the rock, and I find it pays at the rate of $408 per ton, of 2,000 lbs. It was no picked rock, but a fair average of the rock for the ten feet in the vein. They are still at work cutting the vein to find how thick it is; then they intend to call a meeting to take measures to put a mill on the ledge, and I think I am safe in saying that they undoubtedly have a good and rich silver ledge.—June 4, 1864.

BAKERSFIELD, CALIFORNIA

Asphaltum Production. — Sunset Fields. —New Oil Discoveries.

Out in the foothills of the Coast Range of mountains, about 35 miles to the south and west of Bakersfield, lie some of the most interesting resources of Kern county, which are now being rapidly developed, and which have recently drawn a great deal of attention to Kern county. Here are the Sunset and Buena Vista oil fields. For a generation or more they have attracted the attention of capitalists, and company after company has been formed only to abandon the field after unsuccessful attempts to reach the precious oils to which surface indication pointed, and often with the fruitless expenditure of many thousands of dollars. In spite of these failures, two enterprising citizens of Bakersfield—Solomon Jewett, president of the Kern Valley Bank, and H. A. Blodget, cashier of that institution—had an abiding faith that oil lay in the rocks below and could be found in paying quantities. About two years ago they began acquiring oil territory by purchase or lease, and now control two belts of territory. Their Sunset fields lie along the lowest foothills, eight miles to the south of Buena Vista lake, and comprise a stretch of ground about six miles long by one mile wide. The Buena Vista fields are of about the same extent and lie several miles to the northwest. The surface indications of oil in these fields consist of springs of maltha or liquid asphaltum, which, through the course of centuries and perhaps ages, have slowly flown upward and outward, forming cones of asphaltum which have as steadily been buried by blowing sands and the gravel washed down from the hill. From the top of each cone the black oily maltha slowly oozes and gradually trickles in various directions in sticky, glistening rills. As important and extensive as the production of asphaltum is sure to become in Kern county, it bids fair to be eclipsed by the yield of oil, the recent discovery of which has excited so much attention. About three months ago Superintendent Youle, after a careful study of rock strata and surface indications, started a well about a mile from the main group of maltha wells, and after reaching a stratum of sandstone at a depth of about 200 feet, a flow

of dark greenish oil entirely different from anything found before, was struck. The oil was subjected to tests and submitted to experts, with the result that it was pronounced to be a natural lubricating oil fully equal to the famed natural lubricating oil found in West Virginia. Lucas sulphur oil is by far the most valuable oil taken from the earth, and the recent strike has established the richness of the Sunset oil fields in the quality of their product. How extensive the yield will be the future must determine but the indications now are that Kern county will have the most famous oil fields on the coast although other fields have yielded millions.—June 11, 1892.

JUNEAU, ALASKA

Douglas Island.—Low Grade Ores. — Bear's Nest — Pine Creek District.—Cape Nome.

The great success attending the milling of the low grade ore of the big mine on Douglas Island, Alaska, is attracting more attention to Alaska mines. The Douglas Island mine is shipping gold bullion regularly, $74,000 having been sent down this month. The mill has 120 stamps with a full outfit of concentrating machinery, and the ore is being worked at small expense. The mill is run by water power, a Pelton and a Knight hurdy gurdy wheel being used. The ledge from which the ore is obtained is a very wide one, and is in fact a great mass of quartz. The ore is of low grade, however, but there is so much of it that the whole thing is a paying proposition. It is stated that capitalists are now negotiating to put up another big mill on the Bear's Nest mine, which adjoins the Treadwell mine on the north. News from the Juneau mines, on the mainland, is to the effect that they have had severe weather. These mines are mainly worked in the summer.—January 30, 1886.

The first consignment of gold dust from the new Pine Creek district has arrived—300 ounces. The gold is a bright yellow, similar to the Little Manook gold, and free from silver and rust found in Klondike gold. Another stampede is reported to the Hootalinqua, and from $20 to $40 per day to the man is what the pay dirt is said to be running. Many have already left Glenora and Telegraph creeks for the new diggings, and more will follow as soon as provisions can be rushed over to the Teslin. More finds are also reported from the Stickeen. William Reed, of Chicago, owner of the discovery claim of the placer find made on the river, has returned to Wrangel. He says his claims are worth from $6 to $8 a day to the man. Pres. P. B. Weare of the North American Transportation and Trading Co. has had a special investigation made this summer of the coal deposits on the Tanana and Yukon rivers and the copper ledges on the Koyukuk river. He brought down rich specimens of both ores and pronounces the Koyukuk copper samples to be the finest he has ever seen. Weare says mines of both minerals will soon be developed on the Yukon, with every prospect of great profit. A recent report was published in many papers that 3000 Americans were starving on the Teslin trail, between Telegraph Creek and Teslin lake. The U. S. Government asked the Canadian Government to investigate the matter. This has been done and a report received saying only 1500 people altogether are on the trail and that they are well supplied with provisions. The steamer Roanoke arrived at Seattle, Wash., Aug. 30th, from St. Michael, Alaska, with 458 passengers and about $1,000,000 in gold dust.—September 3, 1898.

At Cape Nome all lines of supplies, except dogs, are reported plentiful. Lumber is $250 per M. feet; 100 pounds, a single sack of coal, costs $50. A letter from Cape Nome says: "Bonanza district has been lit on as by grasshoppers and now there is a grand rush for Koksadapagra. The big excitement is at Milk Creek, fifteen miles above Prince of Wales. York is attracting a big lot of attention, and good results are shown. Above Cape Rodney is the latest, called New El Dorado district. The trail is hot with people for this district. There will no doubt be a big stampede for Norton Creek, as $14 a pan is secured. Other creeks yield 10 and 15 cents at the surface. The beach is being worked with good results, and coarse gold at times shows up."—March 24, 1900.

BUTTE, MONTANA

Rich Orebodies.—Sampling Works.—Litigation.

The copper mines of Butte if more convenient to market would not be long in attracting the attention of capital. The Parrott discovery claim situated on the northern belt has paid well. Messrs. Bowers & Lacey have sunk to the depth of 150 feet on the vein which varies from a few inches to four feet, the ore shipped running from 34 to 50% copper and about $30 in silver. The Parrott No. 1 (W. J. Parks) has attained a depth of 160 feet ore vein 12½ feet average for first class, upwards of 10%, second class after concentration running 15%. The ore is sold on the dump at $55 per ton leaving a margin for fair profits.—February 3, 1877.

A Colorado company is putting up sampling works in Butte, where ores may be sampled and sold. Thus mine owners who are not sufficiently well fixed to treat their own ores will have an opportunity of ascertaining accurately their value, after which they can sell to the highest bidder. It is an enterprise which will undoubtedly be of great benefit to the class of mine owners mentioned.—January 2, 1886.

The mines and smelters of the Boston & Montana Co. are all closed down and hundreds of men out of employment pending an adjustment of the legal difficulties of the concern. This state of affairs is the outcome of litigation between the Boston & Montana and the Montana Ore Purchasing Co. Suits for unlawful extraction of ore are pending, involving about $5,000,000. The properties of the two companies are worth according to market quotations, nearly $70,000,000.—April 15, 1899.

In the Pennsylvania mining case won against the Boston & Montana by Aug. Heinze, Judge Clancy of the District Court has allowed Heinze $265,015 as costs in the case. He asked for $324,134. The Boston & Montana has a stay of execution and will appeal to the Supreme Court.—September 29, 1900.

DENVER

Pikes Peak Ores.—Clear Creek and Gilpin Counties. — Leadville. —Cripple Creek and Creed.—San Juan Mines.

The Pike's Peak ores contain no quartz. They are iron pyrites more or less mixed with copper pyrites, lead, antimony, etc. The croppings of the leads are a kind of brown granite, containing some quartz and a considerable amount of iron. On sinking upon this, however, veinstone of any kind is not found. The lead is a simple crevice in the granite bed-rock filled with a mass of pyrites. Free gold is sometimes found in the quartzose granite forming the croppings, but is never seen in the ore itself. I was shown pieces of pure granite quite rich in free gold, of a beautifully bright yellow color. I saw but one or two specimens of pure quartz in which gold was to be seen. The veins of pyrites run in a northeast and southwest direction. There are numerous veins of quartz in the country, running almost due north and south. These have never been prospected to any depth. The miners don't like them. They don't want quartz—iron is what they are after.—April 20, 1863.

The Boston and Colorado Smelting Co. are preparing to erect smelting and separating works. They will be located below the Excelsior mill, on North Clear creek.—July 6, 1867.——Two bars of silver bullion were shipped this morning by the Georgetown Silver Smelting Co., their united weight being 342½ ozs., coin value, $460.37½, currency value, $601.08. The repairs on the flue connected with the smelter will probably be finished this week, when the works will again start up with full force.—September 7, 1867.——The Black Hawk G. M. Co. cleaned up and retorted, to-day, 359 ozs. of gold, as the result of one week's work run from 80 stamps, on average ore from their Gregory mine.—September 14, 1867.——This week 15 tons of second-class ore was run from the Smith & Parmslee claim on the Gregory, and the bar as stamped gives the following result: 47 and 28-100 ozs. gold, .864 fine; silver, 110 fine; specie

value—gold, $844.54; silver, $6.62—total, $851.16, or nearly $57 per ton. The assay was $69 per ton, so that the precious metals saved were to the value of 83 per cent. of the contents of the ore as shown by assay. Messrs. Reese, Krause & Bruckner are now running on first-class ore from the same claim, and will clean up early next week.—September 21, 1867.

Manager Ford, of the Wolf Tone, shipped a lot of ore to the La Plata smelting works last Monday, running very high in lead. The shipment consisted of very desirable carbonate ore. The gross receipts from sales of Little Pittsburg ore last month will amount to about $18,000, netting the mine about $7,000. The new No. 9 shaft in the northern portion of the property, near the Amie line, was started up last Saturday. The Green Mountain lode, at the head of California gulch, is working two shifts of men, and at present are making excavations for the same, near Cooper's ranch. Messrs. Berdell and Witherell have placed the major part of the La Plata stock in England. Mr. Thomas Rickard, of London, is now on his way to take charge of these works. The Long & Derry mines have shown up some very fine ore bodies during the past winter, and large shipments of ore from this hill are anticipated during the summer months.—May 6, 1882.

The expectation of those familiar with the ground at Cripple Creek and Creede, is that when the snows disappear and prospectors are enabled to work intelligently, some wonderful revelations will be made. They had just made a beginning last year when winter came on with unusual severity. No prospecting of consequence has been done in either district since last October. Many hundreds have gone in those districts prepared to await the time

Scene of Early Gold Discovery in Gilpin County, Colorado, Gregory Lode Marked by Open Cut.

cumulating considerable rich ore on its dump. Shipments will begin now in a very short time. The shaft and levels of the Little Silver mine, adjoining the Lee on the east, are undergoing repairs preparatory to the resumption of active exploration work. The mine will be worked by Mr. Kearny and others. The Leopard group of mines, at the head of California gulch, is being worked and producing some ore. At the Matchless mine, more attention is being paid at present to prospecting work than to stoping and extracting ore.—April 22, 1882.

The Imes mine, situated on the crest of Iron hill, will begin shipping a large lot of ore, now on the dumps, in a few days. The Nevada mine, in South Evans gulch, owned by August Rische, is reported to be shipping about 6 tons of ore per day. The Cummings and Finn smelter is receiving 40 to 50 tons of ore per day from the Eagle Bird consolidation, on Battle mountain. The Yankee Doodle mine, of the Carbonate Hill M. Co., is looking well, and continues an output far beyond the expenses of the company. The owners of the Ohio Boy, located on Taylor hill, are reported to have purchased a 20-stamp mill, and at when they can begin systematic explorations.—February 20, 1892.

The Pittsburg company which has been experimenting with the ore of the Klondike mine, at Ophir, to determine the best process for its treatment, has decided to adopt a combination of amalgamation and cyanide, and will construct a 100-ton plant equipped with stamps and amalgamating plates. From the plates the entire product of the batteries will go to the cyanide tanks. The new cyanide tank of the Gold Recovery Co., at Telluride, has begun treating ore.—January 20, 1900.

The Animas Smelting & Refining Co. has incorporated with 100,000 shares at $1 per share. Twenty thousand dollars will be available at once to build a copper matte smelter at Silverton.——T. Allen, Supt. Sampson mill, near Howardsville, has bonded his mine to an Eastern company, which will immediately begin work. Mr. Allen will place a 10-stamp mill at the top of the hill on the Animas river to treat these ores.—March 3, 1900.

The new Smuggler-Union mill is to be equipped with automatic stokers. The Four Metals Co. will put up a mill

to treat the ore from its Palmyra group. The ore in the main vein is about 3 feet wide and is said to average $200 per ton. Work on the new mill on the Gertrude has begun. The San Juan Gold & Silver Recovery Co., one mile from Telluride, proposes increase of its cyanide plant to 200 tons in twenty four hours. The tailings are principally from the Smuggler Union mill, and have been washing down and setting on the placer for the past twelve or fifteen years, and it is figured that there are between 200,000 and 300,000 tons of them. The News says tests made before the placer was purchased by the present company showed the tailings to carry from $5 to $6 per ton in gold and silver, while assays previous to that gave values as high as $14 to the ton. The company is also handling the tailings which are coming from the Smuggler Union mills.—March 10, 1900.

BOISE, IDAHO

Mining Districts.—Silver.—Antimony Ore.—Climate.

Idaho Territory extends from Nevada on the south to the British possessions on the north, and from the Rocky Mountains on the east to Oregon on the west, and is large enough for at least four good sized States. The mining localities in the southern parts of the Territory are: Owyhee County, Alturas County, Boise County, and now Ada County is also being brought into the "ring." Yuba, is the principal district in Alturas County, and the Leonora, the most remarkable lode there. The gold is in leaves of about the thickness of ordinary writing paper, with layers of quartz between, and this streak is from two to six inches thick, and is reported to be widening. Mr William Defrees is working it with a 10 stamp mill. The much spoken of Atlanta, is a lode very rich, sometimes even 40 per cent. in silver, but there is so much antimony with it as to render it very difficult to work, and I am informed that the owners say that they cannot save but a small proportion of the silver. The Lucy Phillips Company (English), Dr. Edward Bishop, director in charge, purpose to rent their mill at Quartz Gulch, in the spring, and to go ahead. The Monarch Company are crushing Atlanta rock, and report good results. Several lodes have been much developed during the past summer. The Pacific has been opened by shafts and tunnels, over a length of 2,700 feet, and the vein found in various places at fifty to seventy feet perpendicularly below the ground. The lode is from fourteen to twenty feet wide, and fourteen tons taken from the shaft of Johnson & Co. worked in an arastra, yielded $22 per ton in gold, but by this, all the silver, which an assay shows is a large percentage, is lost, and much gold also. This was rock just as it came from the shaft, and was not picked over. The Golden Wreath also is in the same position, having been opened and explored for a continuous distance of nearly 3,000 feet, and the shafts, tunnels and cuts, at various points, are from ten to forty feet deep, showing the true vein with its smooth casings. A test of a few hundred pounds in a mortar yielder nearly $25 per ton. The Golden Chariot is almost fabulously rich, and yet the lodes are small, and cost much more to work than at Yuba. For instance, at Yuba, a 400 foot tunnel will strike the Pacific lode at least 300 feet under ground, and ore can be quarried and delivered at the mill, (if erected below it on Grouse Creek) for $3 per ton, at present high rates of labor ($5 per day). Again, the advantage of wood and water is great over Owyhee, but the nearness to traveled trails was what brought Owyhee out first. Now, however, the railroad will pass not over sixty miles from Yuba, and will be the making of that place, and bring wealth to it only to take away for distribution those precious metals that for untold cycles have been waiting to be called forth, for good and for evil, at the hand of man. The climate of Yuba is preferable to Owyhee. At Yuba, the warm springs keep it more temperate, whilst at Owyhee, the snow-storms and continual and terrific winds during winter, are evidenced by the few trees they have. Still Owyhee, as far as wealth of ore is concerned, stands high in the mining districts of the world, and will yet, when it gets out of its infancy, enrich many. The mines of Boise County are apparently doing better than formerly.—December 26, 1868.

SALT LAKE, UTAH

New Installations.—Sampling Works.—Smelters.

The Germania Separating and Refining Works is situated on the west side of the U. S. R. R. about eight miles from Salt Lake City, and were commenced nearly six months ago, and although not yet completed are now in operation and producing about forty tons or desilverized or marketable lead daily. The buildings are extensive, substantial, and arranged with a view to economy of labor and convenience in manipulation. They consist of the main building, or furnace house, refining house, assay office, engine house and all necessary offices and outhouses, together with manager's and superintendent's dwellings. In the furnace building are five large cast iron pots, set in substantial brick work, each one over its furnace or fire place, two reverberatory softening furnaces, two calciners, and two flowing furnaces. Connected with this building is the engine house, containing a forty five horse power engine, and a fifty five horse power boiler. A little further to the north of this is an inclined shaft furnace, while to the west of the works, at a distance of a few rods is a substantial brick stack, which is connected with the furnaces by means of underground flues of strong masonry. A side track is laid from the main track to the works, by means of which all the materials employed are brought to their respective destinations without trans shipment. Howland's Mill was the first complete sampling works erected in the Territory, and is situated at the corner of the block due south of the U. S. R. R. Depot, and contains an engine of twenty horse power, which communicates motion to a "Howland Crusher and a Burr stone mill." The whole of the machinery, together with a spacious sampling floor and private office being under one roof. This mill was erected by Messrs. S. W. Howland & Co., of San Francisco, in the winter of 1870, and was by them sold about the fall of 1871, to W. T. Richmond, Esq., of Chicago, who is the present owner. During the last summer it was leased by R. Macintosh, Esq., of this city, who now carries on the business. The Salt Lake City Sampling Mill is situated on the west side of the U. S. Railroad track at the corner of 4th South and 3d West streets, and was built in June, 1871, by Geo. J. Johnson, Esq., who formed a business co-partnership with Messrs. James Lewis & Son, of Liverpool, the firm assuming the name of Lewis, Johnson & Co. The machinery consists of a fifteen horse power high pressure engine by J. C. Hoadley, of Boston, a Brodie crusher and a French burr-stone mill. The building, which is under one roof, consists of a spacious sampling roof 60x40 feet, an engine room, private office, assay office and laboratory. Since last summer the business has been carried on by Mr. Johnson alone. This mill has a sidetrack from the U. S. R. R., and a spacious platform for the reception of ores. H. S. Jacobs & Co.'s Sampling Works is situated one block north of the above, and on the eastern side of the railroad, with a side track for loading and unloading ores. The machinery consists of a very finely finished stationary engine and a Dodge crusher. The sampling floor, engine room and office are in one and the same building. These works were erected in June, 1871, by H. S. Jacobs & Co., of Pennsylvania, and last summer passed to Baxter & Co.—January 18, 1873.

MEXICO

La Dura Mine to Install Chlorination.

Mr. I. Hoffman, of the firm of Kustel & Co., left San Francisco on Tuesday's steamer for Sonora, Mexico, to introduce the chlorination process at the La Dura mine, on the Yaki River. The ore of this mine consists principally of argentiferous zinc-blende, fahlore, and some lead. Heretofore the ore was roasted in two revolving Bruckner's furnaces, with ten per cent. of salt, and then amalgamated in Varney's pans. The amalgam obtained from this operation is so heavily charged with base metals, that the retorted metal is not salable unless cupelled, whereby again some loss of silver must be suffered. There is from six to eight per cent. of copper in the ore, which, at the present mode of working, can not be realized.—October 3, 1868.

JOHANNESBURG, TRANSVAAL

Rhodesian Mining Conditions.—Ancient Workings.—Geology of Districts.—Comparison With the Rand.

Of all the various quests for minerals, to the ordinary man none is so fascinating as that of the search for gold. And of all countries in the world nowhere was there to have been found a surface so redundant, I might say, so saturated with gold; and yet the prospector of Rhodesia is not happy to-day, for after enduring the hardships of pioneer travel, of actual warfare, of poor food and unhealthy climate, he finds that the country which should have rewarded him handsomely for all his pains and toils has been ransacked by some earlier bird, who has got the golden worm, leaving but the form or skin, as it were, of the ornithological delicatessen behind in the shape of the well known "old workings." In comparing these northern gold fields of South Africa with others, this then is the great difference to be noted: Whereas elsewhere the prospector "foreran the royal camp" of promoters, brokers and share speculators, and by the sweat of his honest brow and the strength of his good right arm earned for himself an independence, only giving place to syndicate or company when he had demonstrated the value of his ground and his nomadic spirit urged him "to seek fresh woods and pastures new," here, along with the prospector, must travel hand in hand the middleman, for nowhere can the former find the "actual stuff" to give him even the poorest living, but must content himself with pegging off the empty shell of some "old working" and then handing it over to his companion-in-alms, the promoter, must await the successful begging of the latter in making a flotation. Here in Rhodesia are, so to speak, the self-same gulches that in California or Australia would have supported each its own little community. But, alas, here is no "busy hum of men," for the level lips of the ravine are pock-marked and even the cheeks of the adjacent hills have lost their "bloom," for the ancient has "spread his wings on the blast and breathed on the face of the 'earth' as he passed," and his irritating little shafts are everywhere and so close together that nought remains at or near the surface that will pay our up-to-date prospector to work. And under the conditions in Rhodesia to-day this great incentive of ownership and belief in the property does not exist, and the result is a lax state of affairs most prejudicial to the best interests of the property and its speedy exploitation. In speaking thus of the present system of prospecting and exploiting in Rhodesia, I do not overlook the fact that there are exceptions where honest work is done and intelligent quest conducted, but these are but the exceptions that prove the rule. In the Penhalonga, the Enterprise, the Salisbury, the Abercorn, the Beatrice, the Dunraven, the Bonsor, the Tebekwe, the Pioneer, the Queen's and the Ayrshire, the country can show properties that have gone beyond the initial stage, and in some of these the amount of ore in sight can be reckoned in thousands of tons. In numbers of other properties the showing is quite promising, and much exploratory work is being carried on that will without doubt lead in many cases to the uncovering of good ore bodies.

In comparing the gold occurrences in situ with those of other countries we are handicapped by the fact that, except in the few cases of "virgin" reefs, the outcrops have all been previously mined, and while we can see and determine the character of the enclosing rock, we can only tell what the matrix of the reefs is where the "old workings" have been bottomed or the reefs cut below them. In these cases the matrix usually is found to be, as elsewhere, quartz, but it has been a not infrequent experience to discover that the reefs mined by the ancients were composed of some other material; thus in the Ayrshire the matrix was found to be a diorite, in the Gaika a soapstone, in the Johnson of Manica a kaolin, and I have noted other cases where the occurrence may be classed as "abnormal." Hence it is too early yet to state definitely what we must look upon as constituting the Rhodesian ore bodies and what the prospector must look for as indicating his best chance of success. A similar state of uncertainty prevails with regard to the enclosing rocks and the character of the reefs themselves; there have been opposing opinions given by the various geologists and mining engineers who have visited the country. In conclusion I would point out that in gold mining, as indeed in all mining, the surrounding conditions are what govern the question of whether a deposit will pay to work or not.—March 28, 1896.

PRESCOTT, ARIZONA

Hassayampa District.—Jerome.—Bisbee.—Globe.

W. A. Rowe is prepared to ship a carload or more of rich ore from the Davis mine, Hassayampa district. It will go to Argo, Colorado. Col. Bigelow, of the same district, is waiting, patiently, for a home smelter, or the advent of the railroad, so that he can operate his mines with profit. Frank Kuhne has brought to Bones' ore-rooms several hundred pounds of good-looking ore from his Zalida mine, seven miles east of Prescott. John Hutchins, a well known prospector and miner, returned from Silver Mountain district, with rich-looking ore from the claims of Wm. N. Kelly and T. S. Bullock, on the Mammoth mine, which is the biggest mine ever seen by the writer. Olive Camp, 22 miles south of Tucson, not only keeps up its reputation as one of the best chloriding camps in the Territory, but it is rapidly going to the front as one of the most prosperous permanent camps. The mines are improving with depth and the ore grows richer, and every indication and development is full of encouragement.

The appearance of silver as coatings and flakes on copper ore continues in the fifth level of the Globe mine, in Gila county, and forms a separate strata between other beds of ore, indicating the presence of silver ore near by. It is thought probable that an argentiferous vein will soon be discovered, which, in that case, will greatly add to the value of the mine. We are also informed that the owners of the Globe, realizing the importance of cheapening the rate of freights, have signified their intention to materially assist in the construction of the narrow gauge road from Tucson, provided that assurance is given that it will be built to Globe. The owners of the Globe mine have purchased the Interloper, which adjoins the Globe property on its southeast side.—November 13, 1886.

In the tunnel run by W. A. Clark to drain the United Verde Copper Co.'s mines, work has been suspended for the present. The tunnel has been looked upon as a kind of a mystery and many questions made about it since the flow of water; and for the satisfaction of your readers I would say after the flow of the vast amount of water in a few hours the tunnel was filled with sediment and sulphuret ore, while the gulch extending to the Verde river was strewn with the same, which after the exposure to the air and sun now carries all the beautiful hues the corroding copper sulphurets can produce. It is hard to tell the amount of sulphuret ore that passed out of the tunnel in the flow in a few hours; some might estimate it at 500 tons and it might have been many thousand. Soon after the flow had ceased, men were put to work cleaning out the tunnel, which took from four to five weeks, and arriving near where the cave took place, J. L. Geroux had heavy timbers placed in the drift to save the face of the tunnel; he went in after to take a look and saw everything was on the move, and ordered the men to get out, and he at the head made for the incline, followed by the men catching hold of the ropes just in time to save themselves, for the cave followed close after them, crushing the timbers like pipestems, and they had a very narrow escape with their lives. The United Verde Copper Co. is running with good success. Its ores carry considerable silver, gold and copper. Its mine is one of the finest properties in Arizona. The company has two smelters running; no idle men in camp; about 50 to 60 men at work; no place for bummers around the works of the company.—June 8, 1889.

The mining news is good, the prospecting of the Bisbee Co. we learn is satisfactory; the same indications of large bodies of rich copper ore is showing up on these claims as in the Old Dominion. There is no doubt but the claims are all that the company want.—April 4, 1891.

AUSTIN, NEVADA

Isabella —Troy Morgan & Muncey —Litigation.

At the close of my last letter we were on Oregon Hill in the Austin Canon. A short distance west of the Oregon and North Star ledges are the Isabella and its eastern extension. Both claims look promising well and work is now being prosecuted on both. The Troy is not more than 100 feet from the Isabella. The incline on it is about 40 feet in depth. The width of the ledge 30 inches. In the course of testimony elicited in a recent visit between the Oregon and Isabella companies some witnesses were of the opinion that the Troy was merely a seam or slide while others considered it a ledge. If it is only a streak it is a rich one. The Florida, which has been before the San Francisco Stock Board for some time, has an incline to the depth of 90 feet. Its ledge varies in width from one inch to two feet. Workmen are now engaged on one of its shafts. The Magnolia has a shaft sunk on its ledge, which is about two feet wide, to the depth of 60 feet. The Black ledge and the Cincinnati are about to have war in a legal way. The S. A. Douglas has a ledge of four feet in width, and an incline on it to the depth of 60 feet. The Morgan and Muncey has a ledge two feet wide and a shaft sunk to the depth of 145 feet. This ledge is considered one of the best in the district. Though the ledge makes some queer curves and angles, it continues so far a well defined ledge. There are [illegible] this rock is very rich showing sulphurets and even the sulphate of silver in abundance. Some of the rock from the North Star ledge will work $ 000 to the ton. The Mills, Post and White Consolidated are still in litigation with the Black Swan Company. These claims are on Austin Hill as are also a few of the claims mentioned above. When next I write I will speak of them more fully, as also of the characteristics of Austin Hill ledges as compared with those of Oregon Hill. The weather has moderated much within the last two days. Everybody is gay.—April 23, 1864.

VIRGINIA CITY, NEVADA

Financial Depression. —Mismanagement —Reopening Mines.

The times in Virginia City are very dull at present, but the conviction appears to be gaining that the worst is over. No one attributes the cause of the depression to any important depreciation in the mines. The constantly increasing shipments of bullion precludes any such idea. The difficulty has arisen mainly from mismanagement. Important changes in that direction have been made which, it is confidently believed will soon restore confidence, and provide immunity for a future occurrence of a similar calamity to any considerable extent. The mines are decidedly improving in appearance. The Savage is now taking out large quantities of bullion. The mine is under most excellent management. Mr. Day the superintendent is very

Pioneer Mining Conditions.

only 400 feet in the Company's claim. About one year since a speculator agreed to furnish a mill for a one-fifth interest in the claim, depositing $12,000 as a bonus for the performance of the contract. When the ledge "pinched," he hastily concluded the speculation would prove a failure and failed to perform the contract. He thus retired from the Company minus $12,000. A short distance from the Morgan and Muncey is the Die Vernon. It contains 800 feet, with we know not what depth of shaft, as it appears to be caving. Its ledge is, we understand, two feet wide. The Diana shaft is very close to the Die Vernon, and the ledge is generally believed to be the same. The Diana, being the older location, will be likely to get the Die Vernon's. The Seymour has a shaft upon it to the depth of 50 feet, and a ledge of two feet in width. It appears to be well defined. The Parrott's ledge is four feet wide and the depth of its shaft 60 feet. The Diadem has an incline on it to the depth of 30 feet, its ledge being three feet wide. The Chippewa ledge is two feet in width; work done on it, inconsiderable. There are many other ledges or streaks in the vicinity of those we have mentioned, but no great amount of work has been done upon them. The quartz of the ledges in the vicinity in which we have been strolling is of a blackish color, considerably rusted. As the water line is approached, which is usually at the distance of 75 feet, it changes its character, and for a time the rock yields scarcely any pay. If the ledge does not run out, and work is continued upon it, the rock becomes grayish black, like the Gould & Curry. popular with the miners, and can always secure the best labor in the market. Many of the principal mines are increasing the force of their hands. The Gould & Curry have recently added about 100 men to their employ. A large quantity of good mineral is now coming out of their lower gallery, sufficient to keep their own mill steadily at work. The resumption of operations on the Potosi, Bazazette and Golden Era will give immediate employment to several hundred hands, and greatly reduce the number of idle men about the streets. Much interest is being felt in El Dorado Cañon and the Truckee. The impression appears to be gaining ground that an abundance of coal for home consumption, and even for exportation will soon be raised in the localities above mentioned. We append our usual condensation of the current mining news: The Michigan Company after four years of steady prospecting, struck a fine ledge of quartz last week, which promises to amply reward the prospectors, for the labor and money which they have expended. They are down 400 feet. Have run a drift from the bottom of their shaft to the vein, into which they have driven seven feet without finding the eastern wall. Several tons of rock have been raised, but the water has put a temporary stop to the operations—which will continue a few days only. It is confidently believed that the mine will soon be placed on the dividend paying list. The Michigan was the first location for quartz on Gold Hill, made in 1859, and at a time when all others were locating for surface diggings.—August 27, 1864.

Mining Summary

News important at the time and still interesting.

ALASKA

The Scientific Expedition to Alaska, was at Sitka on the 20th of August, waiting for an hour of good weather before starting for Onalaska in longitude 106 deg. The work has been retarded on account of continued rain, fog and wind, with little prospect for the better at this late season. At Fort Simpson the party waited six days and did not get an hour's sunshine. Some developments have been made and hopes are entertained of getting lines of soundings over the fishing banks south of the Fox Islands, but the want of coal deposits will limit the amount of work. When the expedition returns to Sitka, Mr. Davidson will make special local explorations. The Russians and Indians report that the country on the Copper Mine river is very rich in gold, copper and coal. There will probably be valuable diggings discovered there as soon as miners can go thither in large numbers, so as to overcome the Indians,

Map of Alaska, 1867.

who are very bad. Excellent reports are given of the harbor and surroundings of Archangel. The bay is never closed by ice.

October 12, 1867.

With regard to minerals, large and valuable coal deposits were found, convenient to shipping points. Gold is reported by Russians on the Kakuy, a river emptying into Cook's Inlet, about latitude 60°. Copper is reported plenty on Copper River, from whence native copper is brought to the coast by the natives as an article of traffic. The miners from the Stickeen report that they are making an average of $5 per day with a rocker.

November 23, 1867.

ARIZONA

MOHAVE COUNTY

The next district above Castle Dome is called the "Weaver District," and its depot for supplies will be at Olive City. The principal mines in this district are copper, associated with a hard white quartz gangue.

The next district above the Weaver, is the "La Paz", which extends to the eastward from the river some forty miles, and includes the Apache Chief and the Sataza and other mines well known to the public.

The town of La Paz is the largest settlement on the river, and will eventually be the great supply depot for the central portion of Arizona Territory. A good wagon route has been recently explored and located by Herman Ehrenburg & Co., to the new placer mines known as Walker's Diggings, and to the Apache county on the heads of the Gila, and little Colorado rivers.

March 12, 1864.

PIMA COUNTY

The Yellow Jacket mine, on the Ostrich lode, is 75 miles west of south from Tucson, and gold bearing. The owners, Dr. Handy, Bartlett & Co., are working this mine successfully, having a 10-stamp mill, and employing 40 to 50 men. The vein matter is 12 feet wide with a pay streak of over three feet, which works $20 per ton; depth of shaft, 60 feet; length of tunnel, 20 and 30 feet. They have also a parallel vein, 20 feet north, of equal size and richness to the main lode, and a tunnel in some 20 feet; capacity of mill, 15 tons per day; wood and labor both cheap, and a good supply of water.

November 4, 1876.

GILA COUNTY

Globe mining district was organized about twelve months ago. At that time it was confined to Pinal county, but since then a large tract of land has been cut off from the San Carlos Indian reservation and added to the district, said addition being in Maricopa county, and includes the great Apache mountains, in the northeast part of the district, formerly known as the sacred home of the ancient red men, who have been heretofore the great bugbear that has retarded the development of this section of country, which has produced silver ores from the surface, within the last six months, second to no others previously discovered in any part of the Western States and Territories, not only on account of their richness in intrinsic value, but for their mineralogical combinations and crystallization.

September 2, 1876.

YAVAPAI COUNTY

The Badger, is the name of a recently discovered ledge in Big Bug district.

We saw, the other day, a piece of rock from the Patanka lode, in which the veriest ignoramus could detect lots of the pure *plata*. This lode is situated a few hundred yards south of the Sterling lode, in Hassayampa quartz mining district. We are told that the lode crops out for several hundred yards.

J. B. Slack, the owner of the Gross lode, informs us that it is his intention, as soon as the weather moderates in the mountains, to commence work upon the Gross, in anticipation of the running of the Bully Bueno mill, which, it is expected will be set to work in May or June. The Gross is very rich in free gold, and we sincerely hope that sulphurets will not come in for some time, at least.

The last clean up at Lewis & Winning's claim, yielded $10 per day to the hand. A piece weighing over $10 was recently picked up by them.

About two miles below this place, Anderson & Co. are working a bar of Big Bug Creek, and we are assured that they are making good wages.

April 4, 1868.

CALIFORNIA

AMADOR COUNTY

At Jackson several shafts and cuts are being sunk upon veins of auriferous quartz.

Two miles north of Jackson is the Oneida Quartz Mill of twenty stamps, which dates back its existence to the year 1852, although in possession of the present three proprietors but three years. The mill is crushing rock from two claims. The one close by is a vein of hard white quartz from two to six feet wide, and enclosed between walls of black slate, with a shaft down some three hundred feet.

June 11, 1864.

The Eureka, or Hayward mine, owned by Messers. Hayward & Chamberlain, famous as the deepest gold mine in the world, and the deepest mine of any character in California, if not in the United States, being worked to a depth of over 960 feet. This mine is situated on the main Carson lode, and is the richest location ever made upon it. The owners have two mills with an aggregate of fifty-six stamps, and usually clean up at the end of a two week's

run about $20,000. The ore is transported from the hoisting works to the principal mill on a railroad made of light T rails laid on cross-ties after the manner of an ordinary railroad. It is by far the most substantial and durable mining railroad in the State.

March 3, 1866.

CALAVERAS COUNTY

The Union Company at Copperopolis is now working with three engines running night and day. The Keystone Empire and Calaveras claims are giving out better prospects of late, and the Webster, a new claim, under the management of Capt. Sanders, is coming rapidly into importance. Schools, Sunday schools and religious societies are taking root at Copperopolis, and altogether the town is acquiring a degree of permanence and character hardly to be expected of a place whose foundations were laid but two years ago.

December 13, 1862.

From every direction we learn of the success of miners, who have started upon veins and commenced crushing the quartz in arastras, some of them actually making money from the surface down. The success of such quartz workers as Mr. Bovee of Angels, and Dr. Southwell of Carsons, has established beyond a doubt the existence of lodes in the vicinity of these places, of the best paying character in the State. While, in the vicinity of El Dorado, West Point, Mokelumne Hill, San Antone, Indian Creek, Railroad Flat, Murphys, Fourth-Crossing, Jenny Lind, Campo Seco, and San Andreas, the prospects are all flattering.

September 23, 1867.

CONTRA COSTA COUNTY

The first result from the Copper Smelting Works at Antioch came down on Monday last in the shape of a bar of copper, the first copper ever obtained outside of a crucible, on the Pacific Coast. Any doubt which may have hitherto existed with regard to the suitableness of Mount Diablo coal for smelting copper has been removed by the success thus attending the first "firing up" of this furnace.

September 21, 1863.

DEL NORTE COUNTY

The Alta California Copper Mine is located in Del Norte county, about eighteen miles from a good shipping point. It was incorporated in 1860. It has an incline 250 feet deep, and is now shipping 20 per cent. ore. It is one of the most promising mines in that county.

October 26, 1863.

MONO COUNTY

The great excitement of the day is the Bodie district, which is situated about ten miles South-west of Bodie creek. The new mines are just below the old diggings. A large number of well defined lodes have been staked off and recorded in the local district office. The rock is of a copper color and contains a small percentage of copper. Rock taken from the top of a number of the best newly discovered lodes assays from $50, to as high as $400 per ton. A new town has been surveyed and lots are held at high figures, while several new houses are in progress of construction—the present fine weather being favorable to the prosperity and progress of the new city.

February 16, 1863.

NEVADA COUNTY

Experiments at Red Dog, Iowa Hill, and other places, have demonstrated that the cement and gravel common to blue-leads, especially in proximity to the bed rock, can be advantageously worked by the crushing process. As a proof of confidence in this new source of mining profits, Mr. Edward Williams, of Red Dog, is now putting up a heavy mill for such work upon his claims. The hard cement in these extensive gravel doposits will not yield to the action of the heaviest hydraulic pipe yet turned upon it. If we are not mistaken, two or three mills of that description are already in operation in Nevada county.

May 21, 1864.

The Nevada *Transcript* says that Mr. Tallman is experimenting in roasting copper ore at Spenceville which if successful will bring into the market a large amount of low grade ore which will not pay on account of the immense cost of transportation. He proposes by the roasting process to expel the sulphur and other constituents of the ore, lighten the weight thereby raising the per cent. Hundreds of tons of this low grade rock have been taken out and if measures can be devised for its reduction, considerable money can be realized.

August 20, 1864.

There are fourteen hydraulic companies in the neighborhood of Bloomfield now in active operation. Wm. M. Beck has thirteen men at work in his claims, and is now engaged in running a drift for a grand blast, in which he contemplates using sixty five kegs of powder. When he cleans up, a handsome result is expected. McCullough & Co. are engaged in "stripping," and after they get to washing their "pay dirt" expect to take out lots of dust. The top dirt pays $6 a day to the hand. Bush & Co.'s diggings are paying $8 per day to the hand, clear of all expenses.

February 11, 1865.

PLACER COUNTY

The Boulder ledge, near Ophir, owned by Daniel Choate,

Manzanita Hydraulic Mine, Virginia City.

and which was worked about nine years ago, was sold this week to San Francisco parties, for $6,000. This claim formerly produced good rock, but the imperfection of mining machinery, and the great expense attending quartz mining at that time, prevented its successful development. The new purchasers intend giving it a thorough prospecting, and are confident it will prove a valuable mine.

December 23, 1865.

PLUMAS COUNTY

We learn from the Quincy *Union* that Messrs. Bolinger & Blood's smelting works, in Genesee Valley, are in full blast, and are smelting a large quantity of ore. They will commence shipping merchantable copper in a short time. Messrs. Shelton & Co., have a number of men employed upon their works. They will soon be ready to commence smelting.

September 30, 1865.

SAN FRANCISCO COUNTY

A regular Stock Brokers' Board, upon the same general plan as those of the older cities of the Eastern States, has been formed in this city. The necessity for such an organization in San Francisco at present, does not seem to be very urgent, but the rapid increase of stock companies warrants the belief that the stock brokers may have enough to do hereafter. The officers of the Board are: J. B. E. Cavalier, President; E. W. Teackle, Vice President; Franklin Lawton, Secretary; Henry Schmidell, Treasurer.

October 7, 1862.

The ship Regulator sailed from this port on the 21st ult., for Boston, with about $30,000 worth of copper ore from the Copperopolis (Calaveras Co.) mines. Copper ore has now become a regular article of export from San Francisco. About half a million dollars, in value, from Calav-

eras Co., having already been sent forward. It is time that our capitalists were casting about to devise some means for securing the business of extracting the metal from this ore within our own State. Present appearances indicate that the supply will soon be sufficient to warrant the necessary outlay of capital for the erection of works and concentration of skill, which shall make California independent of the world in this particular.

December 6, 1862.

SANTA CLARA COUNTY

California has some of the richest quicksilver mines in the world. The main quicksilver district lies in Santa Clara county, about sixty miles northward from San Francisco, and twelve miles south-westward from San Jose, in the coast mountains. There are three mines here; the New Almaden, which derives its name from the quicksilver mine of Almaden, in Spain; the Enriqueta, so styled in honor of Enriqueta Laurencel, a little daughter of one of

Old Tuolumne.

the proprietors of the mine at the time of the discovery; and the Guadalupe, a name suggested by the little river that drains the district.

May 25, 1861.

SHASTA COUNTY

The Shasta *Courier* says that the Highland mill, of French gulch, recently cleaned up $4,000 after a run of nine days. They subsequently cleaned up $2,500 after a run of five days.

January 21, 1865.

At the Pittsburg Copper mines, the original Williams & Kellinger company have commenced shipping ore below. They are also engaged in constructing arrastras to crush some gold-bearing rock, which is found in their claim, and which is known to be very rich. Much stock in this company has changed hands of late, at high figures per foot.

January 2, 1864.

The Copper City *Pioneer* says the principal offices of the Pittsburg mines should be located at Copper City; the Red Bluff *Independent* thinks Red Bluff is the proper place; the Shasta *Courier* thinks his cotemporaries must be joking and is quite sure that Shasta is just the place for all such offices.

May 28, 1864.

SIERRA COUNTY

Quartz prospects are still lively at the mines about Allegheny. The Union is still getting fine prospects. One small piece of rock about the size of a goose egg, worth about $75, was lately taken out where they are working. The annual meeting of the Fac Similie Company was held last week, and the old board of officers elected, as follows: J. H. Clute, Trustee; M. V. Clute, Treasurer; L. McKelvey, Secretary. The ledge prospects splendidly as the work goes on.

December 23, 1865.

TUOLUMNE COUNTY

App's mill is somewhat over a mile from the town, near the old "Wood's Crossing." The rock of this company has been paying well for years. During my stay in the neighborhood, 20 tons from a shaft considerably deeper than they have previously used, averaged $75 a ton. The machinery is, however, imperfect, and loses, as is now ascertained, at least one-half the gold. Mr. App has recently put one of Varney's Amalgamators in use. The first experiment on the *tailings*, paid at the rate of $30 a ton; the second, with an application of steam, paid $10 more.

The Confidence mill is 10 miles from Sonora, now working rock from the Comstock and Smith veins, and averaging from $60 to $150 per ton.

Sonora, January 23, 1864.

YUBA COUNTY

The Blue Gravel Company, at Smartsville, have had another clean-up, realizing $50,786. This is another clean-up since the 14th of March, the first being $46,000; the second $26,708, and the third as above, making in all, for three months, $123,576. The earnings of the company for the present year promises a much larger yield than the past year, when their net earnings were over $200,000. This, for a hydraulic claim, is probably unequalled in the State.

Rich gravel diggings have just been discovered in the main street of the town of Brown's Valley. Several pieces of gold, valued as high as $60, have been taken out.

June 24, 1865.

COLORADO

GILPIN COUNTY

The Black Hawk (Colorado) *Mining Journal* says that Messrs. Keith, Moller & Co. have decided to throw aside the Frieberg pans and substitute therefor the Plattner (chlorine) process for working the sulphuret ores, which abound to the exclusion of almost everything else in the mine belonging to that company, and indeed in most of the mines of Pike's Peak. This company, it will be recollected, is the one which has so successfully introduced a new process, known as the "Keith's Process," by means of driving, with a blast of air and flame, the finely divided particles of ore through a long furnace, the particles of ore becoming desulphurized in their passage.

June 18, 1864.

MINERAL COUNTY

Creede, a possible new camp, has six shipping mines, with five others in large bodies of good ore and in good condition to forward large consignments to the smelters. The Amethyst tramway being completed, is bringing down from the Amethyst and Last Chance sufficient ore each day to load 15 to 20 cars. The Del Monte the latest wonder, if not at the head of the list is very near it in strength of vein matter and value of ore. In some of the outlying districts where prospecting has been active since the snow disappeared, some valuable discoveries have been made. The latest reports are from the vicinity of Cunningham gulch, 35 miles up the Rio Grande from Creede. The mineral is oxidized lead and iron. The surface is comparatively free from wash, with rocks exposed so that prospecting is a very simple matter. The vein which has excited profound interest and will cause a rush to Cunningham if present accounts shall be verified, is said to be 18 feet wide with a pay streak of five feet which averages $225 in gold and silver and 40 per cent. lead. It is simply a

prospect as yet, but a very promising one. The assay value as just defined is sufficient to induce rapid development.

July 23, 1892.

TELLER COUNTY

At least two of the recent mining excitements have turned out well and with good results. Cripple Creek, in Colorado, and White Hills in Arizona. Of course some of the claims concerning them were exaggerated at first, and as yet there have been no very extensive deep developments. Still, the prospects are quite favorable. In the White Hills the ledges are small but rich, and not the kind that big companies care to take hold of. In the Colorado camp, however, a good deal of capital is being invested and a branch rail road now being built will insure cheap transportation. There has been more of a rush to Cripple Creek than to the Arizona camp, but in both cases the miners who went have remained. This is a good indication of permanency in both districts.

December 24, 1892.

IDAHO

OWYHEE COUNTY

This week a mass of silver, streaked with a little quartz, was found in the Rising Star mine, Flint District. The silver is as pure as the assayed bars, and the celebrated Poorman is, in comparison, an ordinary ledge. The Morning Star mine is yielding immensely rich ore. The ledge, at the point from which the ore is now being taken, is one solid mass of black silver, the latter predominating. The original Hays & Ray is yielding ore of the same character, and equal in richness with the Poorman.

December 30, 1865.

The richness of the Oro Fino ore increases with depth of working. Gold is visible in a large portion of the quartz in the vein. The Morning Star mill is kept constantly at work on ore from the mine.

The ore from the Ida Elmore is now being taken from the depth of 80 ft. Steam hoisting works have been erected at the mine.

The main body or rich streak of quartz in the Golden Chariot, shows a width of about two ft., the remainder being composed of horses of granite and veins of quartz a few inches wide. The ore is of the same quality of richness as that of the Ida Elmore. The gold can be seen in almost any of it.

December 21, 1867.

The parties owning the Ida Elmore and Golden Chariot mine have finally come to the conclusion "to fight it out on that line," and accordingly the fight has commenced in earnest. The partition wall between the two working parties has recently been broken through, disclosing the fact that the two mines or claims, were on one and the same lead. The combatants have fortified themselves in the stopes and drifts, and both parties seem determined to hold their "grip". The Ida Elmore party are preparing hose by which to eject hot steam and water upon their antagonists. About 40 shots were exchanged on Thursday.

April 4, 1868.

SHOSHONE COUNTY

There has been more or less difficulty at Coeur d'Alene, Idaho, for a long time between the mine-owners and the Miners' Union of Coeur d'Alene. This organization comprises the unions of Wardner, Gem, Burke and Mullan districts. Over a year ago, when the mines were working, everybody got $3.50 per day. The mines were finally shut down owing to excessive rates charged by the railroad for taking the ore to the smelter. The mines were to start in April, and then the wages of shovelers, carmen and other surface laborers were reduced to $3 and their time of work increased. The men refused to work on this basis and miners were brought from California and elsewhere to fill their places in some of the mines. On Monday of this week the strained situation culminated in a fight at the Gem and Frisco mines, at the town of Gem, between Union and non-union miners. Five men were killed and 16 wounded. The Frisco mill was blown up during the fight and is a complete wreck.

July 16, 1892.

MONTANA

LEWIS AND CLARK COUNTY

Mining above Cave gulch is turning out better than the prospects promised early in the season. Mining in Montana gulch is being prosecuted with vigor. A large force of hands will be at work on the Rumley mine in a few days. The placer mines at Bannack are furnishing a fine supply of gold. Several rich discoveries have recently been made in the Trapper district. Several placer claims have been purchased by Chinese in Emigrant gulch. Eighty four tons of ore from the Acquisition Spur lode, at Butte, have been shipped East for reduction. Copper ore from the Park mines is going forward to Salt Lake for smelting. Three shafts have been sunk on the Trevonia lode, one of them is to a depth of 70 feet. A splendid nugget, assaying $145, arrived yesterday from the Snow Shoe mines. Twenty thousand dollars in gold dust was sold in Helena Monday, and $21,000 on Wednesday. Twenty two tons of second grade ore from the late Acquisition Spur lode sampled $400 to the ton. A streak of $500 ore has been found on the Clear Grit lode near Butte. A fine clean up was made last week on El Dorado bar. The mines in Henderson gulch are being worked with fine results. There is plenty of water to work the Nevada creek mines. Miners on Spruce bar are taking out good pay. Several new mining claims are being worked on Boulder bar. The Rochester mill is working rich ore and makes a fine showing in silver bullion. The Willow creek mines are turning out well.

July 29, 1876.

SILVERBOW COUNTY

A full supply of water enables the placer miners to continue work night and day upon the claims below Butte and heavy returns from this year's work are expected by all engaged in this branch of mining. If in the other camps throughout the Territory as much success has been met with as in this one there will be no scarcity of gold at the end of the season. On Davis' arastra they have commenced amalgamating the rock crushed but it was of an extremely low grade ore intended simply to fill up interstices and test the working power of the machinery. The ore secured by Mr. Davis which is now being crushed is a medium grade and will probably average about $120 to the ton.

July 15, 1876.

The Butte placers are yielding $500 per day. Mr. Esole continues work on his claim in Silver Bow creek, and is doing well. The Dexter mill will start up again to-morrow, all breakages having been repaired. There are rumors of more mills being put up in Butte within the next three months, but we are unable to give facts at present. In the Mountain shaft at a depth of 15 feet, foul air was encountered, and Messrs. Cameron & Co. are running a day and night shift and hoisting large quantities of first-class copper ore daily.

August 5, 1876.

The La Plata company have contracted with Mr. W. A. Clark to supply him with 500 tons of ore, Mr. Clark agreeing to take it all within a specified time. He will not make a continuous run on this ore, but work a certain amount each month and purchase smaller lots from other mines, in this way aiding in the general development of the camp.

September 23, 1876.

NEVADA

HUMBOLDT COUNTY

The Rye Patch mining company shipped last Wednesday, bullion valued at $6,300, the result of one week's run with five stamps, one of the batteries being out of repair.

September 16, 1876.

LANDER COUNTY

Between the city of Austin to-day and six months ago there is a striking contrast presented. Then, it is true, it was as large as it is now; but what were then brush houses and holes in the side of Austin Hill, have now become comfortable tenements of either wood or stone. The present population cannot, however, exceed 1,800; a great

number of persons who went to California to winter, either not having returned or having directed their attention to the "outside" districts. All of the mills in this cañon are at work pretty steadily, and are turning out a large quantity of silver in proportion to the quantity of rock crushed. Ten tons from the North Star recently produced $7,000. The rock from this ledge sparkles with virgin silver. This company is not incorporated, nor is any of it in the market. The Oregon (not the company of that name incorporated in your city,) Savage, Morgan & Muncey, which are located near the North Star, are also holding good their reputation as first class claims.

April 16, 1864.

The Esther lode, situated directly within the city of Austin, is now turning out most excellent rock. The results of the first crushing from this lode were very discouraging, and ran the proprietors something in debt. Not at all discouraged, however, and believing that the ore was not properly handled at the mill the proprietors again went to work and took out two tons of first class ore which they hauled to the Pioneer mill, and realized $2,523—a very satisfactory result indeed. Another lot of two tons was next crushed and yielded $3,930. Several hundred dollars were also realized from the sale of specimens. Two tons of second class ore were then tried, which gave $604.77. The are was taken out by two men, in two months. After deducting all expenses, reckoning labor at $5 per day, the net profits of the operation were $5,600.

August 13, 1864.

STOREY COUNTY

More than the usual amount of business has been transacted in the Stock Boards since our last issue, notwithstanding the joyous influences of the holiday season. Gould & Curry is rapidly tending upward; $5,000 is offered, while holders are scarcely willing to sell at $5,025. The reports of the President and Secretary have been published, from which it appears that the affairs of the company are in a highly prosperous condition.

The largest clean-up ever made from one day's run of the Gould & Curry mill, was on the 23d instant. The weight of unretorted amalgam taken out was 3,555 lb. This will make about one-fifth that weight in bars, and is worth in the neighborhood of $20,000.

Ophir, since the refusal of the injunction asked against the Burning Moscow, has declined somewhat and cannot now be quoted at over $1,490. The December dividends have also shared somewhat in the depression. A large number of sales have been made during the past five days, commencing at $40 and gradually declining to $25 on Thursday.

January 2, 1864.

WHITE PINE COUNTY

B. B. Martin, the owner of the Tallahassee mine, on White Pine mountain, has just received returns from a lot of ore he sent over to the Richmond works, at Eureka, which assayed $137 in silver and 40 per cent. lead. The company allowed him $70 per ton for the ore.

September 9, 1876.

SOUTH DAKOTA

LAWRENCE COUNTY

There are some 10 "cities" and 30 different Miners' Camps in the Black Hills. The principal cities are Deadwood and Custer. The latter last year was the supply point, and contained 3,000 inhabitants. It has now dwindled down to 400. There are Hill City, Lead City, Montana, Gay City, Elizabethtown and other camps. The total population now in the "hills" is thought by the best informed to be about 10,000. How much gold has been taken out by this swarm of prospectors it is hard to tell. Some think it will exceed some $750,000. But even this would be poor wages for the three months' work of 10,000 men, supposing all had given their time to mining. On Bare Butte creek the First Silver Discoveries have been made, and a new town called Galena laid out. Twelve tons from one of the lodes has been sent to Denver for reduction. It is claimed to be very rich. There are over 20 well developed ledges at Galena. There seems to be a belt of "lodes" three or four miles above Deadwood City in which the quartz is quite rich. From $15 to $20 a pan has been taken out in some places. But the lodes are not what experienced miners would call "well defined." They seem to be mere blow-outs or decomposed rock, and since there are no regularly defined veins the miners have doubts about their holding out. Without doubt all the free gold in Deadwood gulch comes from this quarter. Negro Gulch district, 40 miles from Deadwood, is very promising, but there is lack of water. Parties in from the Big Horn country bring discouraging news. They report no gold, and great hardships in their prospecting tour. This is against the general expectation, as the Big Horn has been regarded as fabulously rich, but very few have ventured in there owing to the Indian troubles.

November 25, 1876.

UTAH

SALT LAKE COUNTY

Evidences of the vast wealth concealed in the mountain ranges of this Territory accumulate daily. In the Wasatch on the east, and in the Oqurrh or West Mountain range, silver, copper and lead have been discovered. In Bingham Cañon, in the latter range, ledges of silver and copper are now being worked, and before Spring, both saints and soldiers will be amazed at the rich developments. On the west, at Deep Creek, at Antelope Springs, at Egan Cañon and Washoe Valley, ledges of silver equal to Reese River and Washoe have been discovered, prospected, and some are being worked. On the north, at Butte Creek, placer gold mines are paying the Morrisites richly, and at Hickman's Butte a whole mountain of cinnabar has been discovered and will be worked in the Spring. Still further north, on the Snake River and the Blackfoot, gold diggings equal to the Boise and Bannock have been worked all Summer. In fact the whole Territory is one vast deposit of rich minerals, only awaiting industry and intelligence to develop it.

December 14, 1863.

TOOELE COUNTY

In East cañon, Ophir City, is the new camp. Country rock limestone. The chloride veins are very irregular and "pockety." Some of them a month or so ago paying immensely, but now with little or no ore in sight. The ore averages $225 to the ton, and as it is nearly as soft as earth, when they do strike a pocket the daily product is often very large—10, 15, 20 and 25 tons. The Mountain Lion looked the best of any and has an open drift, 40 feet long, on one side of which is a wall of chloride 2½ feet thick, which runs from $200 to $400 a ton. The big stories about the Emma are all true, or seem to be, it often turns out 100 tons of good ore a day. Following is a telegram dated Stockton, (Utah), March 19th: Rich chlorides have been discovered in Soldier Cañon, about six miles east of here, and the town is almost deserted. It is mostly float that has been found.

March 25, 1871.

CANADA

A Milwaukee newspaper speaks of important discoveries on the northern shore of Lake Superior. The Indians and trappers of this region have often brought pieces of silver ore into the settlements. This has given rise to a general belief that when the shore should be thoroughly explored, deposits of this precious metal would be found. This isolation and ruggedness of the region, however, have discouraged private enterprise, and the peculiar land policy of the British Government has prevented the formation of mining companies. Veins of ore have been profitably worked at the mouth of Pigeon River and on Prince's Bay, but elsewhere little or nothing has been done until within a year past. It is about a year since a Mr. McKeller, of Ontonagon, discovered indications of a silver deposit at the head of Thunder Bay. This summer other persons have prosecuted the search, with very favorable results. Two veins have been found carrying paying quantities of native silver, and several others bearing "silver lead". One of the veins with native silver also carries a notable quantity of argentiferous sulphuret.

December 21, 1867.

Special Correspondence

MEXICO

Oil War.—Guanajuato Development.—Hidalgo Smelter.—Dos Estrellas.—Yaqui River Smelting.—Sonora Mining.—Lawson Collapse.

H. Clay Pierce, head of the Waters Pierce Oil Co., is now in Mexico, presumably to watch the oil war at close range, and announces that he will remain for several months. Sir Weetman Pearson, head of the Pearson Aguila interests, who is now in the Argentine, is expected in Mexico within a few months. A meeting of the two men in this country, with the settlement of the oil war as a result, is not considered unlikely. The losses of the oil fight so far have been heavy, and both sides have shared in them, but the exact proportion is difficult to estimate. A division of territory is considered a probable basis of settlement, although the purchase of the Pearson holdings by the Waters Pierce is conceded to be a possibility at any time. Just now the Pearson Aguila interests claim to be in better condition than at any time since the oil war opened. They announce that the delivery of oil from the Furbero fields in Vera Cruz has been made possible by the extension of the pipe line under the waters of Tuxpan harbor to buoys outside the bar, and that the first shipment has been made by tank steamer to the Minatitlán refinery. The Furbero fields are credited with several producing wells, and the Pearsons have a contract on the production up to 6000 bbl. per day, on the strength of which money was advanced for a railroad and pipe-line to the Gulf port of Tuxpan, 83 kilometres distant. It is also announced that wells recently brought in at Tanguijo and Potrero del Llano, also in Vera Cruz, are showing good production, and that pipelines will be built to handle the oil. If these sources of supply hold out the heavy importation of Texas oil, necessary for several months to enable the Minatitlán refinery to supply demands, will cease. When the Pearson-Aguila interests launched the oil war they believed they had native oil supplies in sight for all requirements, but their wells failed to come up to expectations. It is reported that the Mexican Fuel Co., a Waters Pierce concern, is experiencing difficulties at wells brought in at Santa Fe, in the Topila district of Vera Cruz, casing having collapsed. The opening of the Huasteca fields of the Huasteca Petroleum Co., a Doheny concern, will be of benefit to Waters Pierce, as it has contracts with the Doheny interests for crude oil. A pipe-line that will deliver Doheny oil at Tampico is being rushed to completion.

The Oro Grande Mines Co., organized to re-open the famous old producers of La Luz, Guanajuato, has made a deal for control of the Guanajuato Amalgamated Gold Mines Co., owning mines and a reduction plant in that district. The acquisition of the reduction plant, which consists of 100 stamps, concentrators, and cyanide annex, will make possible the immediate milling of dump ore and mine filling from the Oro Grande properties. The plans of the Oro Grande included the erection of a 1000-ton plant, and it is now stated that the Amalgamated plant will be enlarged. The Guanajuato Amalgamated was for a time in the hands of a receiver, but under the management of W. H. Puffer the concern was placed on a profitable basis and the receiver discharged. The first subsidy payment of ₱7500 has been made by the Mexican Government to the Mineral Development Co. for the Nueva Luz shaft in the Guanajuato district. This is for the first 50 metres below the 500-metre level. The shaft will prove the mother lode of Guanajuato in depth, and the Government is interested to the extent of paying ₱150 for every metre below the depth mentioned. At 2000 ft. a cross-cut will be driven to the mother lode, and a second will be run from 150 to 200 ft. lower. During the ten months ending with April a record of 64.5 ft. per month was made in sinking, the shaft starting the present month with a depth of 1818 feet.

The erection of a custom smelter in the State of Hidalgo is now said to be certain as a result of the gratifying manner in which the Flojonales copper mines are developing. These are the property of the Robt. S. Towne interests, purchased last year for ₱100,000. The smelter will open to ores from other mines in the Zimapan and Encarnacion sections of Hidalgo. An electric railroad to Sayula, on the National Railways, is contemplated, and in anticipation of power needs the Towne interests have secured water power concessions on the Tula, or Ixmiquilpan, river.

The Dos Estrellas Mining Co., owning the great Dos Estrellas mine, has increased its dividend rate to ₱3 per share quarterly, a distribution of ₱900,000 every three months. Dividends paid last year amounted to ₱3,000,000. The ore extracted last year reached a total of 348,580 tons, at an expense of ₱7.09 per ton, and the milling cost was ₱3.04. The ore reserves at the end of the year were over 2,018,000 tons.

The re-opening of the old Mina Grande, in the Hostotipaquillo district, has been commenced by a company of

Mining River Bed, Guanajuato, Mexico.

French capitalists. F. J. Fournier, the Dos Estrellas millionaire, is one of the stockholders. The property was purchased last year from the Dwight Furness Co., of Guanajuato, for ₱75,000. The Vick Mining & Milling Co., owning the old Espada, Deseada, and San José mines in the Hostotipaquillo district, will build a modern plant for concentration and cyanidation next year. Development so far has placed in sight about 45,000 tons.

The Guanajuato Power & Electric Co. has started construction on a transmission line to San Luis Potosí, a distance of 87 miles. It is also planned to place power in the Pinos district of Zacatecas. The Guanajuato Power & Electric Co. and subsidiary concerns have so far invested $6,000,000 in power plants, transmission lines, and distributing stations in Mexico. There are two hydro-electric plants in operation in the State of Michoacán, and a third, now under construction, will give a total capacity of 20,000 hp. by next year.

The custom smelter of the Yaqui River Smelting & Refining Co. at Toledo, Sonora, is about to go into commission. The smelter has a capacity of about 180 tons per day. An experiment with natural coke from the Barranca coalfields belonging to the Southern Pacific is to be made, and if this can be used it will reduce operating expenses. The Sunset Development Co., a Southern Pacific concern, is working 150 men at the coalfields. The 60-ton cyanide plant of the Barranca Mines, Ltd., of London, at Las Goteras is nearing completion and will be soon in commission. It is one of

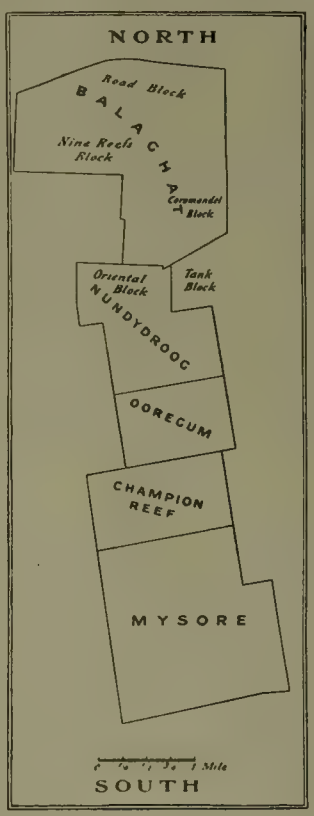
the most complete cyanide plants in Sonora. Ore supplies sufficient to keep the mill in operation for two years have been developed. The Wyman Mining Co., at San Javier, is operating its 50-ton concentrating plant and shipping some high-grade ore. Surveys for the projected narrow-gauge railroad across the Sahuaripa district of Sonora from a connection with the Southern Pacific at Tonichi to the camp of the Cieneguita Copper Co. and beyond are in progress. It is stated that construction will commence in October. The financing of the railroad is in the hands of a syndicate headed by Charles Deering, of the International Harvester Company.

The reduction plant, silver-gold mines, and valuable water rights of the Lawson Mexican Development Co., a Thomas W. Lawson enterprise, in the Mascota district of Jalisco, are to be sold at auction for the benefit of creditors. The properties have been appraised at ₱85,761, and no bid of less than ₱57,214 will be received by the court. The amounts involved in the attachment total about ₱40,000. The Lawson investments in Jalisco have been far in excess of the appraised value of the properties attached. Capital was first provided for the erection of a furnace at the cinnabar mines, and later it developed that the ore was too low-grade. The custom plant followed, and the failure of this enterprise is now attributed to the fact that the Lawson mines were not developed so as to supply the mill. The Mexican Iron & Steel Co., a Boston concern that recently purchased the Tula iron mines in the Tapalpa district of Jalisco, is placing a bond issue of $1,500,000 in France. Plans are afoot for the reorganization of the Oaxaca Smelting & Refining Co., with the object of operating the custom smelter at Oaxaca.

LONDON

Kolar Mines, Ooregum, and Balaghat.—Kalgoorlie, Horse-Shoe, Ivanhoe.— Taxco Mines of Mexico.

The names of the Kolar mines, running from south to north, are: Mysore, Champion Reef, Ooregum, Nundydroog, and Balaghat. Of these Mysore has been the most consistent producer; the next three have had anxious times at various points in depth; but Balaghat has not been favored by fortune. The Ooregum company was formed originally in 1880 and reconstructed in 1885. Production commenced in 1888 and dividends in 1891. Though not as large a producer as Mysore, Champion Reef, and Nundydroog, the mine has done well, and the total dividends distributed up to the end of 1909 have amounted to £1,715,355. The average content of the ore mined has periodically shown decreases. One such period of depression occurred during the years 1905-7, and the dividend paid for 1907 was only £38,353. Since then the grade has improved, and during 1909 it was 12½ dwt., as compared with 8¾ dwt. in 1905. For 1909 the dividends amounted to £120,231, and the general position is decidedly encouraging. The amount of ore crushed during 1909 was 125,349 tons and the yield in the battery was 79,181 oz. bullion. In addition, 114,748 tons of tailing was cyanided and yielded 12,677 oz. bullion, and 5378 tons of slime was treated in an experimental plant yielding 205 oz. The total production of gold was 82,346 oz. fine, an increase of 5811 oz. over 1908. The gold realized £349,012, and the working expenses were £184,493; other small items in income and expenditure left a profit for the year of £151,973. Out of this, £5866 has been paid as income tax, £27,894 has been written off capital expenditure, and £120,231 has been paid as dividend as already mentioned. This dividend corresponds to 40% on the 240,000 preference shares of 10s. each and 30% in the 481,544 ordinary shares of similar denomination. The old original lease for 30 years has just expired and the company entered upon the new lease on March 22. The working expenses will show a marked decrease during the current year, as the cost of power supplied by the Madras Government's electric generating station at the Cauvery Falls has been lowered from £24 to £10 per horse-power per year. The total ore reserve on December 31 was 157,582 tons, an increase during the year of 3300 tons. Some rich ground has been proved to extend to the lowest workings, 3810 ft., and the continuity of this shoot is highly encouraging for the current year's prospects. The Balaghat was started in 1886 and there have been three reconstructions of the company. It was not until 1900 that dividends were paid. Subsequently the output and profit were gradually increased, until in 1905 and 1906 dividends of £55,000 were paid. In 1905 the output realized £164,203, and in 1906, £178,898. Since then the output has seriously fallen and the results for 1909 are far from encouraging. During the year 7136 ft. of development work was done, with only disappointing results. On December 31 the reserve was 29,353 tons. During the year 37,350 tons of ore was milled, producing 18,285 oz. bullion, and 54,970 tons of tailing yielded by cyanide 2918 oz. The total gold realized £81,028. The battery worked at only two-thirds capacity. It is proposed to continue at the present rate, about 3000 tons per month, but if development results do not improve, the position of affairs will have to be seriously reconsidered.



Kolar Mines.

The interest in connection with the Kalgoorlie group of gold mines in Western Australia is nowadays divided between the study of the persistence of ore in the deep levels of Great Boulder Proprietary, Ivanhoe, and Golden Horse-Shoe, and the rearrangements and consolidations among other mines, some of which have low-grade ore and no mill, and others a plant but only exhausted stopes. As regards the Proprietary, the ore has been proved to 2600 ft., and as this lode passes into the Horse-Shoe, the latter, being as yet only 1700 ft. down, is rejoicing in its prospects farther down. The official details about Horse-Shoe and Ivanhoe have been published this week and are of interest in showing the positions. At the Golden Horse-Shoe, during 1909, 263,361 long tons of ore was sent to the 150-stamp mill, where 39,135 oz. gold was recovered; subsequently 18,609 tons of concentrate was roasted and cyanided, yielding 37,437 oz. gold; 51,574 tons of sand was cyanided and yielded 8155 oz.; while 193,178 tons of slime yielded 52,828 oz. In addition, 12,751 tons of tailing was re-treated, producing 3003 oz., and cyanide slags yielded 2165 oz. The total production of gold was therefore 142,723 oz. The percentage of extraction, excluding that from re-treatment, was 87.7, and

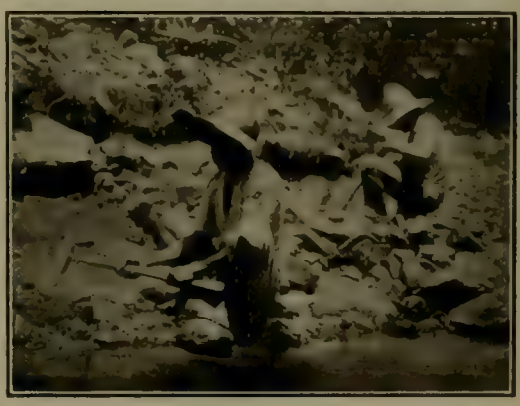
the average extraction per ton was 46s. The income from the sale of gold was £606,316, and the items of cost were as follows: mining, £135,225; extraction, £148,661; maintenance, plant, etc., £17,134; development, £28,212; management, £13,524; London expenses, £7233; duties and taxes, £13,868. The balance of profit was £242,870, out of which £240,000 has been distributed as dividend. Since operations commenced in 1899 the output has been 1,746,751 oz. from 1,904,235 tons of ore, and £3,000,000 has been distributed as dividend. It is noteworthy that practically the whole cost of mine development and machinery has been provided out of income, the figures being £319,171 and £500,059 respectively, also that the content and cost have both been greatly reduced. In 1902, 122,019 tons yielded 193,677 oz. at a cost of mining and milling of 35s. per ton. In 1909, 263,381 tons yielded 142,723 oz. at a cost of 22s. 9d. Costs might still further be reduced, and an intimation that this will be so is given by the engineer. It is necessary to guard against superficial comparison with adjoining mines where the short ton is used. The ore reserves on December 31 amounted to 1,071,638 long tons averaging 11 dwt., a figure practically the same as at the beginning of the year. The reserve is only calculated to the 1650 and 1767-ft. levels on the two chief lodes; these lodes have proved to go down to 2000 ft., but development is not sufficient to warrant any estimate of the ore in the lower parts. As already mentioned, the adjoining mine on the eastern boundary, the Great Boulder Proprietary, has proved to 2600 ft. a lode that passes into the Horse-Shoe, so altogether the prospects of the Horse-Shoe for the future are good. The Ivanhoe mine is surrounded by the Horse-Shoe and the Great Boulder Proprietary. It originally formed one of the Whitaker Wright flotations, having been purchased by the present company in 1897 from the Melbourne owners. After the collapse of the Wright régime, Bewick, Moreing & Co. became consulting engineers. Large profits have been made since the beginning and dividends amounting to £2,470,000 have been paid by the English company; during the same time the output of gold has been 1,310,908 oz. fine, valued at £5,587,674. At the present time the position is that the lode has been cut at the lower levels, 1970 and 2120 ft. Though the content is low at the point of intersection, at the 1970-ft. level it increases as the level is continued, and at one point some valuable ore has been cut. The ore reserve above this level amounts to over one million tons with an average assay-value of 45s. 8d., which is an increase of 73,700 tons during the year and a decrease of 4s. in value. During the year 1909, the ore sent to the 100-stamp mill was 231,063 tons. By amalgamation gold valued at £137,586 was obtained; 21,051 tons of concentrate was roasted and cyanided yielding £122,082; 104,218 tons of sand yielded £67,874; and 105,794 tons of slime gave £171,710. The total extraction was therefore £499,253, and the percentage of recovery was 88.3, which is an improvement of 1.53% over 1908. During the year one of the improvements introduced was aeration of the roasted concentrate before agitation with cyanide. A screen has also been introduced to eliminate the fine before the ore is sent to the grinding pans. The cost of treatment was £241,549, which includes development, mining, extraction, and general expenses. This is at the rate of 20s. 11d. per ton, and is practically the same as during 1908. After paying London expenses, taxes, etc., the divisible profit was £248,585, out of which £240,000 has been distributed as dividend. It is worth noting that altogether £759,353 has been written off the expenditure on development, plant, equipment, etc., and that the company has a reserve fund of £208,499 invested in first-class securities, mostly debentures of English railways.

One of the most interesting recent promotions in London is the Taxco Mines of Mexico Limited. This company has been formed to acquire the old Rosario silver mines in the mining district of Taxco, Guerrero. The properties have been recommended by T. R. Marshall, of London, and are presented with a report by Ezequiel Ordoñez. The oxidized silver ore of the district was worked successfully by the patio process in past years, but the sulphides were not amenable to this treatment and operations were suspended. During recent years the use of fine grinding and cyaniding has been proved successful on similar ores in Mexico, and the intention is to apply this treatment here. A plant to treat 90 tons per day is to be erected. The ore in the lodes is irregular and there are many barren spots, but much of it is valuable, though low in grade. The bunches and stringers that formed the sole basis of former work were numerous. The veins consist of quartz containing silver sulphide with some gold. The ore that is left in the old stopes averages 20 oz. silver and 1 dwt. gold per ton. The richer bunches and stringers were extracted by previous workers and sold to smelters, and there is every reason to suppose that when development is undertaken in virgin ground similar rich patches will be found. The capital of the company is £60,000, divided into 240,000 shares of 5s. each; of these 120,000 go as purchase price to the vendors, and 80,000 are being offered for subscription, the remainder being retained for future issue. The promoters are C. W. Whittemore, director of the local company, and L. T. Boustead and D. J. L. Anderson, of London.

MANILA, P. I.

Private Work by Members of Division of Mines.—Assay Plant.—Plans for the Summer. — Third Annual Bulletin of the Mineral Resources.

The question of work by members of the Division of Mines on private and semi-private undertakings has come up at numerous intervals in the past, and Warren D. Smith, Chief of the Division, has recently given out a statement substantially as below: "Private engineers will undoubtedly in time become established here, and they should be given every opportunity to do a remunerative business. It is not our purpose to compete with private individuals. For the present, however, the Division of Mines will continue in part, at least, its practice of doing work for private individuals; but such work will only be undertaken



Breaking Rock, San Mauricio.

when it is not possible for the persons desiring it to obtain competent private persons within a reasonable time, to do it for them, and therefore the following scale of charges to be paid to the Bureau of Science as Government business has been decided on. For a geological or engineering report which is confidential and which becomes the property of the person or persons requesting the work, the charge should be ₱30 per day and all expenses. If the Bureau of Science be allowed to have access to the information gained to publish it as new work, it would be proper to share the expenses, the person requesting the work paying the transportations and per diem and all costs of the expedition, with a charge of ₱5 per day for each member, which would in part reimburse the Bureau for the inconvenience. The Government will pay the salaries of the men so employed and furnish all equipment. For private work which does not involve a confidential report or responsibility, where the officer is assisting, for instance, some other engineer in surveying, mining, or sampling, the charge should be ₱10 per day and expenses. All preparations of maps, drafting, etc., are charged according to the labor involved and are extra."

Demands for information on certain districts are con-

stantly coming to the Division of Mines. At times the giving out of such information might involve injustice to those engaged in operations in the district in question. The statement is frequently made that it is desired to put such information into a prospectus for the purpose of raising capital. For this reason the Division of Mines has undertaken the publishing of the Press Bulletin to give information as promptly as possible in regard to the districts which have been visited by the members of the Division. Beginning with the next fiscal year, the Division of Mines will assume entire charge of the assay plant of the Bureau of Science. Paul Fanning, a metallurgist of experience in the United States, and in the Philippine Islands, will be in charge. The assay plant will be enlarged and new apparatus installed so that large orders can be handled promptly. The same regulations regarding the information resulting from assays will hold in the future as now. The Division of Mines will continue to make free assays from new districts when the requests are accompanied by a reasonable amount of data that may be used for general information. Where an assay is paid for, the information is held strictly confidential.

The field work of the Division of Mines for the next few months will be as follows: A completion of the Benguet work begun in 1906 by A. J. Eveland. This work will be carried on by Mr. Smith personally, assisted by F. T. Eddingfield, mining engineer, and H. G. Ferguson, geologist. The map published in 1906 will be revised in the new light and a complete study of the ore deposits will be made. The map will be extended to the west and north if funds are available for topographic work. Later the work begun by Mr. Eveland in 1904 in the Mancayon-Suyoc district will be carried farther. This work will be done by Mr. Smith and Mr. Eddingfield. Beginning with the first of April, Mr. G. I. Adams, assisted by Mr. Pratt, will continue the general geological reconnaissance of southwestern Luzon, particularly in the Tayabas peninsula, provinces of Albay and Ambos Camarines. This work will extend over several months. Particular attention will be given to the Paracale and Mambulao districts, as a base map of those districts is now almost completed. The reconnaissance of the Sierra Madre range, northeastern Luzon, has been postponed until the return of Mr. Ferguson from the United States.

The material for the Third Annual Bulletin of the Mineral Resources is almost ready for the press. The Bulletin this year will contain a number of new features, among them being special articles on the different districts with maps; an article on the forest conditions in the Aroroy mining district by Mr. Whitford, of the Bureau of Forestry; a translation of Abella's report on the auriferous deposits of Misamis, Mindanao; a geological map of the Philippine Islands; a special article on cyanide practice in the Philippines by C. M. Eye, formerly superintendent of the Benguet Consolidated Mining Co.; and an abstract of the mining laws. It is hoped that this Bulletin will be published before the first of May.

SALT LAKE, UTAH

Tintic District.—Chief Consolidated Plans.—Eagle & Bluebell.—Centennial-Eureka.—Eureka Hill.—Grand Central.

The Chief Consolidated Mining Co., organized in February, 1909, by Walter Fitch and associates, is one of the important properties in the Tintic district. Its holdings comprise eight claims on the north slope of the range, overlooking Eureka, and in addition to this includes the mineral rights to most of the lots underlying the town. The area between the town of Eureka and the base of the mountain is known as Poverty Flat. The original development thereon was done by those formerly in control of the Little Chief, who sank a 1000-ft. shaft, and from it ran drifts westerly but found little or no ore. Mr. Fitch secured control of the Little Chief ground and soon thereafter acquired other adjoining claims, making up the present group. A cross-cut, driven easterly from the 1000-ft. station, opened the north-south ore-zone, though some of the veins on that level proved to have been partly leached. The shaft was then sunk to 1400 ft. in depth, and from that station a cross-cut was driven east, resulting in finding several veins of ore, important shoots, and chimneys occurring at the intersections of these north-south veins with cross-fissures. The orebodies here are not wide, but the ore therein is of good grade. The shaft was now sunk to the depth of 1775 ft., a cross-cut was run to the ore from the 1600-ft. station, and a drift of considerable length was driven on the orebodies. The work of making a raise from the 1600 to the 1400-ft. level has been commenced. The ore encountered in this raise is supposed to be on one of the same shoots as was opened on the 1400-ft. level. The plan is to sink to 1800 ft. and from that point follow the ore zone into the territory under the town where mineral rights have been obtained. The limestone of this part of the district is overlain by strata of rhyolite which is from 300 to 500 ft. thick. Present development indicates that there are numerous cross-fissures intersecting the mineralized zone. The ore is said to contain about 70 to 87% silica, and carry very little oxidized iron. It runs about $2 gold and 60 oz. silver per ton. This valuation is based upon the returns from shipments of 3000 tons since Mr. Fitch assumed control, the net proceeds of which were $62,000. The silver occurs as ruby and native. The holdings are estimated to cover 4000 ft. on the strike of the mineralized zone. In order to acquire the mineral rights from lot owners, the Eureka City M. Co. was organized with 1,000,000 shares. Of this the Chief Consolidated took 510,000 shares, and agreed to supply a development fund up to $100,000; the balance of the shares were used to exchange to lot owners for their mineral rights. Later the Chief Con. absorbed nearly all the outstanding shares of the Eureka City M. Co. by exchanging its own shares therefor. Thus, all lot owners who gave quit-claims to their mineral rights now hold shares in the Chief Con. M. Co. in lieu of same. In anticipation of more aggressive work, the company has ordered a double-drum steam-hoist of Wellman-Seaver-Morgan Co., some additional boilers, and contemplates the purchase of a new air-compressor having the capacity of 2200 cu. ft. of free air per minute. In the meantime the 2-compartment shaft will be enlarged to 3-compartment.

The Eagle & Bluebell mine, lying southwest from the Chief Con. group, is shipping 16 to 18 cars of ore per month, which runs 0.17 to 0.71 oz. gold, 16 to 20 oz. silver, and 10 to 40% lead. One shipment of 100 tons netted $3593; another of 51 tons brought $1977 net. The mine is now worked through a 1200-ft. adit, at the farther end of which is an 1100-ft. interior shaft in which the ore is hoisted by compressed air. The ore-zone is entered by a 1200-ft. drift north from the 1000-ft. station, the ore occurring on this zone in parallel lenses. Close to the face of the 1200-ft. drift a winze has been sunk 200 ft. in the ore. A cross-cut is to be driven about 250 ft. from the vein on the 1000-ft. level to reach a point exactly below the old 200-ft. shaft, which is to be sunk to the level of the cross-cut. This will afford more direct connection between the main workings and the surface and make more economical mining. Imer Pett, manager for the company, states that a new steam-hoist is to be installed at the collar of the shaft.

The Centennial-Eureka and the Bullion-Beck, both properties of the United States S. R. & M. Co., operate under the general superintendency of C. E. Allen, with R. A. Brown in direct charge of the former, and L. C. Doty of the latter. The Bullion-Beck, with 30 men on the pay-roll, is mining at the 300, 400, and 500-ft. levels on a new ore-zone, parallel to the strike of the old orebodies, and 250 ft. west from them. This ore has been opened a distance of 400 ft. on the fourth level, its width ranging from 8 to 10 ft. A 100-ton shipment is said to have sampled 6% copper, 1 oz. gold, and 15 oz. silver. Several lessees are mining in the old workings and producing about 200 tons per month of fair-grade ore. The Holden tunnel, which starts at a place 1500 ft. west of the Bullion-Beck shaft and 70 ft. below it, runs 2200 ft. southwest into Centennial-Eureka ground, connecting with the shaft on the latter property at the 600-ft. station. The portal of this tunnel is about on a level with the railroad, and eventually all ore mined at the Centennial-Eureka will be hoisted only to the

600 ft. station and then hauled out through the tunnel by electric locomotives. A power plant is being installed close to the tunnel's portal to consist of steam hoisting engines, and electric generators, all of which are being housed in a steel building. The Centennial-Eureka management is having a pump station cut out at the 2200-ft. point in the shaft, which is water-level.

The Eureka Hill mine, of which George W. Riter is manager, has 24 sets of lessees at work, who ship an average of 700 tons of ore per month, some ore being taken from all levels from the surface to the 1000-ft. level, the work being in the nature of a cleaning up process. The ore contains gold, silver, copper, and lead, some of it very high grade, and of many varieties. The lead occurs as carbonate and steel galena, the silver as bromide, sulphide, and chloride, the copper as malachite, azurite, tetrahedrite, and native. Charles Baker, superintendent for the company, states that while there are but 27 acres of surface in the holdings, there are 30 miles of workings. All leases run three months, subject to renewal at the end of that term. Royalties paid by lessees range from 20 to 50%, the sliding scale being according to the grade of the ore. It is said most of the men make sums far better than ordinary wages. On this property is a tailing dump said to contain 250,000 tons, which accumulated during the years that the concentration and pan amalgamation mill operated. It is supposed to contain 6 oz. silver, 80c. gold, 1½% lead, and 0.2% copper.

The Grand Central, situated on the Mammoth side, opposite the Centennial-Eureka, shipped 1400 tons of ore in April, which ran $3 gold, 30 oz. silver per ton, 4% copper, and 10% lead. This ore was taken from all levels from the 600 to the 2100-ft., inclusive.

NEW YORK

Copper Producers' Figures.— Anaconda and Porphyry Coppers.— Ray Central. — Cobalt and Silver. — Heinze Acquitted. — Nevada Con. and Associated Oil Listed.

The report of the Copper Producers' Association covering the month of April was expected to show a considerable accumulation. Exports for the month were known to have been light. It was with a good deal of pleasure, therefore, that an increased consumption was noted. It has been borne in upon that part of the public interested in copper shares and in the copper metal market that the producers are not in harmony, at least, not in any such close degree of harmony as is necessary to put in force the drastic curtailment which would rescue the copper metal market from its present plight. The copper situation is much like the old story of the boy, who yoked himself with a calf, which promptly ran away, accompanied by loud cries, from the lad, of "stop us, somebody, stop us." Curtailment is the real economic remedy; all the producers are in favor of curtailment—if the other fellow does the curtailing; in the meantime dividends, interest, and depreciation charges must be earned on immense plants, and those who would stop cannot. Since, therefore, it is recognized that the output cannot be reduced, it is gratifying to note an increase in consumption. Domestic deliveries for April were 67,985,951 lb., an increase over the preceding month of 5,141,133, and the heaviest demand since the month of January, when domestic consumption accounted for 78,158,387 lb. Export deliveries, on the other hand, show a decrease of 9,253,364 lb., the total sent abroad amounting to but 31,332,403. This comparatively poor showing in the way of export demand is discounted, however, by the knowledge that some heavy shipments are to be made during the current month, and the further fact that the visible supply of red metal abroad has decreased, though such decrease is not as large as it should be if the demand were up to normal.

The increase in copper surplus for April is 18,159,285 lb. Production for the month was 117,477,639, accumulated stocks total 141,984,159. One large copper producer reports sales of 20,000,000 lb. at 12½c. for delivery during the next ninety days, while the Butte output is reported as sold up to the first of June. It is evident that the Amalgamated-Anaconda situation holds some possibilities which must be reckoned with. Amalgamated owned a short time since, when balance sheets were published, some 1,055,000 shares of Anaconda, or almost exactly two shares Anaconda for every share of Amalgamated outstanding. Amalgamated owns its timber lands and 100,000 shares of Greene-Cananea in addition to its Anaconda. Nevertheless, the sale of 200 Anaconda shares against the purchase of 100 Amalgamated would show a profit of $1750. The new Anaconda is, of course, to feel the pressure of cheap copper. The porphyries are in the lead, a little unwillingly, perhaps, just at the moment, but in the lead nevertheless, and it is an open question as to the opposition they are to encounter. The leading group of steam shovel properties, Utah, Ray, Gila, Chino, and a half interest in Nevada Consolidated, are closely allied to the Guggenheims and the A. S. & R. Co. The International S. & R. Co. is distinctly a Cole-Ryan-Amalgamated enterprise, and it is not to be believed that this concern is to be absorbed by the Guggenheims or is to be a non-aggressive competitor. It is quite true that if forced to do so Anaconda could meet the situation in Butte by doing what was done before, taking out only high-grade ore, and so cutting copper costs to a five-cent basis, but this policy is something of a desperate one, and the entry of the Amalgamated interests into the field of porphyry coppers is more logically to be expected. In any event there are signs of alignment for a bitter struggle in which the only complacent figure will be the consumer, who is perfectly willing to have cheap copper and to let the producer carry it for him. The figures for the quarter ending March 31 showing the production of the porphyries indicate how fully they control the situation; Utah Copper produced 18,511,819 lb., which was sold at an average of 13⅛c., and which cost to produce 8.43c. per pound; the net profit for the quarter was $871,958. This production is an increase of 3,000,000 lb. over the best quarter preceding, and, as operations on the Boston Con. ground are followed up, further increases in output are to be expected. Nevada Con.'s output for the like quarter was 13,528,647 lb., while the net surplus, after the dividends were paid, was $80,562, as against a deficit for the previous quarter of $33,602. It is just exactly this situation which forces the production of millions of pounds of copper, and the payment of all the net earnings in dividends, which cries for regulation. That a huge producer such as Nevada Con. should show a deficit one quarter and a bare margin for surplus the next, means great waste. Huge production, involving much capital, and a return of but $1.50 annually upon an investment of $20, or at the rate of 7½%, without any buttressing of the investment by a growing surplus, demonstrates that, like the boy and the calf, some of the big new coppers have 'got going and can't stop'. J. Parke Channing, who has been expected to make some kind of a statement in reference to Ray Central, was before the directors at a meeting held this week in New York, and went quite fully into the recent developments at the property. Mr. Channing stated that there was satisfactory progress being made in the matter of ore development, but presented no estimate of tonnage. Some 6% copper ore is stated to have been developed in a winze between the 300 and 400-ft. levels. A 1000-ton mill is planned.

While the price of silver has been advancing, it has caused no revival of interest in Cobalt. Cobalt has been outstripping previous records in the matter of shipments. In many of the more important properties a better showing is possible in the way of ore reserves than at any time in the history of the camp, yet the attention of the Canadian prospectors and the Canadian public is centered in Porcupine. The first actual test of the new camp has been made, with results that justify the boom the district has so far had. Before the winter roads broke up the Timmins people, working what is locally known as the Hollinger property, got a carload of ore out to the railroad. Part of this was sent to the School of Mines at Kingston and part of it went to the refinery at Perth Amboy, New Jersey. The shipment is said to have been made without any sorting of ore, and the returns just made public show an average value of $202.75 per ton. The result of this first real return for Porcupine is a wave of renewed activity and a

general stiffening of prices for claims and options. In Cobalt an interesting new project is being discussed. Proper prospecting in Cobalt has always been at heavy expense by reason of the deadfall and overburden which could not be removed but must be cut through by trenches. Now it is proposed to profit by the work of the hydraulic engineer and install giants to wash the face of Cobalt so that such silver sidewalks and vein 49s as may be hidden under the surface may be revealed. There are several details that must be worked out before the scheme becomes at all possible. Consolidations, or working agreements at least, are necessary to prevent trouble on account of the piling of débris. If this and other matters can be arranged it would seem logical that such work might greatly increase the known mineral wealth of Cobalt.

F. Augustus Heinze was acquitted of the charges upon which he has been on trial for the past two weeks in the Federal Court in New York. The real verdict was to the effect that bad banking is not necessarily a crime. United Copper, one of the mysteries of the copper market, was much in evidence, but out of all the mass of testimony in relation thereto nothing has come to really enlighten the present shareholders as to the assets and liabilities of the company. It is said that the Santa Brigida, near Ocampo, Chihuahua, Mexico, is to be examined by engineers for Thomas F. Cole, who has taken an option on the property in behalf of the Sierra Con. M. Co., which latter organization is controlled by Mr. Cole and Joseph B. Cotton. The Santa Brigida was largely developed by W. C. Greene and is now owned by Norval J. Welsh, of San Antonio, Texas. The Sierra Con. M. Co. is an organization which took over most of the properties of any merit that were controlled by the now defunct Greene Gold-Silver company. John B. Hastings expects to begin work soon overhauling the mill and getting in shape for active operations on the Yellow Jacket property in Lemhi county, Nevada. This property was originally owned by John E. Searles of the American Sugar Refining Co., and by reason of legal complications connected with the settlement of the Searles estate has laid idle until recently taken over by the Proprietary Mines Company of America. The shares of the Nevada Con. Copper Co. have been listed on the New York Stock Exchange. This listing of the stock of the Associated Oil Co. of California by the committee of the New York Stock Exchange has added an impetus to the growing interest throughout the East in oil properties; the tremendous dividends which have been turned back to stockholders on their investments in oil properties in California and the great enthusiasm in oils, which is coincident with the rubber boom in London, are beginning to have effect here, and it will be strange if there is not something of an oil craze here in the near future.

BUTTE, MONTANA

Butte Mines and Copper Costs.—Clark Properties Sold.— Miscellaneous Development.

The talk in Eastern publications of the probable necessity of Butte mines shutting down or curtailing production on account of the increasing copper surplus and falling prices of the metal is far off the mark. Amalgamated authorities say that Butte mines will be turning out copper when many others that are now producing are forgotten. Merging the Butte mines will reduce the cost of production to a point where they can profitably compete. That, together with the high silver and gold content of the Butte ores, will make copper mining in Butte profitable when copper is much lower than it has yet been quoted. When copper sold at 9c. per pound the Butte mines made money, and they can do it again. The production of the district is, in fact, gradually increasing. Not only are all the old mines, with the exception of the Parrot, producing normally, but several new producers have been added to the list. The Butte-Ballaklava Copper Co. has begun regular daily shipments of 300 tons of ore to the East Butte smelter, and is producing copper at a cost under 8c. per pound. Official announcement is made of intention to pay the first quarterly dividend in July.

The sale of the Clark copper properties in the Butte district to the Amalgamated Copper Co, which was announced in these letters a month ago as being under negotiation, has been consummated and officially confirmed. These properties have been producing from 1,000,000 to 1,500,000 lb. of copper per month. An official statement issued from Mr. Clark's Butte office says: "The sale is of the Original Consolidated Mining Co.'s property, which includes the Original and Stewart shafts, with all the copper interests immediately adjacent to them. The only other mining property involved are two small fractions lying between the Alice and Magna Charta mines, which latter already belong to the Amalgamated company. The Amalgamated company acquired the Butte reduction works, but Mr. Clark retains the use of the concentrator for a term of years, and all the shops, such as machine shop, blacksmith shop, carpenter shop, and assay office. The concentrator will be operated on zinc ores, and it is anticipated that the zinc business will develop immensely and become a very important element in the future of Butte. Work will soon be commenced on mining properties that have been lying idle for years, and it is anticipated that the change of ownership in the copper mines will in the long run tend to promote the welfare of Butte." The Tuolumne Copper Co. has become a regular shipper and is producing around a million pounds of copper each month. Everything is moving satisfactorily in Butte. The merger of the principal mines has been completed, the deal having gone through without a hitch. W. A. Clark, John D. Ryan, W. D. Thornton, and A. C. Carson have gone or are going to Europe to spend the summer. Official announcement is made that the time for exchanging Butte-Milwaukee stock for Butte-New York Copper Co. stock will expire May 31.

The new electric hoist of the Butte-Ballaklava Copper Co. is in operation and working satisfactorily. The hoist is being watched with a great deal of interest as it is the first deep-sinking electric hoist in this section. It is driven by a 300-hp. electric motor and has a capacity for sinking to 3000 ft. It can lift from 300 to 500 tons of ore per day, and in addition carry on development on a large scale. During the month of April the output of this property amounted to about 350,000 lb. of blister copper and 35,000 oz. of silver; the latter fully paying the treatment expenses. The books, records, documents of all kinds, together with the cash in the treasury amounting to some $259,000 of the Barnes-King Gold Mining Co., are now in the hands of W. H. A. Fischer and his associates in New York. Some time ago a demand was made for the records and money from the officers in this city, but the demand was refused, pending a certified copy of the directors' meeting showing that officers had been elected. This was recently received and the order was complied with. Nothing can be ascertained here as to what the new board of directors proposes. Mr. Fischer has expressed himself as favorable to acquiring the North Moccasin property. The Raven company has for several months been proceeding quietly with development. The shaft has been sunk to a depth of 1500 ft. and at the present time a cross-cut is being run north to intersect the vein developed above. The cross-cut is now in about 200 ft. from the shaft. On the 1500-ft. level a number of stringers have been cut and some good ore found. The Radersburg Consolidated Mining Co., which recently took over the Ohio-Keating, is likely soon to add the Dew Drop group of claims adjoining the Ohio on the northeast and group of three claims lying about 1000 ft. south of the Black Friday property. The Black Friday is reported to have opened a body of ore at 450 ft. Ore taken out recently averaged about $50 net per ton. Good progress is being made in installing the electrical equipment of the Keating Gold Mining company, and the surface plant on the Blacker claim should be in operation early this month.

It is expected that mining will be commenced at the Ophir mine of the Butte Central Copper Co. about July 1. Three boilers with a combined capacity of 330 hp. are now being set. Between five and six weeks will be required to unwater the mine. A new compressor is to be installed and will be in readiness for operation when the water has been taken out.

General Mining News

ARIZONA

COCHISE COUNTY

(Special Correspondence.)—The Eagles Nest group in the Paradise district has been re-christened the Solwico and a company will be formed to further develop the property. M. R. LaRue, of Paradise, is one of the owners of the ground.——The vein in the face of the drift on the 120-ft. level is now about 2 ft. wide and assays from 3 to 4% copper.——The shaft at the Scott & Crawford is now down 45 ft. in the limestone and is expected to open the ore in a short distance.——The shaft at the Nippers property of Otto Duffner is down 30 ft. and has opened a vein of lead silver copper ore.——The Virtue company is driving a 1000-ft. adit that will tap the vein at a vertical depth of 700 ft. when completed.——Bisbee capitalists are operating the Leadville group under bond and have made several shipments of lead ore.

Bisbee, May 14.

The Employees' Benefit Association, one of the philanthropic institutions of the Copper Queen, inaugurated on January 1 last, has rendered its report for February. The members' contributions yielded $3800, being at the rate of 2% of the wages of the employees. Death benefits paid were two, one being on account of death from pneumonia, yielding to the heirs $1277, or one year's wages, and the other being for death from accident in the converter plant, the insurance paid amounting to the equivalent of two years' wages, or $2555. Total payments of benefits for

Miami Mill Under Construction.

February reached $5223. The total number of members at the beginning of February was 2067. Membership is voluntary, but admission is now conditioned by age and medical examination. Those registering for admission at the time when the association was organized on January 1, 1910, were accepted regardless of age or condition of health, the only requirement being that they were enrolled among the employees of the Copper Queen. The company contributes $2000 per month to the fund.

GILA COUNTY

(Special Correspondence).—As the 420-ft. haulage level at the Miami mine has been virtually completed, the second haulage level at a depth of 570 ft. is being established, a drift from the No. 4 shaft toward the orebody having already been started. The steel frame of the concentrator is nearly finished and some parts of the interior equipment have arrived. Nearly all the machinery for the power-house and new hoisting plant is at hand. On the Captain claim, the twelfth churn-drill hole is being sunk.——Drill-hole No. 2, which is 300 ft. west of the vertical shaft on the Live Oak property, has just passed into chalcocite ore at a depth of 232 ft.——The Warrior mine is continuing shipments at the rate of 90 tons per day of 9.5% ore. The churn-drill hole being sunk on the Winnie claim has penetrated schist at the depth of 300 ft.——The Little Miami Mines Co. is installing a 25-hp. gasoline hoist, preparatory to sinking a 2-compartment shaft on its property, which is situated between the holdings of the Miami and Warrior companies. Richard Fleming of Globe, is general manager.

Globe, May 13.

The orebody opened recently 1200 ft. west of the main shaft of the Old Dominion mine is proving to contain first-class ore. The company has just received its steam turbines and generating equipment for the installation of the smelter power plant and is installing the new machinery. The management is now considering the installation of an electric haulage system on the 12th and 14th levels of the A shaft. Three of the large Nordberg pumps installed on the 12th level have been running for over a month and the fourth will be in operation in a few days.

MOHAVE COUNTY

The Needles Mining & Smelting Co. expects to blow in the smelter at Needles about July 1 and will have the concentrator in operation shortly after that date. The two plants will cost in the neighborhood of a million dollars. Custom ore is now coming in and all offered is being purchased.——The drift on the 100-ft. level of the C. O. D. mine has opened 12 in. of high-grade lead silver ore.——The Los Angeles Gem Co., which is operating the George Washington mine in the Mineral Park district under bond, has opened 2 ft. of gold copper ore assaying $238 per ton in the drift that is being driven to develop the vein.——At the Home Pastime mine, which Joe Prisk and Charles Perdue have been working on a lease for two years, a 7-ft. body of milling ore with one foot of high grade has been opened.——The old Mexican mine, one of the best of the early producers, has been bonded to A. M. and A. H. Smith. New machinery will be installed at once and development started.

PIMA COUNTY

The Cerro-Colorado Mines Co. has purchased the Cerro-Colorado mine in the southern part of the county from Hugo J. Donau and will commence work on the property at once. The group was first worked in the early sixties and is now equipped with a good hoist, compressor, and electric lighting plant, but the distance from the railroad made the expense of working excessive and it was not considered a profitable venture until the Tucson & West Coast of Mexico railroad was completed.

YAVAPAI COUNTY

(Special Correspondence).—It is reported that the Great Republic Copper & Gold Mining Co., owning properties in the Bradshaw mountains, are preparing to resume active work on the group. About 3000 ft. of development has been done, including one double-compartment shaft 726 ft. deep.——The Haynes Copper Co., at Jerome, has completed the unwatering of its property and is working three shifts with 30 miners.——J. J. Fisher, manager for the United Verde Extension Mining Co., reports that the recent discovery in the Little Daisy property continues high grade.——The bunk-house of the Speck Mining Co., on Lynx creek, was destroyed a few days ago by fire.

Prescott, May 14.

Wires from the main line have been strung to the property of the Mount Elliott Consolidated Mines Co. in the Big Bug district and connections made with the new hoist at the Ticonderoga shaft. At the 200-ft. level cross-cuts are being driven to tap the Ticonderoga No. 2 and Independence veins both of which have good outcrops. Ten additional stamps are being installed in the mill and ten more will be installed in the near future.——The United Verde Copper Co., at Jerome, recently blew in a new furnace which makes the fifth now in action in the great copper works.——The 2-stamp Nissen mill which the Midnight Test Mining Co. recently purchased has been erected at the property south of Prescott and is now running successfully. It is estimated that there are 1000 tons of ore on the dump which will keep the mill busy till the shaft is unwatered and timbered to the 100-ft. level. If the work proves satisfactory the company will increase the milling capacity of the plant and add concentrating tables. G. S. Alstead is manager.——The adit of the Pacific Copper Mining Co. cut a body of sulphide ore when in 400 ft. The property is situated in the Silver Mountain district four miles south of Harrington and adjoins the Monte Carlo mine.——The assay office

and laboratory at the Humboldt smelter was completely destroyed by fire last week. The loss is estimated at $25,000 which is partly covered by insurance.

YUMA COUNTY

Llewellyn Humphreys, W. H. Clark, and associates of Salt Lake have acquired control of the Silent King group of mineral claims in the Alamo mining district, 40 miles south of Vicksburg and 55 miles north of Mohawk. The claims cover a strong cropping of quartz-porphyry, a representative number of samples from which assayed an average of $1.50 per ton in gold. Mr. Humphreys spent some time there recently and reports having put on a small force of men to do exploration and development work. The group is situated between the Plumas and Eagle Tail mountains. The ore seems to be favorable to cyanidation. The operation of the Parker branch of the Santa Fe railroad is having the effect of advancing mining development in this part of Yuma county.——The North Star mine and mill, at Polaris, are operating successfully with a force of 100 men, the mine workings extending to a depth of 500 ft. The property has a vein of medium-grade gold ore; the milling process consists of roll-crushing and cyaniding.——The King of Arizona, at Kofa, has not been in operation since January last, but it is reported that operations may be started again before long.

CALIFORNIA

AMADOR COUNTY

J. M. McDonald has filed an attachment for $112,947 against the California Consolidated Mines Co. which amount is due on the bond that the company held on the Keystone mine near Sutter Creek. The company secured a number of claims in this district about three years ago but has failed to raise sufficient money to meet the payments and has been attached by several firms.

CALAVERAS COUNTY

The shaft of the Ball Mountain Co. has cut the blue gravel of the old Vallecita channel at a depth of 540 ft. The company so far has not been bothered with an excessive flow of water and will sink through the gravel to the bedrock. Water is to be brought from the Union Construction Co.'s ditch, a distance of 1200 ft., to the property and the work of sluicing the gravel started at once.

NEVADA COUNTY

A creosote plant consisting of two 16-ft. tanks is to be installed at the Empire mine near Grass Valley. The solution will be heated by circular coils and the timbers each given two treatments.——The unwatering of the Canada Hill mine has been completed and a new compressor ordered which will be installed within the next few weeks. ——The bond on the Oustomah mine which Mrs. Minnie Mundy has held for the past 18 months has been given up and operations, except pumping, suspended at the mine. The Oustomah Gold Mining Co., which owns the property, has brought suit to recover $18,000 that it claims is due as royalties from E. O. and J. O. Hayes who formerly had a lease on the mine.——The adit at the Black Bear mine, at Moore's Flat, cut a vein of high-grade ore much of which shows free gold, and picked samples have assayed as high as $1000 per ton. The McKinley vein has been crossed and average samples, taken across the width of the ore, milled $10 per ton. C. L. Wilson is one of the main owners and it is the intention to erect a mill on the property this summer.

PLUMAS COUNTY

(Special Correspondence).—The Bushman placer claims, where a fair grade of gravel has been opened, has been taken under bond by Pennsylvania capitalists.——E. Arundell Smith, an English mining engineer, has taken a bond on the Golf Leaf group of quartz claims in the Argentine district. The stated purchase price is $12,000. The bonder has leased the Crown Point mill and states that development will be started at once.——The White Lily is keeping six stamps in operation and working a force of men on the main vein, which, in places is 60 ft. wide. Sterling P. Dunn is manager.——The Seneca Development Co. is driving an adit to intersect the gravel deposits in the Sunnyside mine.——The Walker Mining Co. is developing an excellent body of copper ore in the Genessee district. The lode is over 50 ft. wide and assays 4 to 25% copper, in addition to gold and silver value approximating $5 per ton. ——The Engle Copper Co. is rapidly completing its 100-ton smelting plant in Light's canyon.——The Genessee Valley Copper Co. has a force of men at work on promising deposits. W. G. Lummis is superintendent.——The Mountain Meadow Co. expects to resume operations before the end of summer.——It is reported that rich ore has been uncovered in the Hinchman mine.——Two monitors are in operation at the Neoscene placer mines at Scales, and large restraining dams have been completed to prevent the escape of débris to the river.——The Supervisors have decided to construct a wagon-road from Mohawk valley to connect with the road building to the Gold Lake section. This will greatly facilitate mining in the southern portion of Plumas county.

Quincy, May 14.

SHASTA COUNTY

The iron smelter at Heroult is again running and turning out about 20 tons of pig iron per day.——The foundation of the bag-house at the Kennett smelter has been completed and the superstructure is well under way.——Seventy-five members of the Shasta County Farmers' Protective Association have signed the smoke agreement with the Balaklala Copper Co. ratifying the agreement made by the executive committee.——There are 20 men working at the Gold Leaf mine, on Salt creek, and the ore is being shipped to the smelter at Kennett. The Brackett property, in the same district, is also shipping to the smelter.

SIERRA COUNTY.

A new company has been organized to re-open the old Phoenix mine at Sierra City and work has been started re-building three miles of flume that will carry water to the mine for power and for the mill.——The adit at the Queen Radigunde mine, in the Alleghany district, opened an 18-in. vein of high-grade ore.——A mining car and a consignment of rail have been shipped to Downieville for the Sierra-Poorman mine, and will be packed to the mine as soon as they reach town.——The mill at the Omega drift mine is being run one shift per day, and from 20 to 25 tons of gravel crushed that assays about $3 per ton. ——The channel has been cut in the South Fork mine at Forest which the Rio Antigua Mining Co. is operating under bond. The gravel was opened on the west rim and an incline has been started to tap the bottom of the channel.

TUOLUMNE COUNTY

(Special Correspondence).—Operations have been resumed at the Gold Ship Mining Co.'s gravel claims in the Groveland district. Drifting is in progress and the main shaft is to be sunk to bedrock. A transmission line from the Tuolumne Electric Co.'s plant, three miles distant, is contemplated.——Work is to be resumed at the Mary Ellen mine, situated near the Mohican and owned by A. B. Cruickshank, of London.——The Karnac Mining Co., whose property is west of Jamestown, contemplates the erection of a 10-stamp mill in the near future. The Hancock shaft has attained a depth of more than 100 ft. and will be sunk 150 ft. before cross-cutting.——A small crew of men is employed at the Clio mine, recently bonded to Salt Lake interests.——A new boiler has been installed at the Mangante mine, near Jamestown, and a four-drill compressor purchased.

Tuolumne, May 16.

The Carlow-Hensley Co. is prospecting the old James Wickman mine, near Tuttletown, upon which it has secured a bond.——There are 200 tons of ore that averages $50 per ton on the dump of the Champion mine which will be crushed in the plant of the Penon Blanco as soon as the Standard Electric Co. completes its line to the mill.—— It is reported that operations are to be resumed at the Mary Ellen property on the Tuolumne river.——An 8-hp. gasoline engine has been ordered for the Chilano mine near Tuttletown, and will be installed to drive the 3-stamp mill on the property which is being operated under bond by W. T. Watson.——The bedrock adit at the Haslam placer claim

is now in 200 ft. and the operators W. H. Buchenuth and Clarence Hassam are washing a good grade of gravel.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—The shaft at the Bruce mine is to be unwatered and retimbered from the 125-ft. level, at which time drifts will be started from the various levels.—C. L. Jaynes is manager.——J. J. May, who has been awarded the contract for driving the Lucania adit 500 ft., started work last week. Power for the operation of machine drills will be secured from the Hoosac plant.—The adit is now in 4200 ft.——It is stated by W. E. Malm, in charge of construction of the Malm chemical electro plant at Georgetown, that the mill will be ready to begin ore treatment by July 1.—The heaviest of the machinery has arrived and the balance, consisting of electrical equipment, has been shipped from New York.——A body of smelting ore 4 ft. wide has been opened in a stope on the Aetna vein of the Capital mines. From a shipment of one carload that was made a few days ago returns of 4 oz. in gold and 10% in lead were realized.—W. N. Brady is the new manager.

Idaho Springs, May 14.

GILPIN COUNTY

(Special Correspondence.)—A hoist and small compressor have just been installed at the Sea Bird property in the Northern district and a winze is now being sunk from the adit level.—Grading has been started for the new mill to be constructed by the Golden Sun Mining & Milling Co., on South Boulder creek.—The shaft on the War Dance mine, down 330 ft., is to be sunk another 100 ft. Shipments from the east drift on the 280 ft. level are being settled for at the rate of 20 oz. gold per ton.—The 500 ft. shaft on the Chase mine is being sunk an additional 100 ft., work having been put under way last week.

Central City, May 13.

LAKE COUNTY

One of the steadiest producers on Breece hill, in the Leadville district, is the Penn property which is being operated by three sets of lessees.——The new work that was started at the old Gallagher mine last year is again being advanced and the north drift is being driven to open an orebody that is known to lie in this direction.——Thomas Gilroy has commenced work on the Galesburg and Free America claims and is sinking a shaft to prospect the vein.——A number of local operators have secured a lease on the Robert Emmet mine which is one of the oldest in the district and will open the old stopes to recover the low-grade ore left there in early days.——Work has been started on the Famous shaft in South Evans gulch by G. S. Schroeder who recently secured a lease on the property.——The breast of the Yak tunnel has now reached the lateral work of the Diamond mine and the workings are being drained. The water will soon be out of the old stopes of the Resurrection which has also been tapped, and the lower levels of the property re-opened. The present work is being carried on by the company though there are a number of lessees shipping ore from the stopes above the water-level.

SAN MIGUEL COUNTY

Work has been resumed on the Paradise group on South Lookout mountain in the Ophir district. Over 600 ft. of development work has been done on the property opening a vein of gold-lead-silver ore that is worth from $40 to $50 per ton.——The first payment of $20,000 has been made on the Favorite property which was purchased last fall for $60,000. There are 20 stamps dropping in the mill where the ore is concentrated in the ratio of 6 to 1, which has a value of about $85 per ton.——At the Wealth of Ophir mine a shoot has been opened that assays $20 gold and 100 oz. silver per ton.——Work for the season has been started on the property of the Trilby Gold Mining & Milling Co., in the Silverton district, which is under lease to the Danville Mining & Leasing Co., and ore shipments will be started early in the season. The company has been operating the group for the past two years and has opened a good grade of copper ore which contains some gold and silver with a small amount of lead.

SUMMIT COUNTY

Work has been resumed at the property of the Iowa Nebraska Mining Co. in the Frisco district, and the adit is being advanced to cut several veins whose outcrops have been traced on the surface of the claims. At present the work is being carried on by hand but it is the intention of the company to install a compressor and drills some time this summer.——New sluice boxes and a flume have been put in at the Bodege placer claim and operations resumed for the season.——At the King Solomon the west drift on No. 11 vein has opened some loose ground and progress has been slower than usual on account of having to timber the workings. The company has just installed a new ventilating fan.

TELLER COUNTY

Lessees of the Joe Dandy mine, in the Cripple Creek district, recently shipped two carloads of high grade ore which included approximately six tons of sacked ore that assayed $1000 per ton.——Fred Shaefer and associates, operating a sub-lease on the Anchoria-Leland property on Gold hill, cut a 4-ft. shoot of milling ore.—The quarterly report of the Doctor Jack Pot Mining Co. recently mailed to the stockholders states that the average of the ore shipped during that period was $24.40 per ton, a value slightly above the general average of the district, and the royalties amounted to $5750. The Lucky Corner Leasing Co. continues to be the largest shipper, sending out about 500 tons per month.——Twenty-one sets of lessees are active in the Gold Dollar Consolidated properties according to the report mailed to the stockholders by the manager H. L. Sheperd and have paid into the company's treasury $20,870 in royalties during the past year.——L. A. Van Tilborg and associates have opened a 4-ft. shoot on the 250-ft. level of the Bison property of the Free Coinage company and are shipping material that averages $30 per ton.——The Mitchell mine, on Bull hill, has been brought back to the shipping class by the Pinnacle Mining, Milling & Leasing Co., which has opened several stopes on the 350-ft. level.

IDAHO

IDAHO COUNTY

The Center Star mine, north of Elk City, has been sold to New York interests for $100,000, and the first payment of $5000 has been made. The bond calls for another payment of $5000 at the end of three months, and the final payment of $90,000 at the end of a year.——George Jennings has secured a bond on the Red Horse placer claims and the Hope quartz group on Red Horse creek, three miles from Elk City, and has commenced work for the season. The placer claims are fully equipped and will need no further improvement, but at the Hope group a whim will probably be installed and a shaft started on the vein.——Work has been resumed on the Buckhorn group in the Four Mile district where a 21-ft. vein of free-milling ore has been opened. Samples from the face of the drift, which is in 210 ft., have assayed between $15 and $20 per ton.

KANSAS

CHEROKEE COUNTY

(Special Correspondence).—Among the new mills built in the Galena camp is the 200-ton plant on the O'Neil land at Riceville which will be started in the next fortnight.——The Nowata company is planning the erection of two large mills on the Luscombe-McElroy leases. It has just installed large centrifugal pumps to drain the ground, which has laid idle for a long time.——Thacker & Campbell have taken a lease on the Neal land, which is in the centre of a rich district, from the Galena Lead & Zinc Co., at Galena. Machinery will be installed at both shafts, one of which opens a working face 180 ft. long and 12 ft. high.——The Lizzie D. mill has been bought by the Diplomat company and will be removed from the Badger camp to the Diplomat lease in the Galena field. There are three shafts on this ground, all in good ore.——The Omaha-Petersburg company in the Baxter Springs camp has closed a contract for the erection of a large mill on its lease. A mill built on the plan of the Eastman, with a complete sizing system and having a capacity of 500 tons, will be

built.——The Lolita company is pushing work on its mill and expects to have it done in a few weeks.——A rich body of lead-zinc ore was opened on the Hubbard lease at Badger. ——The Herald mine has installed new ventilating pipes to the face of the workings.

Galena, May 13.

MONTANA.

SILVER BOW COUNTY

The installation of a new electric hoist and the opening of a high-grade orebody on the 800-ft. level of the Butte-Ballaklava mine at Butte have made it possible to increase the shipments from 70 to 200 or 300 tons of ore per day. Work on the 800-ft. level for some time past has been discouraging on account of numerous faults, but recently a body of ore 18 ft. wide and assaying 10% copper, with 20 oz. silver, has been opened by the drift.

NEVADA

CHURCHILL COUNTY

(Special Correspondence).—The Nevada Hills mine and the Fairview-Eagle, at Fairview, have been consolidated and the two properties will be operated by the Nevada Hills Mining Co., with George Wingfield at its head. The original Nevada Hills has opened a fissure vein in andesite to a depth of 470 ft., and the Eagle has a parallel vein, 1000 ft. from the former vein, which has been developed to some extent. The workings of the two eventually will be connected. The ore in both veins consists of silicified andesite and quartz, containing silver and gold averaging $25 per ton, the silver constituting 75% of the total value. Silver occurs as chloride as deep as 250 ft., below which it is mostly stephanite. It has been decided to erect a stamp-mill on the property, which will be equipped with concentrators and a cyanide plant. It is believed the Nevada Hills ores will require treatment similar to that given the ores at Tonopah. W. H. Webber will probably remain in the position of manager. It is said that 300,000 shares of the new organization will be placed in the treasury. The mill to be erected is to have the capacity of about 60 tons per day, but arrangements will be such that additions can be made readily.

Fairview, May 13.

CLARK COUNTY

The cross-cut on the 400-ft. level of the Nevada Eagle mine in the Eldorado district has cut 20 ft. of ore which averages $11 per ton, and the superintendent, G. D. E. Mortimer, has gone to Denver to arrange for a milling plant. A test lot of 2½ tons of ore will be shipped for experimental treatment. The mine is dry and water will be piped from the Colorado river a little over two miles.——At the Capitol property two feet of shipping ore has been opened on the 200-ft. level which assays $25 per ton in gold besides its lead content.——The Searchlight Mining & Milling Co., which is enlarging and retimbering its shaft, has the work completed over 150 feet.

ESMERALDA COUNTY

In spite of the recent heavy loss of the Goldfield Consolidated the gross production during April was the greatest in the history of the mine and the net profit second to but one. The gross production amounted to $1,099,640, and the net profit $964,328.——The Victor shaft on the Victor claim of the C. O. D. Consolidated is being put in shape for operation on company account, and the management will soon start opening the shoots that were exposed in the early days of the camp.——The Combination Fraction is hauling ore from the mine to the mill of the Nevada Goldfield Reduction Co., and it is understood that the 90-ton plant will be started on Fraction ore June 1.——The Goldfield-Silver Peak, 12 miles north of Blair, has been operated by Meginness Brothers for two months under lease and the results of a recent mill-run were very satisfactory.

LANDER COUNTY

C. P. Nellist and C. T. Linluy, of Kansas City, have purchased the 100-ton mill of the Cortez Metals Recovery Co., at Cortez, for $20,000 and will continue to operate the plant.

NYE COUNTY

(Special Correspondence).—The West End has installed three 50-kw. transformers in the new transformer house and is preparing to operate 10 machine-drills. No. 6 raise 300 ft. west of the shaft has exposed 8 ft. of milling ore. ——The Thanksgiving mine at Manhattan reports the opening of four feet of ore assaying $164 per ton in the west drift on the 425-ft. level.——At the Gold Crater the drifts have opened three feet of $30 ore on the 100-ft. level for a distance of 150 ft.——The Union lessees have leased the Canyon mill and will handle custom ore in addition to their own.——The Eclipse company has commenced treating ore in its cyanide plant.

Tonopah, May 13.

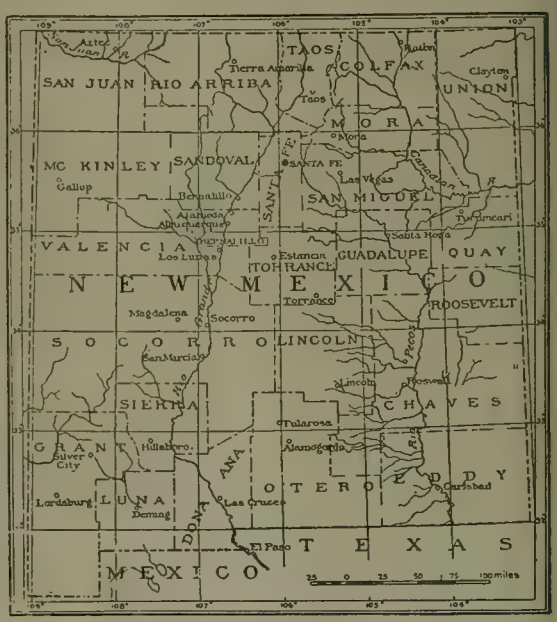
STOREY COUNTY

A raise has been started from the south drift from cross-cut No. 1 on the 2300-ft. level of the Ophir mine in the Virginia City district. At this point the drift cut 40 ft. of ore and it is to determine the extent of this that the raise has been started.——The Consolidated Virginia continues sending low-grade ore to the mill which is stoped on the 1800-ft. level.——Joseph F. Dietrich, who has been operating a lease successfully on the outcrop of the Best & Belcher mine, has secured a sub-lease on the Chollar workings above the 218-ft. level and has put several men at work prospecting the ground.

NEW MEXICO

OTERO COUNTY

Since the middle of February H. Vincent Wallace has been at Bent installing a hydro-electric plant consisting of a Platt-Francis turbine, to drive a Norwalk high-speed air-



Map of New Mexico.

compressor, and a 100-kw. Westinghouse A. C. 3-phase 60-cycle generator at 440 volts for the Talarosa Copper Co. The electric power is to be used to operate the concentrating mill which will have a capacity of 240 tons per day.

OREGON

BAKER COUNTY

It is learned that the Iron Dike mine, at Homestead, which has been under bond to the Lewisohn interests in New York, and on which some development work has been done since last October, has reverted to its owners, the Iron Dike Copper Co. Frank E. Pierce remains in charge as manager.

UTAH

BEAVER COUNTY

The Moscow Mining & Milling Co., operating in the Star district, will pay its first dividend on July 5 when it will

have settled all its debts and have a surplus in the treasury. The ore on the 400-ft. level has been driven on for over 350 ft. and a winze from the level has been sunk 100 ft. in ore.——Two feet of lead-silver ore worth about $30 per ton has been opened in the old Talisman workings of the Cedar Talisman mine and a car of sorted ore will be shipped early in June.——The Utah United Copper Co., having 12 claims close to Solus station, is developing on what is claimed to be the Horn Silver contact, which is of limestone and monzonite granite. A 265-ft. shaft has been sunk, in which iron-copper sulphide was found all the way down. At 230 ft. massive iron ore was obtained that assayed 5% copper, and at a depth of 260 ft. the ore body was 17 ft. wide. A. J. McMullen is superintendent.

BOX ELDER COUNTY

The Salt Lake Copper Co.'s mine continues to be a regular shipper of good-grade carbonate copper ore, as it has been for the past three years. Since last October it has been found to be more profitable to work it under a leasing system, which has proved satisfactory both to lessor and lessee. The property is in charge of N. B. Fisher, as manager.

JUAB COUNTY

Work is to be resumed at the Victoria property at Tintic and the shaft sunk to the 1000-ft. level.——The Iron Blossom shaft is now down 1560 ft. A stope has been started on the shoot that was recently opened on the 500-ft. level of the No. 1 shaft, and several cars assaying over 20% lead with a fair amount of silver shipped to the smelter.——The boilers which are to form part of the new equipment at the Chief Consolidated have been shipped from Racine and the new hoist will be forwarded to the mine some time in June. There is a good showing of ore 20 ft. above the 1600-ft. level, and on the 1400 the raise has opened another shoot.

The Iron King, controlled by E. Luce of Provo, is shipping 50 tons per day of oxidized iron ore to the smelting plants. The mine is being further opened by a 2650-ft. tunnel, which is to cut the orebody 200 ft. ahead. Present production is from a 600-ft. shaft, with levels into the ore from the 400 and 600-ft. stations.

SALT LAKE COUNTY

The litigation as to apex rights on a fissure vein, in Bingham, between the Utah Metal Mining Co. and the New England Gold Copper Co. is in a fair way to be settled out of court. An examination of report on the contested orebody was recently made by W. A. Wilson, of Salt Lake. The two properties are on Muddy fork, a branch of Carr fork.——The Columbus Consolidated Mining Co., operating the Columbus mine and mill at Alta, is mining and concentrating 100 tons of ore per day, producing 20 tons of concentrate. The ore averages about 30 oz. silver, 30% lead, 5% copper, and $1 per ton gold.

SUMMIT COUNTY

Free & Taylor, the contractors who are to drive the Snake Creek tunnel 14,000 ft. to develop the Park City ores, have completed the installation of a compressor, and are soon to start work with machine-drills in the tunnel which is now in 30 ft. The electric line from the Snake Creek powerhouse has been completed and supplies for several months' operations are on the ground.——The Utah Mines Coalition Co., having 15 claims at the head of Big Cottonwood canyon, included in which is the Black Bess mine, has driven a 2000-ft. cross-cut within the last 14 months, which is to be extended 300 ft. farther to intersect the Black Bess vein at a depth of 1000 ft. A raise then is to be made to the old shaft through which the property was formerly operated. The equipment includes a gasoline engine and a 5-drill compressor. Duncan McVichie, J. A. Pollock, H. J. Mahon are concerned in the property, of which R. H. Strickland is superintendent.

WASHINGTON

FERRY COUNTY

Twenty thousand dollars at the rate of one cent per share was paid as a dividend by the Pearl Consolidated Mining Co. on May 10 as the proceeds of the lease and bond on the Lone Pine Surprise group in Republic, held by the Republic Mines Corporation. The first dividend of one half cent per share was wholly obtained from the first cash payment made by the lessees before taking possession of the Pearl company's property. The second of one cent per share was made up equally from a cash payment and from royalties on shipments. The third is wholly due to royalties, which apply as payments on the bond. Of the ore recently shipped, one car was from the high-grade shoot on the Surprise and netted more than $8700. The carload previously from this orebody netted over $10,000. The rest of the ore from the group has varied in value from $18 to $70 per ton.

CANADA

BRITISH COLUMBIA

(Special Correspondence).—The Consolidated Mining & Smelting Co. of Canada has recently secured control of the Molly Gibson mine on Kokanee creek. This property is one of the old time shippers of the district and will be re-opened and worked extensively by the Consolidated company.——A large transaction was effected in Bayonne last week, when C. Manford, of Vancouver, secured a bond on 21 claims in that camp for $225,000, paying $22,500 down. There is a large quantity of gold ore in sight on the property and a 10-stamp mill will be installed at once. The Bayonne camp is not far from the Sheep Creek district and bids fair to rival it as a gold producer.——Vancouver capitalists have also acquired a group of properties on Deer creek and will begin development work at once.——The Inland Empire Mining Co. is considering the installation of a stamp-mill on its property near Paulson.——The Columbia Coal & Coke Co. has begun diamond-drill work on the property on Granite creek.

Rossland, May 14.

ONTARIO

From the 88-ft. level of the Lawson mine at Cobalt the drift has been following the Keewatin vein and has recently opened a 3-in. shoot of 2800-oz. silver ore. The Princess property of the Consolidated company at the head of Cobalt lake is stoping ore on three veins.——The Crown Reserve Mining Co. is having 100 tons of the dump ore treated in the Cobalt Central mill, and if the results prove as satisfactory as anticipated the Crown Reserve will probably erect a concentrator.——The Rochester Cobalt now has three veins, the last one cut being 8 or 10 in. wide and containing a high percentage of native and ruby silver in a calcite gangue.——Some high-grade ore is being taken out of the drifts on the 70-ft. level of the Bellellen property in South Lorrain. This is the old Newman group upon which the most spectacular surface showings in South Lorrain with the exception of the Wettlaufer were made last fall. The shaft was sunk on a lean streak in the vein and it is only recently that the drift tapped the rich shoot.

MEXICO

MEXICO

A new orebody has been opened recently in the Alacrán mine in the Zacualpan district. The company has denounced the water-rights of the Alacrán barranca and will install a hydro-electric plant.——The Chontalpan mine has been taken under new management and will be equipped with modern machinery.——The Reforma Mining Co. has installed a producer-gas plant to furnish power for an electric generator, compressor, and drills. The company is driving a large cross-cut adit to tap the vein.——The Concepción Mining Co. is installing a producer-gas plant.

SONORA

The shaft of the Calumet & Sonora Mining Co., operating two miles north of Sonora cut a body of lead-zinc ore at a depth of 400 ft. An addition has been built at the mill, a Diester slime-table installed, and in the power plant a new 250-hp. boiler has been added to those now in operation.——The April production of the Greene-Cananea Copper was about the same as the March, which was approximately 3,700,000 lb. It is stated that the company is in a position to produce 6,000,000 lb. of copper per month if the market should warrant it.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

TRESPASS ON MINING CLAIMS—TIME FOR BRINGING ACTION

Under a statute providing that actions for trespass on mining claims and mines must be brought within three years from the time the action accrues, but providing that when a trespass is committed by underground workings on any mining claim, the cause of action shall not accrue until the discovery of the trespass, it was decided by the Supreme Court of Utah that an action for trespass brought eight years after the ore was removed from the mine was not barred by the statute where it was shown that the plaintiff did not have actual knowledge of the trespass prior to six months before the bringing of his action and that accordingly the action was not barred.

Bullion-Beck & Champion Min. Co. *v.* Eureka Hill Min. Co., (Utah) 103 Pac. 881, Aug. '09.

HISTORICAL SKETCH OF NEVADA MINING CLAIMS

A very interesting historical sketch of the origin of the rules of mining and of such early mining claims in Nevada as the Comstock and Canyon claims has recently been given by the Supreme Court of Nevada. The Court suggested that it could properly take judicial notice of the fact that the particular property in controversy was in the region of the earliest discoveries of gold in that State, the region whose history is part and parcel of the history of the Comstock Lode, which in turn was a part of the history of the Government, of such importance as to merit recordation, as long as the nation, which the Comstock helped so effectually to maintain, should last. To this region, from 1859 and until after the seventies the miners from the 'diggins' of California, adventurous spirits from all pars of the nation and the world, gathered, and a large portion of the country was located in accordance with the customs and rules of the miners before the passage of any laws regulating such locations. The court pays tribute to that distinguished lawyer, statesman, and citizen, Hon. William M. Stewart, under whose leadership was enacted by Congress in 1866 the first legislation upon the subject. The distinguished Senator, advocating the passage of the Act, spoke in high praise of the regulations and customs of miners and portrayed in glowing language the wonderful results that had followed the system of free mining, which had prevailed with the tacit consent of the Government. He stated that the legislature of California had wisely declared that the rules and regulations of miners should be received in evidence in all controversies respecting mining claims, and when not in conflict with the constitution or laws of the State or the United States, should govern their determination, and that a series of wise judicial decisions had molded these regulations and customs into "a comprehensive system of common law, embracing not only mining law, broadly speaking, but also regulating the use of water for mining purposes." He declared that the miner's law was a part of the miner's nature; that he had made it and he trusted it and obeyed it; that he had given the honest toil of his life to discover wealth which when found was protected by no higher law than that enacted by himself under the implied sanction of a just and generous Government. He also stated that the proposed Act continued the system of free mining, holding the mineral lands opened to exploration and occupation subject to legislation by Congress and local rules; that it merely recognized the obligation of the Government to respect private rights which had grown up under its tacit consent and approval, and that it proposed no new system, but sanctioned, regulated, and confirmed a system already established, to which the people were attached. The court said that while these statements of the author of the Act in securing its adoption could not control its construction, yet they did show the condition of mining property on the public lands, and its tenure in the absence of legislation, and thus indicated the probable intention of Congress.

Golden *v.* Murphy, (Nev.) 103 Pac. 394, July '09.

COMPANY REPORTS

ALASKA UNITED GOLD MINING COMPANY.

It is charming to witness absolute frankness in a mining report. The Alaska United is a model of what such a report should be. Nothing is hidden; the whole round of operations is revealed by statistics, which are analyzed to interpret their meaning. The balance sheet shows a total income for the year 1909 of $1,090,287, of which $261,743 was profit. Out of this the sum of $234,260 was disbursed in dividends. The year ended with proved ore reserves of 821,821 tons in the Ready Bullion mine, and 296,403 in the 700-Ft. Mine; while there remained in the stopes of these mines, respectively, broken ore to the amount of 294,829 and 239,666 tons. The average assay-value of these reserves was respectively $2.68 and $2.36. The estimate of ore reserves, however, is much higher than the figures above given. This brings the total in the Ready Bullion mine to 1,116,650, and in the 700-Ft. to 536,069 tons; this estimate including ore that must remain in the mine as pillars. The report is teeming with valuable data, from which only a few selections of larger interest are possible. The duty of the machine drills employed is stated to have averaged 40.67 tons broken per drill per shift, the average length of hole drilled being 34.65 ft., labor costs averaging $8.38, explosives $2.08, and supplies, power, and repairs $5.65. In shaft sinking the average depth of hole drilled was 45.08 ft., and tons broken 15.24. The mill of 120 stamps crushed during the year 227,710 tons of ore at a total cost of $56,859 or 24.97c. per ton. The ore yielded in free gold, including copper and base bars, $278,868, or $1.2247 per ton, and $215,359 from concentrate treated, or 94.57 cents per ton, making a total yield of $494,227, or $2.1704 per ton. The running time of the full mill for the year was 351 days, 19 hours, during which time steam was used for power 241 days, 18 hours, and water power 110 days, 1 hour. During the year 1 lb. of chrome steel in the shoes crushed 2.63 tons of ore, and 1 lb. of iron in the dies, cast locally, crushed 5 tons, at a total cost for the iron and steel consumed of 2.62c. per ton of ore. The stamp-duty was 5.37 tons per diem. The supplies for the mill show the following totals, which constitute renewals: shoes 510, dies 310, cams 15, cam shafts 14, stems broken and replaced 595, new stems 23, tappets 48, boss-heads 6, vanner belts 7. The analysis of quicksilver used and consumed is most interesting. The quantity fed, in ounces, and the places of application, were as follows: batteries 38,123, plates 1895, vanners 658, elsewhere 7822, total 48,498. The quicksilver recovered from retorting was 32,919, and the total loss is estimated at 15,807, or 32.59%, the distribution of losses being, in retorting 242 oz., and in the mill 15,565. These details apply to the Ready Bullion mill, which is representative of the work done in the 700-Ft. mill of 100 stamps, where, for example, the quicksilver loss was 32.71%, the stamp-duty 5.41 tons, and the total cost for iron and steel consumed in shoes and dies per ton of ore crushed was 2.5c. The latter mill crushed 184,799 tons at a total cost of $45,615, or 24.68c. per ton. The ore yielded in free gold, including base bars, $265,607, or $1.4373 per ton, and $224,083 from concentrate treated, or $1.2127 per ton, making a total yield of $489,690, or $2.65 per ton. Drill-duty in the 700-Ft. mine works out at an average for all classes of service of 26.68 tons of rock broken, and 26.89 ft. of hole drilled per shift. The elements of these figures are worth re-stating, the duty having been, for stoping 36.98 tons broken with 24.99 ft. of hole drilled; development, 7.89 tons and 31.88 ft. respectively; and cutting out 12.72 tons and 27.06 ft. The average number of tons of ore broken per foot of hole drilled during the year was 0.99. In the Ready Bullion mine the average per foot of hole drilled was 1.17 tons of ore and waste broken. From the Ready Bullion mill the total concentrate-yield was 4390 tons, and from the 700-Ft. 3230. In the two cases the recovery by Amalgamation was $1.2247 and $1.4373 and from concentrate 94.57c. and $1.2127 respectively. The operating costs of the Ready Bullion were $1.63 per ton, and of the 700-Ft. $1.74. The number of employees was 489, and the accidents 4, making an average rate of 2.04 per thousand.

Personal

Professional men are invited to send items of their movements and travels. Such news is interesting to friends.

S. H. Ball is at Nalca, Chihuahua.

H. W. Hardinge will be in Denver soon.

J. E. Spurr, was in Los Angeles recently.

L. J. Maynes is examining mines in Bolivia.

M. K. Shaler has left New York for the Congo.

Robert M. Raymond has been in San Francisco.

F. S. Wayne, of New York, is in San Francisco.

W. G. Miller has gone to the Porcupine district.

Fritz Wolf has gone to Seven Troughs, Nevada.

George H. Garrey was in San Francisco this week.

Max F. Abbe, of Abbé Engineering Co., sailed for Europe May 10. He will be absent six months.

W. D. Smith, chief of the Division of Mines, Manila, P. I., visited the Bulacan iron fields recently.

C. L. Herrick, of Denver, has been in San Francisco lately.

Guy A. R. Lewington has arrived at Dawson, Yukon Territory.

Juan Felix Brandes has left London for a trip to France and Germany.

D'Arcy Weatherbe will go to Siberia this year with C. W. Purington.

Thomas J. Clinton has returned to Detroit from a visit to San Francisco.

A. W. Geiger has sold his interests at Cortez, Nevada, and is in San Francisco.

George W. Heintz, manager of the United States S. R. & M. Co., was in San Francisco.

T. G. Janney, manager of the Shasta Dredging Co., has returned to Redding, California.

George W. Metcalfe, manager of the Mammoth Copper Mining Co., was in San Francisco.

A. A. Blow will deliver the commencement address at the Colorado School of Mines, May 27.

J. B. Tyrrell has been elected president of the Canadian Institute, the oldest scientific society in Canada.

Leo. Von Rosenberg, of New York, has returned from Peru and gone to Georgia to examine gold properties.

J. H. Young has become manager of the Guggenheim interests in the Northwest, with headquarters at Seattle, Washington.

Gardner F. Williams and W. P. Blake were given the degree of LL.D. at the Semi-Centennial of the University of California, May 25.

Errol Mac Boyle has returned from the Seven Troughs district of Nevada. He will sail on the steamer *Mongolia* Tuesday for the Philippine Islands.

Morril B. Spaulding met with a serious accident April 25 while engaged in progessional work in South Carolina. Both of his legs were broken, but fortunately, no other complications have arisen, and his speedy recovery appears now to be assured.

Underground traveling in London increases at an astonishing rate. The number of passengers carried for the first half of the present year by the Metropolitan Underground railway was 16,503,395, against 5,823,437 in 1863 and 7,462,283 in 1867.—July 13, 1867.

The Erie Railway Co. in New York, it is stated, are about doing away with the use of wood on their locomotives, and have already commenced selling off the wood they have on hand. Coal is to be used hereafter.—July 6, 1867.

The Union Pacific railroad is now opened to Julesburg, 376 miles west of Omaha, and daily trains have commenced running each way. Over 500,000 pounds of freight was awaiting the opening.—August 17, 1867.

Personal

What some engineers were doing long ago

Louis Janin is in Grass Valley.—March 30, 1895.

A. T. Dewey starts for the East by steamer Monday.—August 17, 1867.

A. A. Blow, of South Africa, is on his way to London.—March 25, 1899.

Ross E. Browne expects to return from London about March 7.—January 28, 1899.

Leo Von Rosenberg has returned to San Francisco from Arizona and gone to New York.—May 6, 1899.

Prof. Charles H. Hitchcock has been appointed State Geologist of New Hampshire.—November 14, 1868.

Ben Stanley Revett is in San Francisco en route to Colorado to examine mining property.—November 13, 1897.

Alfred James of Glasgow, Scotland, representing the Cassel Gold Extracting Co., is visiting this State.—July 21, 1894.

Prof. Geo. Davidson has assumed the superintendence of the Pacific division of the Coast Survey.—December 26, 1868.

R. W. Raymond, Esq., Mining Commissioner of the Pacific States, left this city on Thursday last for the interior.—June 13, 1868.

T. A. Rickard, State Geologist of Colorado, is visiting San Francisco with his bride on their wedding trip.—January 7, 1899.

Baron von Richthofen will accompany J. Ross Browne and C. D. Poston on the Chinese mission, in the character of geologist.—August 1, 1868.

Thos. H. Leggett, president and general manager of the Standard Cons. Mine at Bodie, is in the city on a brief business trip.—October 27, 1894.

H. W. Turner of the U. S. Geological Survey is in Butte county securing material for a map of the Sierras in that part of the State.—July 21, 1894.

Guido Kustel has transferred his assaying and metallurgical business at 611 Commercial street to Lopold Kuh of Virginia City.—November 28, 1868.

J. Ross Browne, our new minister to China and late Commissioner of Mining Statistics, arrived in this city on Friday last from New York.—July 11, 1868.

Gardner F. Williams and J. E. Davis have recently returned home from several years' stay at the Mining Academy at Freiberg, Saxony.—November 14, 1868.

W. C. Ralston, the secretary of the California Miners' Association, returned this week from a six months' sojourn in London and Paris.—May 18, 1895.

George W. Starr has resigned the superintendency of the original Empire Mining Co. of Grass Valley to go to South Africa. Robert Walker is his successor.—July 29, 1893.

Prof. R. Pumpelly, the well known geologist and mineralogist, has been engaged the past summer in exploring the Menominee region near Lake Superior.—October 26, 1867.

John Hays Hammond has recently returned from a business trip to London. He is about to leave California for some months and will go to South Africa on professional business.—June 17, 1893.

Baron von Koschkill, a geologist and mining engineer of Tiflis, Russia, is visiting the principal mining districts of the United States under orders from the Russian Government.—November 7, 1868.

A. de Vial and Alexis Janin, recently students at Freiberg, Saxony, arrived here a few days ago. The former leaves today for Guaymas, Sonora; the latter goes to Virginia City.—November 28, 1868.

D. N. Coffin has resigned from the superintendency of the W. Y. O. D. mine at Grass Valley. His successor is W. H. Shockley, who was superintendent of the Mount Diablo mine at Candelaria, Nevada, now closed owing to the decline in silver.—July 29, 1893.

Market Reports

LOCAL METAL PRICES.

San Francisco, May 19.

Antimony	12—12¾c	Quicksilver (flask)	48—49
Electrolytic Copper	14½—15½c	Spelter	7—7¼c
Pig Lead	4.70—5.65c	Tin	35¼—36¾c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
May 12	12.69	4.26	5.03	54
" 13	12.69	4.26	5.05	53¾
" 14	12.63	4.26	5.08	54
" 15	Sunday.	No market.		
" 16	12.63	4.30	5.10	54
" 17	12.63	4.30	5.15	
" 18	12.63	4.30	5.15	53⅞

ANGLO-AMERICAN SHARES.

Cabled from London.

	May 12. £ s. d.	May 19. £ s. d.
Camp Bird	1 11 0	1 11 0
El Oro	1 7 3	1 7 0
Esperanza	2 14 9	2 18 9
Dolores	1 8 9	1 8 9
Oroville Dredging	0 9 4½	0 9 4½
Mexico Mines	8 10 0	8 11 3
Tomboy	0 18 9	0 18 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, May 19.		Closing prices, May 19.
Adventure	6	Mohawk	51
Allouez	43	North Butte	33¼
Atlantic	7	Old Dominion	36
Calumet & Arizona	62½	Osceola	136
Calumet & Hecla	570	Parrot	15
Centennial	17	Santa Fe	1⅞
Copper Range	66½	Shannon	11¾
Daly West	8	Superior & Pittsburg	12
Franklin	12	Tamarack	49
Granby	40½	Trinity	5½
Greene-Cananea, ctf	8½	Utah Con	24
Isle Royale	23	Victoria	3
La Salle	12½	Winona	8
Mass Copper	8½	Wolverine	116

(By courtesy of J. C. Wilson, Mills Building.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, May 18.		Closing prices, May 18.
Amalgamated Copper	70⅝	Miami Copper	21⅞
A. S. & R. Co.	79⅞	Mines Co. of America	⅛
Boston Copper	18⅜	Montgomery-Shoshone	⅝
B. C. Copper Co.	6⅛	Nevada Con.	21⅛
Butte Coalition	20½	Nevada Utah	1
Chino	12¾	Nipissing	10½
Davis-Daly	2⅛	Ohio Copper	3
Dolores	6	Ray Central	2⅛
El Rayo	3⅜	Ray Con	18⅛
Ely Central	1	South Utah	1¾
First National	4¼	Superior & Pittsburg	12¼
Giroux	7⅝	Tenn. Copper	27⅛
Guanajuato Con	1	Trinity	6
Inspiration	7¼	Tuolumne Copper	3⅛
Kerr Lake	8⅞	United Copper	7¼
La Rose	4½	Utah Copper	46⅛
Mason Valley	6⅜	Yukon Gold	4⅜

SOUTHERN NEVADA STOCKS.

San Francisco, May 19.

Atlanta	$ 13	Mayflower	$ 2
Belmont	4.00	Midway	29
Booth	13	Montana Tonopah	97
Columbia Mtn	6	Nevada Hills	84
Combination Fraction	50	Pittsburg Silver Peak	71
Daisy	6	Rawhide Coalition	30
Fairview Eagle	12	Rawhide Queen	35
Florence	2.25	Round Mountain	55
Goldfield Con	8.20	Sandstorm	4
Gold Kewenas	6	Silver Pick	9
Great Bend	3	St. Ives	10
Jim Butler	27	Tonopah Extension	99
Jumbo Extension	21	Tonopah of Nevada	8.50
MacNamara	29	West End	50

(By courtesy of the San Francisco Stock & Exchange Board.)

Markets

Quotations of Former Years

STOCK MARKET

Ophir.—Sanborn's circular of last week quotes sales of 468 shares of Ophir Stock at rates from $2400 to $2750 per foot. The sales at the Board for the week have been very uniform—from $2450 to $2475 having dropped somewhat from last week.

Gould & Curry.—Fifty shares were sold last week for $2550 and 40 for $2560, 1st January. The shares at the Board for the present week are quoted at from $2475 to $2500.

Central.—Thirty-six shares were sold at $1425 and the same number subsequently for $1600 as per Sanborn's circular.

California after remaining quiet for several weeks is quoted at $1200, an advance of $100. Two hundred and forty shares sold for $1250, 1st of March.

Chollar is rapidly advancing and is quoted on the Stock Board from $305 to $350. $500 was asked Wednesday.

Potosi has been but little enquired for. Small transactions are quoted at from $75 to $85.

North Potosi is quoted at $7 offered $6.50 asked.

Sierra Nevada is quoted at to $65. Forty shares changed hands at that figure last week.

Burning Moscow is quoted at from $63 to $65.

December 13, 1862.

The Mining Share Market still continues its unusual activity. The amount of transactions the past week foot up to the very large aggregate of $1,972,807—a considerable excess over last week.

Ophir shares opened the week with a decline of $50 which was steadily maintained until Thursday when they suddenly dropped to $1550 and remained unactive on Friday. 594 shares have changed hands since our last issue.

Chollar shares continue to be largely dealt in, and at declining rates. We quote sales of 582 shares at from $285 to $352 cash. We notice a single transaction on Saturday of 64 shares at $1000, buyer 60 days. Much mystery appears to hang around the operations of this company. They are still sinking on their mine.

Melones has still further advanced. It reached $75 on Saturday last, at which rate 40 feet found purchasers. On Monday it receded to $55; recovered to $75 on Tuesday and closed yesterday at $62½. We learn of a report of a rich strike, to which we gave credence last week, was without foundation. The present advance is the result of an improved management at the mine.

January 30, 1864.

Chollar	$ 26	Mexican	$ 44
G & C	80	Ophir	88

October 20, 1900.

Ophir	3.40	Tonopah Extension	5.56
Savage	81	Belmont	5.30
StandardConsolidated	2.00	Midway	2.23
Eureka Consolidated	8.50	Montana	2.80
Consolidated Virginia	87	Mohawk	2.05
Tonopah	18.15	Jim Butler	1.46

August 11, 1896.

METALS

American Pig Iron per ton	—— @ 42.00
Refined Bar, bad assortment, per lb.	—— @ 3½
Horseshoes, per keg	7.50 @ 8.00
Copper—braziers per lb.	.31 @ .32
Tin Plates	
Plates, Charcoal, IX per box	13.00 @ 14.50
Steel—English cast, per lb.	.20 @ .25
Zinc—Sheet	—— @ .11½
Quicksilver, per lb.	—— @ 1.45

April 25, 1874.

PUBLICATIONS RECEIVED

Any of the books noticed in these columns are for sale by or can be procured from the MINING AND SCIENTIFIC PRESS.

HISTORY OF THE SAN FRANCISCO STOCK AND EXCHANGE BOARD. By Jos. L. King. Pp. 353, ill. Published by the author. San Francisco, 1910. Price $2.

Literature is a by-product of mining as it is of other industries, and to mining men, if not, indeed, to others. The books which tell of mining and its related industries are more interesting than the most popular 'best seller' When the author has at hand such a mass of incident and biography as Mr. King was able to command, coupled with an 'experiencing nature', and the fortunate ability to say 'all of this I saw and much of it I was', the reader may well anticipate a treat. And he will not be disappointed. From the fragments of the records of the Board saved from the fire, from the files of the MINING AND SCIENTIFIC PRESS and the daily papers, from old letters, personal recollection, and reminiscences of friends, the chairman of the Board has built a fascinating story. The organization of the Board, its early history, the Hale & Norcross corner, the Ophir contest, the great market of bonanza days, the suspension of the Bank of California—all these and many other topics are treated on the basis of first hand information. Anecdotes of James R. Keene, B. F. Sherwood, Mark L. McDonald, William Sharon, D. O. Mills, the 'Bonanza firm of Flood, Mackay, Fair, and O'Brien, and give graphic pictures of men and times. As a recent searcher for data regarding these men and their lives, the reviewer can testify that Mr. King's book supplies much not otherwise available. The chapter on broker's superstitions is exceedingly readable. For example: "Should a black cat whine at your front door, take the cat in right away, and if it purrs and rubs against your leg, let us know what you buy that day and we will all follow you." Or: "When you meet a cross-eyed man, looking hard at you, and you are certain it is you he is staring at, you must instantly go out of the Board and do nothing that day." We may cherish a lingering doubt whether implicitly following these rules will bring wealth, but they at least bring a laugh and that makes for health.

PRACTICE AND THEORY OF THE INJECTOR. By Strickland L. Kneass. Pp. 175, ill., index. John Wiley & Sons, New York, 1910. Price $1.50.

This is the third edition of a standard work covering fully the history, development, construction, and use of injectors. It includes also a study of the requirements of modern railroad practice, methods of feeding locomotive boilers, feed-water heating, efficient feeding, use of scale-bearing water, and similar topics of vital interest to engineers. It is well printed and bound, and is authoritative.

TESTS OF WASHED GRADES OF ILLINOIS COAL. By C. S. McGovney. Univ. Illinois, Eng. Exper. Station, Bull. 39. Pp. 146. Urbana, 1909.

An illuminating discussion of the steaming qualities of washed coal.

GOLD, SILVER, COPPER, LEAD, and ZINC IN 1908. By Waldemar Lindgren, H. D. McCaskey, B. S. Butler, C. E. Siebenthal, and others. U. S. Geol. Surv. Extract from Min. Res. 1908. Pp. 157-681. Washington, 1910.

A convenient handbook of production.

PURCHASE OF COAL BY THE GOVERNMENT UNDER SPECIFICATIONS. By George S. Pope. U. S. Geol. Surv., Bull. 428. Pp. 80. Washington, 1910.

An account, with analyses, of the actual operation of the system.

INNOKO GOLD-PLACER DISTRICT, ALASKA. By A. G. Maddren, U. S. Geol. Surv., Bull. 410. Pp. 86, ill., index, maps. Washington, 1910.

A useful summary of existing cartographic and geologic data regarding a district attracting much attention.

PROGRESS OF THE MINERAL INDUSTRY OF TASMANIA. By W. H. Wallace. Pp. 21. Tasmania, 1910.

The customary quarterly review, in this case covering the period ended December 31, 1909. A slight increase, mainly in silver and copper, is shown by comparison with the figures of the preceding quarter.

An Ancient Wire Rope

Until very recently it was supposed that wire rope was an invention of the nineteenth century, but in 1895 there was dug up at Pompeii a wire rope that had been buried for more than 1800 years. The illustration herewith is

from a photograph of this rope secured by the Broderick & Bascom Rope Co. at the Musio Borbonico in Naples, where this interesting relic is kept. The rope is about 15 ft. long and ½ in. diam., laid in three strands of 15 wires each. The exact use of this rope is not known, but it is thought from its surroundings to have been used as a sort of crane. Now, if this rope was used and worn out nearly twenty centuries ago, is it improbable that the Egyptians used similar ropes even earlier? We know the Egyptians made hemp ropes. That the art of rope making from fibre was known in Old Testament times is evinced by the aphorism in Ecclesiastes 4:iv, "A three-fold cord (rope) is not quickly broken." We know the Egyptians used wire in many ways. They were the wisest and most practical of all ancient peoples. They dug a canal where the Suez canal now is. Their ships circumnavigated Africa and traded in India before Greece or Rome had even emerged from barbarism. A recent discovery has brought to light an iron tool peculiarly preserved among some annealed copper implements. It does not exceed probability to assume that such a wonderful people, who knew the uses of wire, of fibre ropes, and of iron, may have made and employed wire ropes.

Dividends.

Dividend No. 31 of 20c. per share has been declared by the Alaska United G. M. Co., payable May 28, 1910.

Dividend No. 59 of 30c. per share has been declared by the Alaska Mexican G. M. Co., payable May 28, 1910.

Dividend No. 89 of 50c. per share has been declared by the Alaska Treadwell G. M. Co., payable May 28, 1910.

On Thursday, May 5, 1910, the Bunker Hill & Sullivan M. & C. Co. paid Dividend No. 152 of $98,100. This makes the amount of dividends paid since January 1, 1910, $353,100, and the total to date $11,639,100.

In San Francisco greenbacks are worth 2½c. more per dollar than in New York.—January 16, 1864.

Electric Locomotives on Exceptionally Heavy Grades

Satisfactory operation of electrical apparatus under severe conditions is illustrated by the installation at Holt & Gregg's lime quarry at Kennett, Shasta county, California. This quarry is situated near the large copper mines and smelter of the United States S. R. & M. Co., and supplies the limestone which is used as a flux in smelting the ore. It is about two miles from where the rock is stored for the smelting company and about 2000 ft. above the bins. In order to transport it to this point it was necessary to build a road with many curves and heavy grades. There is a total of 35 curves with a minimum radius of 35 ft. and a maximum of 33. The entire road is laid on heavy grades varying from 4 to 12%, the average being about 7. This grade was originally laid out for a wagon-road, but was afterward used for a 30-in. mule tramway, equipped with 30-lb. T-rails laid on 4 by 6-in. ties 5 ft. long. The track is well ballasted with limestone and the cars are small so as to be handled by the mules. The demand for rock became so great that it was not possible to supply it with this equipment, and an electric mining locomotive was purchased. The cars are now operated in trains of three,

Climbing 12 Per Cent Grades.

each car weighing 4400 lb. empty and consisting of a wooden body mounted on substantial double trucks, having a wheelbase of 3 ft. A complete brake equipment has been provided, including both track and wheel brakes. The mining locomotive has a rating of 11 tons and is equipped with two 42-hp. 550-volt motors. Because of the heavy grades and consequent wear of the wheels by the brakes, the locomotives were equipped with track brakes in addition to the standard wheel brakes. This track brake consists of a steel shoe or slipper, mounted under each side frame at the middle point of the wheel base. This shoe can be applied to the rails with heavy pressure by means of a screw and nut mechanism placed at the operating end of the locomotive. As the locomotives have to be retarded throughout the down-grade trip, the wear on the wheel tread would be excessive unless track brakes were used. By their use the wear is confined to a simple and readily renewable casting. It was planned that the time for hauling this train from the ore-bins to the quarry should be 15 to 18 minutes with intervals between of about 10 minutes. The cars are then loaded and started down the grade by gravity, followed by a locomotive which picks them up after they have been unloaded at the ore-bins. These locomotives have run steadily all day, making a total of about twelve trips. Afterward the business increased so rapidly that two more locomotives were purchased.

Owing to the mountainous country, it was necessary to install the power station at the end of the line. The equipment at present consists of a 60-kw. and 150-kw. motor generator set, both compounded for 550/575 volts, the two being operated in parallel. Owing to the long haul over this road, the motor generator sets are operating under a heavy continuous overload, and from tests recently made it was found that this overload was about 25%. Up to the present time they have apparently suffered no injury from this severe service. The complete equipment was furnished by the General Electric Co., of Schenectady, New York.

COMMERCIAL PARAGRAPHS

The Hardinge Conical Mill Co., New York, advises that the Miami Copper Co. has ordered four Hardinge mills for use at Globe, Arizona.

Wallace & Summerhayes have closed their offices at Nogales, Arizona, and established themselves in the Trust building at El Paso, Texas.

The Ingersoll-Rand Co. announces the removal of its Chicago office from the Old Colony building to the Peoples' Gas building, 150 Michigan avenue.

The King Metallurgical Laboratories and Smith, Emery & Co., of San Francisco, have been consolidated and the business of the two firms will be conducted from the office of the latter.

Free & Taylor, of Salt Lake, who have taken the contract to drive the 14,000-ft. tunnel for the Snake Creek M. & T. Co., in Park City district, Utah, have commenced work with two drills, working three shifts.

The students of the A. Van Der Naillen School of Engineering, Oakland, California, recently spent some time in Napa and Lake counties on the annual summer excursion. The purpose of the trip is to give the boys a chance to do practical work in the different engineering courses.

The Broderick & Bascom Rope Co., St. Louis, is distributing a desk paper-knife made from its Yellow Strand wire rope. The individual wires from which the cable is made have a tensile strength of between 240,000 and 260,000 lb. per square inch. It is to be hoped that the knife will be helpful in 'loosening' many orders for the makers of Yellow Strand wire rope.

A light railway possessing many interesting and unusual features was built some time ago by the Orenstein-Arthur Koppel Co., for the Otavi Mines & Railway Co. in German Southwest Africa. It is the longest narrow-gauge (2-ft.) railway in the world, being 361 miles in length. The rails weigh 30 lb. per yard. Steel ties are used, the maximum gradient is 1 in 50, and the sharpest curve has a radius of 260 ft. The line was built during the 'Herrero' war in less than three years. This and many other interesting installations are described and illustrated in Album No. 742 issued by the Orenstein-Arthur Koppel Company.

The Revere Rubber Co. is devoting special attention to the mining business at its new Pacific Coast branch, 543 Market street, San Francisco. A complete stock of special goods, such as concentrator belts, air and steam drill hose, suction hose, is always on hand. Four grades of transmission belt are carried in sizes up to 24 in. The new 'Paramo' conveyor belt, with a convex shaped cover, is meeting with great success. The belt is flexible and the construction of the cover causes the belt to trough naturally. The 'Revero' and 'Silvertown' elevator belts for bucket elevators are worthy of special mention. This company has always made it a point to study mining conditions and construct its goods accordingly. This is probably evidenced most fully by the favorable reports received from its gold dredge stacking belts. Descriptive circulars on any goods will be sent cheerfully from the San Francisco branch.

CATALOGUES RECEIVED

The Hunt Filter Co., Mills Building, San Francisco. 'Hunt Continuous Filter'. Revised catalogue. Illustrated. 6 by 9 inches. 8 pages.

Lehigh Car, Wheel & Axle Works, Catasauqua, Pennsylvania. 'Fuller Face-Hardened Sprocket Wheels'. Illustrated. 20 pages. 6 by 9 inches.

Hydraulic Supply Mfg. Co, Seattle, Washington. Catalogue of riveted steel pipe and hydraulic mining machinery. Illustrated. 32 pages. 6 by 9 inches.

Hardinge Conical Mill Co., 43 Wall street, New York. Catalogue No. 7, 'Hardinge Patent Conical Ball and Pebble Mills. Illustrated. 20 pages. 6 by 9 inches.

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EDITORIAL.

FAIRBANKS, Alaska, may be far away from the United States, measured in miles, but by trail and telegraph its citizens keep in close touch. The special issue of the *Fairbanks Times* published April 3 is quite metropolitan in appearance, and in content is far more interesting than most Sunday supplements published in the States.

STILL the oil war wages in Mexico. Mr. H. Clay Pierce is on the ground, and presumably he is ready to listen to the voice of conciliation. So are S. Pearson & Son, according to those who profess to know; nevertheless Sir Weetman Pearson has gone off to the Argentine with a cool indifference to results in Mexico that must have its effect, even if the Englishman is bluffing. Meanwhile, we believe, each concern is pleased to have the public buy its oil from the other fellow—at present cut-rates.

CORNWALL has been a great training ground for miners, and in every mining district of any size a few Cornishmen are sure to be found. It still has important mines and is still a proving ground for new devices. Mr. Thomas Rickard, who writes in this issue on 'Fifty Years in Cornwall', has not only the advantage of intimate personal experience with that Duchy, extending back through the years, but has also seen at first hand the introduction of Cornish methods and development of independent systems throughout the world. His article arrived too late for use in our anniversary number last week. The younger men who have known Mr. T. A. Rickard will probably think of Mr. Thomas Rickard as his father, but we sacrifice no modesty, because of our intimate relations with both father and son, in saying that they shed lustre each upon the other.

ONYX-MARBLE has been difficult to account for: its origin has been obscure, and it has not been observed in process of formation. Mr. E. M. Lawton contributes a brief paper to this issue, throwing out a valuable suggestion of genesis by metamorphism. This seems reasonable; in fact another such occurrence, in a small way, is to be seen on the north side of Silver lake in San Bernardino county, California. It is doubtful whether metamorphism, however, will account for all deposits of this material. The onyx-marbles of the world have been particularly studied by Mr. George P. Merrill and Mr. Courtenay De Kalb, both of whom have published monographs on the subject. While not in agreement on some points, they both claim deposition from hot solutions as a necessary condition. Cave-marbles are usually calcite; onyx-marble is aragonite. It would be interesting to determine the mineral in the case referred to in Oaxaca.

Anaconda Copper Company

Criticism from a stock-market point of view has been directed against the Anaconda Copper Mining Company on account of the showing made for the year 1909. A price of $40 per share does indeed seem unwarranted when it is considered that the earnings per share were $1.78. The company is not to blame for what the public chooses to pay for stock, but without prospects for immediate betterment of general trade conditions it is, to say the least, a doubtful policy to continue using up an accumulated surplus in the payment of unearned dividends. During 1909 the Anaconda disbursed $2,400,000 to shareholders, this being $265,227 more than the available profits. The surplus now stands at $4,679,216, having been gradually eroded from the stately height of $6,261,460 in 1907, by persistence in this policy. We believe that it is better practice to face the facts, to live within one's income, and to keep a surplus well guarded during days of stress. However, if the speculative public chooses to pay $40 for a stock of $25 par value under such circumstances it is no affair of ours. On the other hand, it is a matter of deep concern to everyone interested in mining that a great enterprise like Anaconda should be maintained upon a secure footing. In some ways it is the premier copper mine of the world; it has superb prospects for the future; its plant is unexcelled; the milling and metallurgical operations are conducted in a masterly manner, under the direction of Mr. E. P. Mathewson; but there are difficulties still to be overcome, and the company may find need for its resources before improvement in the price of copper shall increase its earning power. The smoke-problem is still before the courts, and the economical way out is not apparent. While the expenses are not analyzed in this report, the mining costs are known to be high. The most encouraging feature of the year was the increase in metal recovered from 57.6 pounds per ton in 1908 to 59.7; the improvement, moreover, was not spasmodic, as shown by the fact that the product in 1907 was 56.1 pounds per ton, which in turn was on approximately the same level as in 1906. The total output for 1909 was 75,860,194 pounds of copper from 1,282,681 tons of ore, and the recovery of precious metals was 2,363,184 ounces of silver and 7466 of gold. The total of ore from all sources treated in the Anaconda reduction works was 3,517,386 tons. The gross costs were $9,820,897, and the cost per ton of ore was $7.65. The net cost of the copper produced, after crediting gold and silver, was 10.7 cents per pound, the precious metal credit being 0.4 cent per pound. During 1909 the company suffered embarrassments from blockades on the railroads cutting off the supply of coke, and also from a mine-fire which put the Anaconda shaft out of commission for many months. This necessitated hoisting the ore from the Anaconda workings through the Never Sweat and St. Lawrence shafts. Among the outside operations of the company are coal mining and lumbering, the sales of coal from the mines at Belt, Montana, being 108,600 tons out of a total production of 147,263 for the year, and the lumber sales reached 22,802,883 feet out of a gross cut of over 24 million. The possibilities of producing acid phosphate from the smelter-fume have been extensively studied, without encouraging prospects of earning a profit. The demand for fertilizers in the West is not yet sufficient to consume a large quantity, and the long haul to the East places a prohibitive freight-charge against the product. Mr. B. B. Thayer, president of the company, calls attention to the difficulty of applying apex rights to determine ownership of orebodies in Butte. He states that the only solution of these conflicts lies in a consolidation of the Butte mines. The relations of the deposits are such that economical mining cannot be conducted in many places upon adjacent properties by independent operation, so that vertical side-line agreements do not avail to remove friction and difficulty. We heartily endorse his position in this matter. In conclusion, it is important to observe that the stock of copper, silver, and gold on hand at the end of 1909 was 5,986,964 pounds, as compared with 6,169,245 for 1908, and that the receipts from sales of these metals during the year were $11,591,845, while in 1908 the corresponding figure was $9,060,472. Considering the increased output for last year this is an encouraging result.

William Phipps Blake

Death has just called the oldest practising mining engineer in America. William Phipps Blake has been actively identified with mining ever since the days of the California gold excitement. He came into the field at a time when men prepared by scientific education were rare in this country. On that account he found prompt demand for his services, and he was known in every mining district of the West. He was a man of deep penetration and of alert intellect, and he soon made his power recognized, so that his aid and advice in scientific matters were sought by the Government as well as by individuals and corporations. He was summoned to Japan in 1862 to conduct scientific investigations for the Imperial Government. On his return he explored the Stickeen river, in Alaska, rendering a report to Mr. Seward, the Secretary of State, which confirmed the reports of mineral wealth and materially aided in securing legislative consent to the purchase of that territory from Russia. It is remarkable that Mr. Blake, at that early time, should have foreseen the probabilities of important resources of gold in Alaska. We were fortunate in publishing an account of this reconnaissance in our golden jubilee issue last week. It was the last article ever written by Mr. Blake, as it was also the first explanation given to the public of the circumstances under which his Alaskan report was prepared. In 1864 he was professor of mineralogy and geology in the College of California. He became geologist to the Commission despatched by President Grant to Santo Domingo in 1871, when the United States was contemplating the annexation of that country. As commissioner to international expositions his career has been notable. He was executive commissioner to the Centennial Exposition in 1876, and in 1878 he was appointed as one of the representatives from the United States at the Paris Exposition. He reported

this world's fair for the MINING AND SCIENTIFIC PRESS writing a series of articles on metallurgic and mining progress as there revealed which had great influence in forwarding the development of those arts in this country. In 1894 he assumed the post of director of the School of Mines of the University of Arizona, becoming professor emeritus in 1905, at the same time he served Arizona in the capacity of territorial geologist.

His published reports and articles number several hundred titles, a partial list of which was recently printed by Mr. Kendric Charles Babcock, president of the University of Arizona. The 'Geological Reconnaissance of California', a work which is now of great historic value, he prepared in 1855; other well known volumes from his pen are 'Silver Ores and Silver Mines', 'Tombstone and Its Mines', and 'Ceramic Art and Glass'. For a brief period in the latter fifties he was editor of the *Mining Magazine*, a paper then published in New York.

Mr. Blake was born in 1826 in New York. He prided himself upon his descent from William Blake of Dorchester, Massachusetts, who arrived in the New World in 1630. Another distinction was that of belonging to the first class which graduated from the Yale Scientific School. Within three weeks of his death he made an examination of a gold mine near the Colorado river in Arizona. Thence he came to Berkeley to receive what proved to be the last honor of his long and useful life, the honorary degree of LL.D., conferred upon him by the University of California on May 18. His name is interwoven with the history of the development of American mining.

The Quicksilver Situation

Quicksilver has been unsteady in price for a considerable period, but as a matter of fact it has not varied in price as widely as other metals, nor as sharply as would be expected from the decreased demand. A remarkable complication of factors enter into the quicksilver situation. There has been an increase in the cost of labor over past years; the deposits themselves have either been largely exhausted or the grade of metal in the ore has lessened. In the early days ore as rich as 20 per cent in mercury was regularly treated; 3 and 4 per cent ore was common; the depths to which mining was carried had not become great. At the same time the metallurgic processes were crude and the losses were large. Today an ore yielding three-quarters of one per cent of mercury is moderately high grade, and at least one of the large California producers is treating material that will not average 0.5 per cent. Formerly the demand was fairly steady. The hydraulic miners consumed great quantities, and in their case consumption was literal, absolute, irrevocable. The wastage into the tailing piles was huge. There will be those who will deny this charge, but our remarks are founded upon personal observation. The waste in stamp-milling was also a great factor. Few companies report their quicksilver loss, but it probably exceeds 20 per cent; the United Alaska Gold Mining Company recently confessed to a total quicksilver loss of 32 per cent, of which the greater part was naturally in milling, not in retorting. In the pan amalgamation process the wastage was enormous; great quantities of quicksilver were lost by 'flouring'. The amount permanently locked up in the normal operation of a plant was also immense. The patio process made a heavy draft upon the quicksilver resources of the world, here the losses were both mechanical and chemical. From 1875 to 1884, when silver mining was at its zenith, the output of the California mercury mines exceeded 50,000 flasks per year; in 1909 it had fallen to less than 16,000. Formerly the metal went in carloads to Montana and Mexico; today the smelter and the cyanider have driven out the old-time amalgamator; and yet the value per flask has kept on a fairly constant level. This has been due to the decrease in the grade of ore, and to increase in the cost of production. Despite the fact that California is still full of promising prospects of mercury ores, capital has been averse to competing with the established producers when they are confessedly in uncertainty as to the future.

The price for a few months was on the ascendant, reaching a maximum of $51 per flask. It has now dropped back to $47.50. The improvement in price was in answer to heavy demands from Germany and Russia, which began toward the end of 1909. The shipments made to those two countries were approximately 1500 and 1000 flasks per month for a considerable period. The object of these importations was obviously to manufacture fulminate, and the motive was therefore at bottom political. This demand has now subsided, and the market drops. The manufacture of fulminate is one of the chief uses of mercury today. A classification of the consumption cannot be made with much reliability, but the demand, in order of quantity, is for amalgamation, for making fulminates, for mirror plating, for thermometers and other philosophical instruments, and for pigments. In the early days large shipments were made to China for conversion into vermilion; this trade has now wholly ceased.

The quicksilver market is today under control of a virtual monopoly. As in the case of so many other metals, the house of Rothschild exercises a dominant influence, but the business in none is guarded with such secrecy as in mercury. The most acute observers of production are unable to trace the inflow and outflow of the stocks held in London by this great firm. It can dictate prices, and it does. Until some new use shall be found for this metal the Rothschilds will determine the quotations. It is interesting to note, in this connection, that the E. I. du Pont de Nemours Powder Company is preparing to deliver itself from market uncertainties by becoming a producer of quicksilver. This, at least, will have the good effect of encouraging the manufacture of fulminate in the United States. The metal is protected by a duty of 7 cents per pound, which is the salvation of mercury mining in this country, but it happens to work against the making of fulminate. A large proportion of that substance used here is made in Canada, using quicksilver imported from England. The entry of the powder companies into the arena as producers would, however, affect the present miners of that metal to no small extent.

Mining and Aviation

By A. E. Berriman*

Mining engineers, of all people in the world, have reason to pay close attention to modern progress in aviation, for in connection with mining it is already possible to imagine a field of utility for the aeroplane in its present state. For the time being the aeroplane happens to be a plaything of the rich—so was the motor car, ten years ago. Such a lesson in the rapidity of twentieth century progress naturally makes for an optimistic outlook on the future of flight and although it does not justify the inane faith of those who 'suppose' that flight will soon supersede every other system of locomotion, it at least rebukes the equally thoughtless comment, "what's the use of a machine like that," which is too frequently the remark of those whose minds are unable to grasp more than the obvious disproportion that now exists between the great size of the flyer and the dimensions of the man it carries.

Flying has not yet taken its place as a recognized system of economic transport in the realm of commerce but undoubtedly it is on the threshold of that domain. It only awaits the man who shall arise and show his fellows how to apply the new found art to the furtherance of some industry wherein it may serve a useful purpose. Undoubtedly, such men will in good time come forward—mayhap the mining engineer will be among the first. He is a man whose work leads him far from the traces of civilization, into corners of the earth where roads and railways are only conspicuous by their absence, oftentimes into places whose topography unfortunately maintains their isolation even while their mineral wealth causes them to permanently harbor a community of men. Who among traveled mining men is as familiar with the awkward situations of such mines as is the mining engineer, and who has not realized the drawbacks of the narrow line of communication by which they are in physical touch with the world at large? What a godsend the telegraph and telephone have been in breaking down the absolute character of the barrier by which isolated centres of life would otherwise be imprisoned. Yet the electric wave does but convey a thought and how often, in this material world, does it not happen that more substantial goods need transport? What an advantage it would be, upon occasion, to possess the means of traveling quickly from a mine to the nearest town; to discard tortuous mountain paths and to go straight 'as the crow flies' through the air.

Four hundred years ago a few men dreamed of such things, Leonardo da Vinci was one of them. One hundred years ago a few men still pondered on the problems of flight, Sir George Cayley was one of them. Twenty years ago an aeroplane first rose from the ground, in it was Ader of telephone fame. Three and a half years ago Santos Dumont won the first flight prize by flying 25 metres under official observation. More than a year elapsed before Henry Farman succeeded in flying round a circular course of only one kilometre in length, but eight months afterward Orville and Wilbur Wright had each flown for over an hour at a stretch. That was in September, 1908, since when about 50 pilots have achieved flights of over 60 minutes duration, several of them remaining aloft twice as long. The English channel has been crossed without touching water and cross-country journeys of over 100 miles in extent have been carried out without touching the ground.

Admittedly these latter are not ordinary exploits, but this does not detract from the importance of the fact that the present state of the art has already been developed to a degree of real utility. Any modern aeroplane might be used to perform a journey of 30 miles with reasonable certainty of success. There is, today, sufficient evidence to warrant a mining engineer seriously considering the air as a path of economic locomotion where natural difficulties interfere with the use of terra firma to the best advantage. A year ago such a thought would have been deemed a mere poetic wish; how long it has passed from the realm of imagination it would be difficult to say. Many readers believe it to be there yet, but one day they will surely read in the Mining and Scientific Press that "—— have an aeroplane at the —— mine and are using it for special journeys to —— which is 20 miles distant across difficult country." Then they will realize that the aeroplane is a vehicle of locomotion even in its present imperfect state, and they will no longer wait for some luxurious 'Aerial Century Limited' any more than the pioneer users of motor cars waited for the coming of the motor 'bus.

Doubtless the introduction of the flying machine into the realm of mining is involved with many difficulties and needs not a little pluck; but doubtless, too, the first man who carried on traffic in a boat upon the waters was considered before his time. Nor must it be supposed that the successful use of the atmosphere in one place and for a certain purpose necessarily implies that it affords a universal solution to the problem of economic transport. The wheel, even in its simplest form, has proved such a wonderfully efficient device for reducing the co-efficient of traction that it makes quite indifferent conditions of transport on land many times superior, on this score, to those obtaining with the 'aerial sleigh'. The resistance to motion in terms of the load is in the order of 2% on decent roads and 1% on rails. In the air the resistance to horizontal flight is in the order of 15%; an amount that is comparable with the resistance offered by a sand road.

On the other hand the air goes everywhere and affords a ready made path direct to the goal. It involves no capital outlay and no expenditure on maintenance. It can be traversed at any speed and as the co-efficient of flight resistance is independent of velocity, a very high rate of travel in a flying machine suitably designed for the purpose would not be attended by such disproportionate increase in the expenditure of power as occurs with marine navigation.

The modern aeroplane in its biplane form carries about 500 sq. ft. (total) of supporting surface on two decks having a span of about 40 ft. Equipped with a nominal 40-hp. gasoline engine such a ma-

*Technical Editor of *Flight*, London.

chine weighs about 800 lb., and is capable of carrying in horizontal flight an additional load of about 450 lb., of which about 200 lb. is represented by the pilot and fuel, thus leaving a surplus lift of 150 lb. to support a passenger or a dead load. Such figures are mere approximations, but they serve as some indication of the present order of things. In mountainous districts the necessity of flying up hill and in rarified atmosphere would involve special consideration, but, just as it would be proper to regard a journey of 30 miles as lying within a practical range, so would it be reasonable at the present time to plan to carry a useful dead load in the order of 100 lb. These are not, perhaps, very encouraging figures but they at least represent a margin of utility. It is probable that many a mining engineer has known occasions when he would have been more than glad of the opportunity of getting even a smaller load transported 30 miles in an hour, which is in the order of modern flight speeds, and it is conceivable that many situations now exist that would justify the capital expenditure of $5000 (aeroplanes cost anything from $2500 to $7500 at the present time) and the wages of the pilot.

It is always difficult to illustrate a general argument of this character by a specific example, but every mining engineer will be able to call to mind cases in which merely being able to get up in the air and look around would have been invaluable. It may sound a little far fetched to suggest an aeroplane as part of the equipment of a prospecting party, but imagine what advantages would accrue if it were shown to be possible. Paulhan, the famous aviator, is in the habit of using a camera while he flies and if such pictures could be taken successfully of strange ground they would surely be useful. But, even if these things are in themselves rather remote, much progress may nevertheless result merely from having the utility of the atmosphere recognized and the minds of mining engineers turned thereto. The aeroplane is not the only aerial machine—when the wind blows it might be worth while trying to use a man-lifting kite.

Alaskan parties of the United States Geological Survey are already taking the field. G. C. Martin will investigate the Matanuska coalfield. Adolph Kopf will make geologic surveys in the Juneau-Berner's Bay region. U. S. Grant will work on Kadiak Island. A. G. Maddren, with a topographic party under R. H. Sargent, will be in the Innoko-Iditarod region finishing the season on the headwaters of the Kuskokwim. P. S. Smith will study the Koyukuk region, going as far as Kobuk. D. C. Witherspoon and F. H. Moffit will survey the south flank of the Alaska range with headquarters at Susitna. At the same time J. W. Bagley and S. R. Capps will work on the north side of the range. A. H. Brooks will visit several of the parties in July. L. M. Prindle will remain through the season in the Washington office.

Unless otherwise expressly stated therein a covenant in a mining lease to mine the premises continuously will be taken to mean continuously to the end of the term for which the lease is granted.

Genesis and Classification of Mexican Onyx

By E. M. Lawton

One of the products of Mexico now coming into popular use in the United States for decorative building purposes is the so-called Mexican onyx. Strange as it may appear, various eminent geologists are at variance with regard to the genesis and formation of this interesting product. While it is a deposit frequently found in the Sierra Madre range in Mexico, yet without doubt the opportunities for studying its character and origin are not so easily found in other parts, which compels the evolution of a theory, rather than the actual study which the opportunity in Mexico affords.

Real onyx is, of course, a variety of chalcedonic quartz, but instead of classifying it as a silicate, one is accustomed to think of it as akin to the agate or carnelian. In fact, ancient writers, such as Pliny, have considered it a semi-precious stone, and it has been much used in making cameos. This is the true onyx, but Mexican onyx has a different composition and origin.

Dana declares it to be calcite ($CaCO_3$), with rhombohedral structure, while the American Encyclopedia says that it is aragonite, which would necessarily be an orthorombic crystal and without the cleavage of calcite, although with the same chemical symbol.

I have been engaged in developing onyx-marble quarries in Mexico, and have hesitated to advance an opinion in the face of the differences between eminent authorities, but the metamorphism is so apparent and clear in the simplest study of these deposits that it should be easy to classify the rock and determine its origin. In the quarries in question, being those of Etla in the State of Oaxaca, the surface or capping is a blue limestone which is used by the natives in making an excellent quality of lime for mortar. On removing this capping, streaks of a crystalline onyx are found, and this mixture of limestone and onyx continues until a decided slip is encountered, of a soft white stone almost like slacked lime in appearance, but much harder. This white band usually marks the solid deposit of onyx-marble, but even in the solid blocks are frequently found portions of yet unchanged limestone.

The change from limestone to aragonite (for its lack of cleavage would certainly eliminate calcite) is undoubtedly a paramorphic change which is simply a crystallization, resulting from the disintegration of the lime rock by the seepage of the surface waters, decomposing the solid rock into the white semi-powdered form, until a thin line of crystallization commences. This is gradually added to, not unlike the stalagmitic growths in caves, until the whole mass is disintegrated and crystallized. Certain it is that it is not formed by deposition from hot solution or from vapors, for the formation is even now going on. Nor could it be a deposit in pools, for it occurs in the high mountains and on the hill slopes, where the topography and the form of the deposit will not admit of such an assumption. It has been suggested that it might be formed in this manner also, by the

filling up of caverns, which seems equally untenable. Frequently pockets of clear, perfectly sweet water are found hermetically sealed in the onyx, the sides of the pockets being studded with the small crystals peculiar to caverns where lime water is dripping.

The quarry development gives perfect examples of the various stages of the mineral change. To a student of geology it is worth a long journey to investigate this. It is to be hoped that it may be studied at no distant date by some one more able than myself.

OUR ANNIVERSARY

Numerous letters and telegrams have been received congratulating the MINING AND SCIENTIFIC PRESS on its fiftieth anniversary. From among those read at the dinner given the staff at the Palace Hotel May 21, the following extracts may be of interest:

I had hoped to be able to comply with your invitation and write a special article for the number of the MINING AND SCIENTIFIC PRESS commemorating its fiftieth anniversary; but the Jubilee Celebration at the University of California and pressing duties connected with the closing term have made it impossible for me to do so. I cannot refrain, however, from sending a word of greeting on this occasion. Semicentennial anniversaries are so rare in a new State like California that they are more marked epochs here than they would be in an older community.

Some of my earliest boyhood recollections are associated with the columns of your paper. I can well remember the very vivid impressions made upon my youthful mind by its descriptions of wonderful processes for extracting gold from its ores and of machinery for extracting the ore from the earth. Looking back over its pages, it is interesting to see how the minds of the inventors of each period were busy in working out every possible variation of some theme characteristic of the period. Methods of placer and hydraulic mining came first; then gold and silver, quicksilver and copper (vein) mining followed in their turn; amalgamation processes of every kind—the Mexican arrastre, the patio process, battery and plate amalgamation, the use of sodium amalgam, pan amalgamation, with the employment of every conceivable chemical, have been described in your pages. Then followed methods of concentration of sulphide ores; the development of the chlorination process in all of its various forms; then your pages were filled with accounts of the hyposulphite leaching processes for many years, just as now they are largely devoted to the cyanide process.

The origin of your paper harks back to the period before the introduction of engineering art and scientific methods into the mining and metallurgy of our country; and almost the entire history of the development of the American mining and metallurgical art may be traced through the back numbers of your paper. They are, in fact, a veritable museum of curious methods and processes, many of them long since abandoned; but some of these nearly forgotten descriptions contain living germs of useful ideas which, falling on fertile soil, may even yet bear fruit. The pages of the MINING AND SCIENTIFIC PRESS have always been clean; they have never been for sale. And through its darkest hours it has always kept an honorable name. It has always come very close to the working miner—more so than any other mining paper in the world. It is found in every mining camp west of the Rocky Mountains, and is read and quoted all over the mining world. Its pages have constantly grown in value, and particularly since Mr. T. A. Rickard took charge of the paper it has taken a position quite in the lead of the times. May its future be as bright as its past has been honorable!

S. B. CHRISTY.

I regret exceedingly that I will not be able to attend the dinner to be given on the occasion of the fiftieth anniversary of the founding of the MINING AND SCIENTIFIC PRESS. I have followed this paper now for forty years of its existence, and so certainly feel that it is an old time friend. I wish it all the success possible in the future and that it may celebrate fifty more fiftieth anniversaries.

JOHN B. FARISH.

I am very much pleased to get your letter of May 10, inviting me to the dinner on the 21st to celebrate the fiftieth anniversary of the MINING AND SCIENTIFIC PRESS. I am sorry to say that it will be quite impossible for me to go down on this occasion. However, I send you herewith my felicitations on the event, and hope you will all have a good time.

J. R. FINLAY.

I had hoped to be present at the California celebration, and then at yours, but I am held here and cannot get away until some time in June. I hope to see you some time this summer. With best wishes for the celebration and the future, and congratulations for the way the editorial staff is keeping up and improving the PRESS.

C. F. TOLMAN, JR.

I do not expect to be in town on that date. I shall leave this city *Deo volente*, Thursday morning next, not to return until after you shall have finished your celebration. Thanking you sincerely for the courtesy of your invitation, and with compliments of the season to the MINING AND SCIENTIFIC PRESS.

CURTIS H. LINDLEY.

I regret very much that I will not be in San Francisco at the time of this function. As this letter will reach you after the date of the anniversary, I can only add what probably has been said many times at the function, that I wish you another fifty years of uninterrupted prosperity.

J. PARKE CHANNING.

Wish I could be on hand May 21 to celebrate the golden anniversary of the PRESS, but there is no chance of my being in the West before next month at the earliest. With kind regards and best wishes to all connected with the PRESS.

F. LYNWOOD GARRISON.

I am sorry not to have been able to be in the city at your anniversary jollification. Please accept congratulations on your anniversary number. It is worthy and valuable.

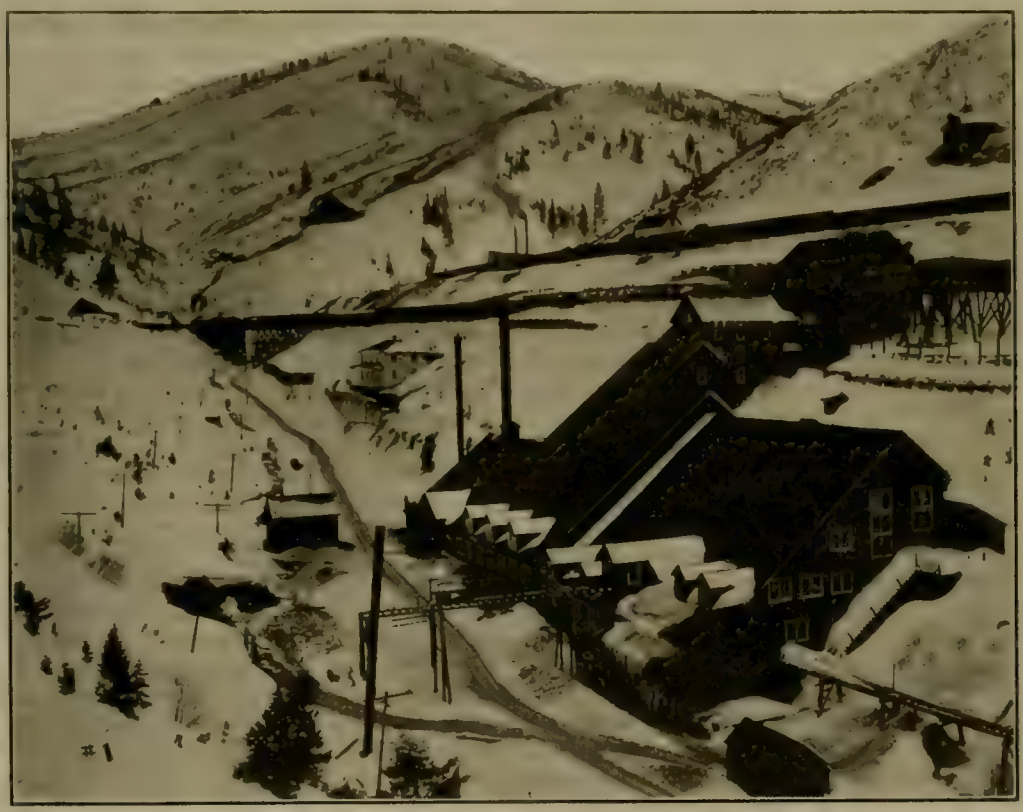
HORACE V. WINCHELL.

Park City, Utah

STAFF CORRESPONDENCE

The Daly-Judge mine at Park City, Utah, is shipping 25 tons per day of first grade ore and is concentrating 150 tons. The mill ore runs 6 to 9% lead, 4½ to 9 oz. silver, 6½ to 12% zinc, and 10% iron. The mill work results in concentrating 3½ tons into 1, the zinc-iron concentrate being sold to the Grasselli Chemical Co. which has a plant at Park City; the lead-silver product is shipped to the smelting plants in Salt Lake valley. The high-grade ore probably will run 20 to 27% lead and 25 to 35 oz. silver, though some shipments have run as high as 70 oz. silver and 4 to 5% copper, with a corresponding increase in lead. The mine originally was opened by a vertical shaft, 1650 ft. deep, and later by a transportation and drainage tunnel which starts in Empire canyon, running 6600 ft. southwesterly to the shaft at its 1200-ft. station. The tunnel is equipped with electric haulage facilities. Through this avenue the miners go to and from work, and the ore is hauled out to the mill and shipping bins. The fuel and other supplies for the steam plant are taken in this way and hoisted to the collar of the shaft, 1200 ft. above the tunnel level. The shaft-house contains a double-drum steam-hoist, installed in 1891, and four steam boilers. A Nordberg air-compressor, installed last January, having capacity of 2100 cu. ft. of free air per minute is run by a rope-drive from a 350-hp. electric motor, the compressor having a constant speed of 87 r. p. m. The motor is of General Electric make. It derives its power from the Snake creek power plant, the current coming over the transmission line at 6600 volts, is stepped down to 440 at the compressor plant.

The mine workings open three veins on the property. The Ontario-Daly fissure strikes northeast and dips northwest. To the depth of 1500 ft. this is a fissure in the limestone, below the 1500-ft. becomes a contact vein between limestone and quartzite. The Middle vein, 1000 ft. southeast, almost paralleling the Daly fissure, is a bedded vein between a limestone hanging wall and a quartzite foot-wall. This is the vein from which the old Anchor company obtained most of its ore. The Black vein, still farther to the southeast, has more of an easterly strike than the Ontario-Daly, and dips nearly south, the hanging wall being limestone and the foot-wall quartzite. All three of the veins named are important, and the ore-bodies therein are well developed. The Ontario-Daly is entered on the 1200-ft. level by a short cross-cut from the shaft, connecting with a 2600-ft. drift running southwesterly along the vein, but keeping within the foot-wall. Raises No. 2, 3, and 7 have been made on the vein from this drift and stoping is in progress. The stopes off raise No. 7 are 10 sets high, the width being 30 ft., but the vein matter is accompanied by considerable waste. A cross-cut which starts from the Ontario-Daly fissure some 2000 ft. from the shaft runs easterly to the middle vein, opening into the main drift on the latter, which connects with a cross-cut running east from the shaft; thus establishing a circuit for ventilation as well as ore haulage. Several raises have been made from the



Daly-Judge, Park City, Utah. Entrance to Main Tunnel on Left

1200-ft. level on the Middle vein, one of these being raise No. 1, which is up 80 ft., a stope therefrom showing a good body of ore. The same cross-cut that runs east from the shaft to the Middle vein has been extended on to the Back vein, connecting with drifts on the latter. All the foregoing relates to the 1200-ft. level. Starting from the 1400-ft. station of the shaft, a cross-cut has been run to the Ontario-Daly fissure, and another cross-cut has been driven in the opposite direction to the Back vein, about 2000 ft. distant. From the 1500-ft. station connection is made with the Daisy stope on the Middle vein, the main body of the ore being iron, but within are narrow seams of ore carrying lead, silver, and gold, one 5-ton shipment of which ran $138 per ton. The Back vein has likewise been opened by a 1500-ft. level. A connection was made from the 1600-ft. station to the Ontario-Daly fissure some years ago, but as all workings below the 1500-ft. level are now under water that part is not accessible. It is understood that the stronger bodies of ore on this main fissure are to be found at and below the 1600-ft. level, where the lime-quartzite contact begins. The Back vein, which averages about 10 ft. wide from wall to wall, accompanied by a lot of waste, is opened on higher levels from the 700 down to the 1500-ft. The mine work is superintended by R. T. Mason.

A Starrett mine pump having the capacity of 800 gal. per minute, operated by compressed air, is set just below the 1500-ft. station, raising water through a 4-in. pipe part way, then through a 6-in. pipe to the drainage channel on the 1200-ft. level. It is said an 8-in. column should be used to get full capacity. This is a new type of pump, made in Salt Lake, and is said to work admirably. A large flow of water, which drains the higher channels on the Ontario-Daly fissure, is arrested on the 1200-ft. level and diverted to the drainage tunnel, thus preventing it from sinking to the 1500-ft. level and adding to the volume which has to be pumped to unwater the lowest workings. George W. Lambourne, general manager for this company, states that a contract has been let to Free & Taylor, of Salt Lake, to drive a 14,000-ft. drainage and transportation tunnel, starting from Snake creek, on the opposite slope of the Wasatch range, cutting into and draining the Daly-Judge ground to a depth of 1800 ft. below the collar of the shaft, and 600 ft. lower than their present transportation tunnel. This project is being undertaken by the Snake Creek Mining & Tunnel Co., composed of Jesse Knight, H. O. Hanke, G. W. Lambourne, T. F. Bayard, and others.

The Daly West mine, also at Park City, is producing every 24 hours from 350 to 375 tons of milling ore and 20 tons of first-grade. The mill ore, which is taken mostly from the 1500, 1700, and 1800-ft. levels, carries approximately 10% lead, 15 to 18% zinc, and 14 oz. silver. The product obtained by the efficient concentrating methods employed in the mill consists of a lead concentrate running 40 to 45% lead, 35 to 38 oz. silver; and a zinc concentrate carrying 40% zinc, 4 to 5% lead, and 15 oz. silver. The first-grade ore, shipped to the smelting plants without concentrating, is taken mostly from the stopes between the 900 and 800-ft. levels, and contains 70 to 80 oz. silver per ton, and 22% lead. The mill ore is hoisted to the collar of the shaft, trammed over to the mill and dumped into the bins; the first-grade ore is landed at the 1200-ft. station, and from there taken out through the main haulage-way to the shipping bins at Park City. The shaft is 2100 ft. deep, at the base of which is a 500-ft. cross-cut through which connection is made with the great Ontario drainage tunnel, and by which this mine is thoroughly drained. The great fissure, from which most of the ore is obtained, stands at a dip of 70° north, has a limestone hanging wall and a quartzite footwall, the strike of the contact being northeast-southwest. There are a number of parallel fissures in the quartzite, each branching out from the main fissure at an acute angle. These subordinate fractures are especially apparent on the 1500 and 1700-ft. levels, and where they join the main fissure there occurs a distinct widening of the latter and a corresponding expansion of the orebody. In some cases the ore extends 20 to 30 ft. from the principal lode into the minor fissure. On the 1700-ft. level the main drift in ore has a length of 757 ft., the average width of ore being 15 ft. The greatest width at any point is 30 ft. The face of this drift is in ore, and E. L. Talbot, mine superintendent, anticipates that it may be continued hundreds of feet farther. Extensive stoping is in progress above the 1700-ft. level, and to carry on this work advantageously a double chute and manway has been put in every 50 ft., with an intermediate chute between. The body of ore in the stope 100 ft. above the 1700-ft. level, off No. 6 raise, seemed 30 ft. wide and free from waste. This stope has been carried up 14 sets, stringer sets of 10 by 10-in. timbers being used. No. 6 raise, now up 100 ft., is being extended up to the 1500-ft. level. A winze has been sunk from the 1700 to the 1800-ft. level, following the dip of the vein; and a 317-ft. drift in ore has been run from the bottom of this winze on the 1800-ft., which at present is a blind level. A cross-cut is being driven from the shaft at the 1900-ft. station to open the main fissure and establish what will be the 1900-ft. level. This cross-cutting has progressed 587 ft., the remainder of the distance to the fissure being 800 ft. Eventually, when the 1900-ft. level shall have been made, a winze will be sunk from blind 1800 to the 1900. These facts serve to illustrate Mr. Talbot's method of development and of obtaining good ventilation. The orebody on the 1700 seems wider than that on the 1500-ft. level. The ore found on the 1700 and 1800-ft. levels shows an increase in the zinc content without any diminution in the lead content, but with possibly a slight decrease in silver. The hoist, air-compressor, and mill machinery are all steam driven, the steam-boiler plant having an aggregate of 1000 hp. The coal for boiler fuel is brought in through the main haulage tunnel to the 1200-ft. station of the shaft, then hoisted on the 3-deck cages to the collar of the shaft and dumped into the bins adjoining the boiler house. Hand instead of mechanical stoking is employed. The mill concentrate is brought to the shaft in cars, lowered to the 1200-ft. station, thence hauled out through the transportation tunnel to the shipping bins.

Fifty Years in Cornwall

By Thomas Rickard

Introductory. First and foremost among the improvements of the last fifty years are doubtless the Bickford & Smith safety-fuse and Nobel's invention of dynamite. Let those who may be disposed to doubt ask the old miners how it fared with them when, as yet, they were compelled to fire with the rush or the goose-quill filled with rough powder and with a sulphur wick for train; ask them how they did when sinking their flooded sumps without the invaluable waterproof safety-fuse. The loss of life and limb through miss-fire, and the consequent necessary clearance of the holes for renewal of charge, was appalling in those days. Decidedly their friends Bickford & Smith will deserve to rank with Abel and Humphrey Davy among the canonized in the miner's calendar. The electric spark for firing belongs to the same order of beneficent inventions, but though invaluable and indispensable for certain kinds of engineering, such as railway and marine and sometimes in mine work, it is not much employed in ordinary mining.

In minor particulars, if indeed, they may be called minor, such as the expeditious removal of the débris, the hoisting and conveyance to the battery or the dump, there is also improvement. In the better equipped mines not only are the rail-gradients, the shoots and tips, in better order than formerly but the cage has replaced the 'kibble' and the trucks (the Decauville side-tip) are of excellent construction; moreover, the endless rope-and-clamp conveyor—of Kimberley type—may be observed in working perfection. In this group of operations the advance is evident and labor-saving devices are being pursued in a manner that is of excellent augury.

It is, perhaps, to be regretted that some better kind of light has not superseded the candle. The acetylene lamp is in occasional use, but, not being favored by the miner, it is rarely adopted. Next in order of efficiency comes the rock-drill, with the air-compressor, which, under certain circumstances, is an invaluable boon to mining. It would be well if financial considerations oftener favored its use in opening up wider fields of exploitation. It is noteworthy, if not disappointing, that as yet the electric drill has not been brought within the domain of the practicable. Though tried in many places, notably in America and Scandinavia, it has yet to be proved a success.

Faith in 'dowsing' as the prospector's means of diagnosing his ground, though not dead, is almost extinct. It survives sporadically and it has been my luck to encounter adepts in the craft ready to offer their dubious services on conditions intended to be seductive. With their hazel twig these picturesque survivals appear as if taken from the wood-cuts of Agricola. The determination of the site of ore deposits by the magnetic needle, not infrequently practised elsewhere with good effect, is seldom practicable in the case of ordinary lode formations and only when ore masses are magnetic. The hopes created some years ago by experiment in mines in the United States have not blossomed. In this field of work the dowser's hazel twig is still foremost in disputing precedence with diamond drilling.

Ordinary transport by road is nearly in the same condition as fifty years ago, though only a decade earlier the country was yet without the boon of a railway. In the days before the railway it was not uncommon to meet mule-trains packing the 'tinstone' from the mine to the mill; the latter being in some place favored with water for power and other purposes. It seems hardly credible that the Duchy of Cornwall, the motherland of the expert tinner, should in this particular have been so recently in the same category with Spain, Mexico, or Sicily, as regards cross-country conveyance. But so it was, though the county even fifty years ago could boast of having excellent highway communication, but more in the western than in the eastern half of the peninsula. In fact, East Cornwall to this day cannot be said to excel in its roads.

Drainage. In pumping there is little actual improvement to record though there certainly is much to indicate that important changes are impending. The revolution that was expected from the introduction of electrical pumping has yet to be realized. Experiment, of which there has been abundance, has hitherto been marked with disappointment and failure, though the reason for failure remains a puzzle. That the electric pump would not work so economically as the old arrangement was easily enough foreseen, but why there has been so great a fiasco is difficult to understand. It was at least to be expected that, properly applied, the electric pump would speedily drain any of the old mines, and that, too, with less plant outlay than is otherwise necessary, but such has not been found true. Despite many attempts and frightful expenditure, the pump is yet in the stage of experiment. In this respect, pumping, to all intents and purposes, is as it was half a century ago. Seeing what has taken place in other mining regions of the world it may safely be predicted that a new order of things is destined to prevail in Cornwall also, and this prediction is largely strengthened by the great economy that attends the adoption of the producer-gas engine. Power generated by the use of this engine and transmitted from the nearest coalfield will probably have to be employed for the drainage of the deep mines of Cornwall. But even then the engineer who may undertake this change will have no easy task to perform, for he will have to compete with the direct-acting engine, working with almost perfect condensation and wonderfully capable of control in speed and degree of expansion, and working with a consumption of only 2½ lb. coal per hp. hour. The consumption of coal in most foreign mining districts, except now in France, is oftener 5 to 7 lb. than 2½ lb. per hp. hour, and in many places it is four times more than in Cornwall with the beam engine.

By the way, may it not be said that had the unrivaled performance of the perfected beam-engine as left to us by the engineers of the 'fifties' and 'sixties' been better understood it would have been better for Cornwall and for those who have so recklessly spent their money on the hitherto almost fruit-

less experiments in electrical pumping. With this, as with the attempt to realize profit by the treatment of the dumps of the old copper mines, there has been lamentable lack of sound judgment. During the spacious times of the 'fifties' and the earlier 'sixties' the Duchy was happily supplied with good technical intelligence in all its branches. In my world-wanderings since those days I have failed to meet with industrial activity of any kind that can be said to be carried on with better ability or greater zest than that of mining in Cornwall. In future we shall hear less of primitiveness of methods in the county.

I confess to surprise that engineers in Britain are so slow in appreciation of the place in mining equipment to which the gas-engine has attained. In the south of France, for instance, this engine is in general use and the ordinary steam-engine and boiler are scrapped all along the line; the economy is immense. I also wonder that mining engineers generally in Britain should seem to be unaware of the success with which the induced-current pump or hydraulic elevator has been employed. I have used it with marked advantage, and without doubt, it is destined to play an important part in the drainage of mines.

Dressing. I choose to retain the term 'dressing', for, like the *aufbereitung* of the Germans, it is often more expressive than the 'milling' of the Americans or the *traitement mechanique* of the French. Decided improvement in stamping has resulted from the tardy introduction of the Californian gold-quartz mill, from the invention of the pneumatic battery, and from laudable attempts in other particulars. I think, however, that the improvement is often exaggerated, for, although the Red River 'streamers' are less happy in their gleaning operations, I fail to learn that there has been any marked saving in labor, and it is said that the tin oxide does not go to the smelter in cleaner condition than formerly, but rather the contrary. It is worthy of note that the California battery may be seen at work alongside the Cornish type that it was supposed to supersede, and on the same mine the pneumatic stamp is also at work. Batteries of these three contending forms mingle their thunders. At some of the mines, for instance, Dolcoath, East Pool, and Wheal Kitty, the old form of mill has made way for the pneumatic battery. This would seem to indicate that the survival of the fittest in the way of tin-dressing equipment in its essentials will henceforth be the pneumatic stamp at one end and the perfected automatic frame table at the other, with varying devices filling the requirements between. Here some are found clinging to the buddle in one or other form, while others are partial to the continuous percussive table as well for the finer sand as the slime. The choice of appliance for the functions of this intermediate stage is, of course, regulated in accordance with the varying nature of the veinstuff but as yet no device is in the field by which the 'framing' can be discarded.

Among the least susceptible of advantageous change is the dressing that follows the calcination of the tin croppings in order to rid them of the pyrite elements. The immemorial 'stripping, keeving, and deleuring' is, in most cases, still the practice, though in some few mines—Crofty, for instance—the percussive table has been adopted for performing the same purpose.

Conspicuous among improvements is electro-magnetic separation. It has done excellent service in such mines as East Pool, Clitters, and Crofty, where the tinstone is associated with wolfram. By this apparatus a product that formerly corrupted, and greatly depreciated the value of the tin concentrate, is made a valuable subsidiary source of profit. Mention may be made of the improved saving of the arsenic. Crofty affords a brilliant example in this particular as the extraction of the wolfram.

Saving of Residue. The Red River problem, in spite of all kinds of ingenious devices that have been applied to it in endless succession during generations, is still unsolved and save for some remedy rather of a chemical than mechanical nature it seems well-nigh insoluble. It is true, however, that wastage is less than fifty years since, as is proved by the fact that the 'streamers' along the course of the effluent waters are not so happy as they were. It is well to bear in mind that the contents of the ore going to the mill is reckoned in pounds of tin per ton of ore. Ore of 2% yield, or 40 lb. black tin per ton, is considered good. Many of the mines yield ore of a lower average even than this, some, indeed, as in the St. Agnes district with less than 1%. Closely examined the cassiterite is so finely distributed that it is barely detectable and that portion of it released by calcination seems almost imponderable. As to much of the tinstone from the deep mines, one may well wonder that the extraction is so good. To those who may be curious as to the manner in which the wastage is traced in the course of dressing, I would commend the excellent article by H. W. Hutchin appearing in *The Mining Magazine* for April, 1910. This 'bleeding' of the ore in the dressing is likely to continue to be a serious handicap; and with this unavoidable wastage at one end and the onerous royalties and the barbaric way of levying them at the other, the miner is often fated to struggle for what looks like the unattainable.

It may be necessary to submit to the inevitable in the matter of wastage by dressing but to have to pay 6 to 9% of the value of the gross output, often irrespective of its being won at a loss or profit, is a cruel hardship. Verily this is a millstone round the neck of the miner. I have before me the latest account rendered by Dolcoath mine, from which it appears that out of the gross profits—amounting to £17,683—the landowner's share is nearly £5000 or about 35%! The published account of the profits of the company show that in some years the landlord's portion was greater than that of the shareholders'. When will the landowners of Cornwall in their methods of levying royalties now so barbaric, be brought into line with those of other leading civilized countries, where the landowner is content with 5% of the earned profit? This is the well known custom in all the leading continental countries, save, perhaps, in the Sicilian sulphur mines which are subject to papal administration.

Other Industries. To the fifty years belong the pitch-blende discoveries, or, shall we say, the excite-

ment of hopes by the attempt now so laudably being made to this connection under the guidance of public-spirited scientists and engineers. Although not yet demonstrated to be in the domain of industrial success, the prospects are fascinating. Note must be made also of the recent attempt to extract gold from the sea water, for, though unsuccessful, the experiments have at least made it more than ever conceivable that the water when treated in larger volume may surrender its gold profitably. The china clay industry, which has attained the vast proportion of nearly 1,000,000 tons per annum, is undeniably profitable and expanding. So important is the trade in this commodity that it has not infrequently acquired an importance superior, as an industry, to everything save agriculture. There is little to record in change of working methods either in the getting of the clay or the reduction of the felsite for clay, save that, in some cases, the clay is piped to the coast, and there has been some experimenting with the vacuum-filter. China clay together with floriculture has largely compensated Cornwall for the collapse of the once famous pilchard fisheries. Decidedly Cornubia has many resources and is a wonderful country. It has survived many an apparently moribund condition and will survive many another.

Present Conditions. But when all is said of the improvement in methods and appliances, the fact remains that with tin in demand at over £150 per ton, or, say £90 for 'black tin', few mines are in operation, and of these it may scarcely be said that any are in a really flourishing condition, in spite of a large expenditure supposed to have been primarily for underground development and general preparatory arrangements. This provides a comment the reverse of flattering on the innovations and improvements in drainage and dressing methods, of which so much has been heard during the last decade. Formerly £60 per ton for black tin was considered altogether satisfactory, but now with £90 a pervading note of discouragement is observable. Nobody seems to be happy or even hopeful. This certainly is not what was expected by those who have parted with their money to vivify tin mining nor by those who advise it. In hard reality there are few more ungrateful propositions in mining than that which faces the tin miner of the present day in Cornwall. Doubtless the difference in respect of the cost of labor accounts to a large degree for the depression. The workpeople, it seems, do less work than formerly, while receiving nearly twice as much pay. It is generally said by the managers, and scarcely disputed by the men themselves, that compared with fifty years ago the day's work is less though the pay has nearly doubled. Formerly it was £3 per calendar month, whereas now it is 25 shillings per week. In most cases labor represents 40 to 60% of the total cost. The increased cost of labor is, therefore, approximately £30 per ton of black tin, if won at £60. The men seem to have lost that interest in the welfare of the master and his mine though more pains are taken in respect to their health and safety and to make their lot generally more tolerable.

The murderous ladder-way, which in deep mines was attended with great danger and frightful loss of vital energy, is a thing of the past, nor do you often see the miner at the face toiling with his candle placed horizontally to keep it alive in bad air. In the struggle for existence the miner has been driven by the frequent lack of employment to far off countries, where he finds a welcome and much better pay. Only the aged and the youthful remain at home. The service has suffered in quality and the attachment to home industry has declined. It will take a long time to remedy this, if, indeed, it is fated ever to be remedied. Finally, the retrospect of Cornish mining, in the 50 years since the MINING AND SCIENTIFIC PRESS was founded, provokes one broad conclusion, namely, that while technical methods have improved this improvement has not been inadequately translated into economic results.

PLATINUM IN SOUTHEASTERN NEVADA

By HOWLAND C. BANCROFT

*At the Key West and Great Eastern prospects in the Copper King mining district of Clark county, Nevada, platinum occurs in peridotite dikes of the enstatite-mica-picrite variety. The properties are situated in the rough foothills of the Virgin range at an elevation of approximately 3600 ft. and are eight or nine miles from the Virgin river. The rocks in the immediate vicinity are gneisses, probably of pre-Cambrian age, and are intruded along the planes of schistosity by basic dikes which contain, in addition to platinum, primary pyrrhotite (probably nickeliferous), magnetite, chalcopyrite, and pyrite. Besides the periodotite dikes there is also present a typical hornblendite dike which shows upon analysis a trace of platinum. Alteration and concentration of the sulphides in the rock by solutions seems to increase the percentage of platinum and nickel, one analysis showing the presence of 0.55 of an ounce of platinum per ton and over 5% nickel. The dikes as exposed upon the surface vary in width from 10 to 50 ft. and are about 100 ft. long. One carload of ore has been shipped from the Key West workings.

Mexican mineral production in 1909, according to the latest Boletin de Estadistica Fiscal, Mexico, has been unusually large. The production of gold amounted to ₱45,015,000, as against ₱38,096,661 of the previous fiscal year. Other factors were: silver, ₱77,110,000; copper, ₱20,283,000; lead, ₱6,397,000; zinc, ₱1,043,000; iron, ₱1,200,000; coal, ₱4,400,000; mineral oil, ₱2,800,000; other minerals not classified, ₱2,052,158. This is the best showing ever made by Mexico and speaks well for her future development. The mineral resources of the country are as yet hardly touched, it being estimated that less than 1% of the known prospect is being worked. The gold output of Mexico in 1890 amounted to ₱2,000,000. In 1896 it had reached the value of ₱10,000,000, and in 1903 it exceeded the sum of ₱20,000,000. The output of silver in 1909 reached the tremendous total of 2,191,199 kilos (one kilo equals 2.2 lb.), the largest on record. The present depression in the price causes it to show a slump of ₱8,000,000, ₱85,446,904 being realized in 1908.

*Read before the Geological Society at Washington and abstracted in *Science*.

Improvements in the Cyanide Process

By Bernard MacDonald

The fact is generally recognized that the only important improvement made in the cyanidation of gold and silver ores during the last five years has been in the mechanical manipulation of the ore-pulp during treatment, and, in the methods of recovering the metals brought into solution, and that the chemistry of the process has remained practically unchanged. The sum of the mechanical means and methods that have been developed and improved during this period, omitting the numerous details of manipulation, may be set down as: (1) Stamping through coarse battery screens. (2) Classification and de-watering of the battery product into sand and slime. (3) Fine grinding (sliming) the sand. (4) De-watering (thickening) the slime-pulp. (5) Treatment of the slime in high tanks by air-lift agitation. (6) Recovery of the solution from the treated pulp by filter-pressing. (7) Precipitation of the gold and silver from the solution by zinc-dust.

In Mexico where the tonnage of silver ore treated by stamp-milling and cyanidation is greater than in all other mining regions combined, and where the largest part of this tonnage is of very low-grade ore, every new design promising greater economy and efficiency has been adopted and used.

The high royalties charged by proprietors of patent devices used in the processes have furnished the incentive if not imposed the duty upon all mining engineers charged with the design of new plants to evolve other methods equally as effective to accomplish the same purpose, hence the number of filter-presses and variety of design of other equipment now on the market. The result is competition and a choice of machinery that makes for cheaper and more efficient plant, with correspondingly greater economy of operation, making possible the profitable treatment of lower grade ores.

A recent improvement in tanks for the treatment of slime-pulp is shown in the accompanying figure, for which United States Patent No. 948,766 and Mexican Patent No. 9948 have been issued. I believe this tank to be a great improvement over any hitherto used in the treatment of the slime-pulp of gold and silver ores. This tank, with its special equipment, is known as the 'Parral' tank, a sectional view of which is seen in the figure. The main improvements in this tank are: (1) The division of the tank-bottom into two or more pockets or compartments of inverted conical or pyramidal form, made of wood or steel partitions. (2) A charge-pipe extending from the top of the tank, and terminating in nozzles placed at the apex of the bottom-compartments through which the pulp-charge entering the tank passes, and is delivered under the pressure of the hydrostatic head due to the height of the charge-pipe over the pulp-level in the tank. (3) Two or more transfer-pipes set at or near the sides of the tank, and extending from the bottom to the top of the tank, having the lower ends resting on the tank-bottom, but open, so as to admit the entrance of the pulp which settles to the bottom of the tank for transfer through these pipes and delivery on the top of the tank-charge.

These methods of charging the pulp into the tank and of transferring to the top of the charge the heavier particles as they settle secures an intimate admixture of the cyanide solution and the pulp-particles which is necessary for bringing the contained metals into solution. This type of tank equipment makes it possible and even desirable in large milling plants to use treatment-tanks each having a holding capacity of 300 to 400 tons of dry pulp, for these tanks may be made of any diameter and any height warranted by local conditions, as the full charge of pulp can be treated with efficiency and economy equal to that in the ordinary small tanks.

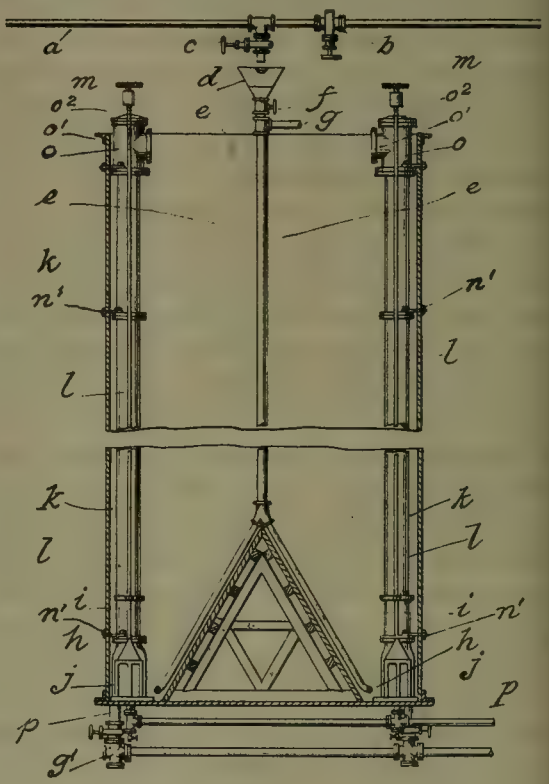


Fig. 1.

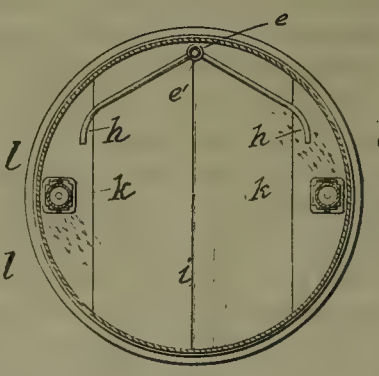


Fig. 2.

In operation the tank receives the charge of pulp for treatment through a charge-pipe of any suitable

diameter which may be placed within or without the tank, according to local conditions. The pulp passing downward through this charge pipe is delivered through branches terminating in nozzles, one nozzle at the apex or bottom of each of the two or more pockets or compartments built on the tank bottom as shown in the figure. The pulp being thus charged enters these compartments through the nozzles under hydrostatic pressure which creates sufficient agitation to prevent settlement of the pulp particles on the bottom of the tank. However, to prevent the possibility of pulp settlement on the bottom of the tank, provision is made for the admission of compressed air or cyanide solution under pressure at the bottom of these compartments through the same nozzles. This gives any desired amount of agitation. The charge-pipe at its intake at the top of the tank is provided with a receiving hopper, or funnel, having a screen bottom. The chemicals necessary to bring the solution contained in the pulp-charge up to working strength are weighed and placed in this hopper periodically, as required, and the pulp being charged into the tank flows over and through them, dissolves and carries them in solution with it as it is injected into the bottom of the tanks through the terminating nozzles of the charge-pipe.

The advantage of this method of under-feeding the pulp which is charged into the tank, and having it intimately mixed with the required strength of chemicals freshly brought into solution, as compared with the open feed on the top of the charge, which allows the heavier pulp particles to settle out of the associated solution to the bottom, leaving the latter on the top, is apparent.

This treatment-tank is designed to receive its charge of pulp directly as delivered from the pulp de-watering (slime thickening) tanks, and thus it fills the functions of a collecting and treatment tank simultaneously. When the tank has received its full charge the agitation necessary to complete the treatment by bringing the valuable metals into solution, is begun. This is effected through the two or more transfer pipes referred to, one for each of the compartments into which the bottom of the tank is divided. These transfer pipes are firmly supported on the bottom of the tank by open foot-pieces of suitable design. Through these foot-pieces compressed air is introduced to the transfer pipes in an upward current, which effects the rapid transfer of the pulp from the bottom of the tank, and its delivery at the top of the charge. The top or delivery ends of the transfer pipes are fitted with tees, or ells, placed at such an angle that their delivery outlets are in the same direction and circumferential to the sides of the tanks. The force of the pulp thus being delivered on the top of the charge imparts to it a whirling motion which carries the pulp particles in a spiral course around the tank in their settlement toward the bottom. When they reach and settle into the apex of the bottom compartments they are again picked up and carried through the transfer pipes and delivered on the surface of the charge, and the agitation is thus continued until the treatment is complete. It is reasonable to believe that this whirlpool motion disentangles the heavier pulp-particles from the colloidal material in the pulp mass in which they may be imprisoned exposing them to freer contact with the chemical solutions, and thereby hastening the extraction of the metals they may contain. It is also considered that a plurality of transfer pipes of smaller diameter can be operated with greater economy than one large pipe of equal area. The reason for this belief lies in the fact that compressed air, in order to be effective as a lifting agent in a submerged pipe, must form in discs, the circumference of which must touch the sides of the transfer pipes and thus travel upward through it, while if the transfer pipe be of large diameter the compressed air will rise as bubbles through its centre and have no more lifting effect on the pulp contained therein than if a rod were rammed up through the centre of the pipe. The bubbles of compressed air merely take a zigzag upward course through the pulp which fills the column, leaving it to remain balanced in equilibrium with the pulp or liquid in the tank outside the transfer pipe. Of course, this equilibrium can be overcome by the injection of a sufficiently large volume of compressed air to fill the transfer pipe so that air may form in discs extending across the pipe, no matter what its diameter may be, but this is wasteful and expensive.

The lifting action of compressed air in a submerged pipe-column is effected by a complete intermittent cut-off or separation of the liquid in the column, from the liquid outside it, by air discs, as described. Separate bubbles, no matter how many, rising through the transfer pipes have no more lifting effect on the pulp contained than the ascending bubbles in a glass of champagne has on its contents. To be effective for this purpose the air must form in discs wholly across the transfer-pipe, in which form they act as the piston of a pump, each disc separating and completely cutting off a certain amount of pulp from the mass in the tank outside and carrying this amount with it as it rises to the top. The number of such discs formed per minute is analogous, in lifting effect, to the number of piston-strokes of a pump.

As stated before, one of the main advantages of the 'Parral' tank is that the apparatus with which it is equipped makes it possible and even desirable to build it of larger dimensions than would be commendable in the use of one central transper pipe. A tank 15 ft. diam. (which is the limit for a treatment tank with one transfer pipe) by from 45 to 47 ft. high is the average of the largest treatment tanks in general use, and has an approximate holding capacity under ordinary consistence of pulp of 100 tons of dry slime, while a tank of equal height and 30 ft. diam. would have a holding capacity of 400 tons of dry slime of similar consistence. It will be readily seen how the larger tank with four bottom compartments, or pockets, and four transfer pipes, placed around the sides with their intake ends opening into the apex bottom of these pockets would effect equally as good agitation and treatment as would be the case in a tank of 100 tons capacity with one air-lift transfer pipe, while the economy in extraction and operation per ton would be an item of considerable importance.

Annual Labor Pending Patent Proceedings

By H. W. MacFarren

The process of patenting or obtaining the fee title to mining claims held by location or possessory right may be divided into three steps or stages. (1) The application to the surveyor-general of the land district for an official patent survey, followed by the field work of the deputy mineral surveyor, and it in turn by the checking and approval of the survey by the surveyor-general and his official filing of the notes and plat. (2) The filing of the approved survey with the local United States Land Office, together with an application for mineral patent to the land embraced in the survey, followed by all the various proceedings, including opportunity to adverse claims, required by the Land Department in its efforts to see that the laws are complied with and that the rights of other miners are protected. (3) The entry for patent by paying the purchase price for the land at the local Land Office and receiving therefor the receiver's certificate, or receipt, to be exchanged for the patent upon its issuance.

By the first step the applicant acquires no further right to the ground, beyond that contained in his possessory right, than such additional constructive right as the better marking of his claim and the official filing of its exact position and boundaries may give. However, it gives some benefit in that it will throw the burden of adversing any conflicting ground upon subsequent numbered surveys, unless there is undue delay in proceeding toward patent. There is also the further safety given by the officially marked posts. No compulsion upon the claimant exists to proceed further toward patent.

Prominent in the second step is the filing of adverse claims against the proposed patent by those who claim the ground or portions of it by other and adverse locations to the one entered for patent. Adverse claims must be filed at the local Land Office during the sixty days of publication of the notice of application for patent. They may be fought out in the courts later. Also prominent in the second step is any protest made by the Government at the instance of its employees or of private parties against granting the patent on the ground that the Federal statutes, and the regulations of the general Land Office, have not been complied with. The protests may be initiated at any time after application for patent and up to its issuance, to be fought out before the Register and Receiver of the local Land Office.

After the adverse suits and pending protests have been disposed of and the local Land Office is able to ascertain what ground the applicant is entitled to under the law, he is allowed to take the last step of making final entry and receiving the Receiver's receipt in temporary lieu of the patent document which will arrive later from Washington.

The status of the claim with reference to performing the annual labor or assessment work during the second and third step—the steps for obtaining patent proper—has been defined by the decisions of the Land Department, and it is believed that the courts will be guided by the principles they have laid down. The statute says "on each claim located * * * and until a patent has been issued therefor, not less than one hundred dollars' worth of labor shall be performed, or improvements made, during each year." The Land Department has recognized that there is usually great delay in issuing the patent, and in its receipt by the applicant; consequently it holds that the date of final entry, of paying the purchase price, and of receiving the Receiver's receipt, may be taken as the date when patent issues so far as annual labor is required. The Land Department has also recognized that final entry cannot always be made immediately after the expiration of the period of publication, since adverse suits and protests often drag out for a few years, but until these are settled it cannot allow final entry. To require the applicant to perform annual labor during the period within which patent is withheld by these suits would be unjust, and in consequence it holds "the length of the interval between the end of the period of publication, or the finality of pending adverse suits in court or protest proceedings in the Land Department, and the date of final entry, is immaterial, so long as entry is made before the close of the then current calendar year; and the principle with respect to the completion of the patent proceedings is the same whether the time remaining to the applicant within which to make entry as aforesaid be only a day or several months." (32 L. D., 200.)

From the above and from other decisions of the Land Department it is apparent that should the period of publication expire December 30, and there should be no adverse suits or protests pending, it would be necessary to make final entry the next day —before the close of the calendar year—if no annual labor had been performed that year, to keep them from being open to location on or after January 1, unless work was immediately resumed and carried into the next year. Should an adverse or protest be pending, no work would be necessary for the closing year. Should these litigations be undecided during the new year, no work would be required; but for the year in which they would be decided and settled, entry would have to be made on or before December 31, or work be performed, whether the litigation ended January 30 to December 30. Where entry does not immediately follow as prescribed, the applicant, when he does make entry, will be required to show that no re-location of the claim has been made, or if there has been material delay, to make a new application for patent.

After entry no annual labor is required except where the Receiver's receipt is cancelled on grounds of fraud. The question arises, is a re-location made by a party adverse to the applicant for patent, and based on the non-performance of the annual labor for the preceding year, and in the belief that patent will be refused on grounds of fraud, such a location as the refusal of patent will validate? The Land Department has said, "a location under the mining laws made upon land not at that time regularly subject thereto, because covered by a subsisting though invalid entry, may nevertheless, if maintained in

good faith and the land subsequently becomes subject to location, be permitted to remain intact as being attached on such date, date of consolidation, if at that time there is no adverse claim. 44 L. D. 30.

In a case where patent was refused for reasons that did not reflect on the good faith of the applicant, but where a new application was required the applicant was protected from forfeiting his claim through having left undone the annual labor. Where the applicant for patent through negligence does not proceed to entry within the required time, but is not guilty of fraud, there is little reason for believing that a re-location made before the expiration of the year in which entry should be made, and based on failure to do the annual labor for the previous year, could be validated by failure to make entry, that is, a valid re-location could only be made after the expiration of the entry-year, and in case no labor had been performed for the previous or closing year.

The following rule may be deduced: if the application be based on an attempted compliance with and obedience to the law, and it is intended to make entry as soon as allowable, the annual labor need not be performed for the year in which the period of publication ceases or thereafter, provided entry is made within the year in which the adverses and protests are settled and the entry becomes allowable. In short, annual labor need not be performed for the year in which publication ceases or thereafter, provided final entry be made during the year in which such entry becomes allowable.

DROP SLUICES

By Dennis H. Stovall

Almost every manager of a hydraulic mine on the Pacific Coast admits that he loses, or fails to save a large amount of the gold in the ground. This loss is due to the fact that fully 25% of the gold is associated closely with black sand. This is the fine or 'flour' gold. Because of the lightness of the sand and the fineness of the gold it is practically impossible to save them by riffle and sluice. They simply refuse to settle and lodge, and are carried to the dump and lost. Numerous methods have been tried, and appliances of every description employed, in this work. Experience has proved many of them worthless; in fact, the more complicated the machines, the less efficient they are in saving the gold. One of the best means employed for securing the fine gold is that of drop-sluices or undercurrents. These are easily built, require no attention save that of cleaning once a month, and can be installed at little expense. One such system, placed on the Old Channel mines of the Galice district, is shown in the accompanying illustration. This saves an average of 30 oz. of gold per month during the operating season. This is gold that would otherwise be lost, as it is taken from the extreme end of the sluices. The undercurrents are two in number, each taking its water and concentrate from two different points on the line of the sluice. One is placed four box lengths from the end of the sluice, the other, one box from the end, and, being near the dump, they give the boxes and riffles every possible chance to save the gold before dropping into the undercurrents. These are merely single or double riffle tables set by the main sluice, the water and concentrate being drawn through a grizzly plate and delivered by an adjustable gate, whence it spreads over the table. The fine gold settles on the table, over which burlap is spread to serve as riffles. The grizzly on the sluice bottom is made of ½ in. iron bars, 3 or 4 in. wide set edgewise ¾ in. apart. It should have a length of 5 ft. and a width equal to the width of the sluice. Beneath the grizzly is placed a cross-sluice into which the water falls and is delivered immediately to the upper end of the undercurrent. As stated, this flow is regulated by a drop-gate.

Undercurrents Attached to Sluice.

Once a month the burlap is lifted off, rinsed in vats of still water, and replaced. A few hours work is all the attention required. The undercurrent tables should be at least 10 ft. wide and 15 long, with burlap coverings made to fit. A drop of 8 in., or as little as 6 in., is ample. It should be enough to allow a smooth and even flow of the water and sand over the riffles. If the miner does not care to use burlap he can build the undercurrents with riffles already provided. This is done by constructing the floor of two-by-fours, setting them edgewise, every alternate plank being dropped down ½ in. To clean these, the water is shut off, just enough being allowed to flow over to assist in the work, and the concentrate collected with a pan and broom. The amount of flow over the undercurrents can be regulated only after several trials. The miner will soon learn, however, just how much to admit through the grizzlies to give best results.

Ferrobamba Limited is the name of a company recently formed in London to take over copper mines situated about seventy miles from Cuzco, Peru. The properties were reported on by W. E. Gordon Firebrace, who claims that the mines contain millions of tons of 8 to 9% ore and also a reasonable tonnage of bornite and chalcopyrite on hand. The address of the London office is 638 Salisbury House, London Wall, E. C. The capital of the company is £120,000, of which £20,000 is to be spent for development, it being the intention to increase the capital later on to £1,000,000 and to build a railway from the mines to Cuzco and also to build a large smelter. However, even if the orebodies are proved, it will take about four years to complete the railway and the smelter.

MINERAL PRODUCTION OF CHILE IN 1908 AND 1909

By F. A. Sundt

The 'Estadistica Minera de Chile', Vol. IV, years 1908-1909, has recently been issued by the Sociedad Nacional de Mineria and from it I quote the following figures of the mineral production of Chile.

1908.

	Quantity.	Value.
Gold (fine), gm.	1,188,522	$1,070,354
Silver (fine), gm.	52,435,071	1,515,241
Copper (fine), kg.	42,096,731	27,156,579
Manganese ore, kg.	1,000	20
Lead in silver-lead ore, kg.	9,722	360
Ores for collection, kg.	3,433	5,025
Saltpetre (NO_3Na), met. tons.	1,970,974	215,033,296
Iodine, kg.	330,090	3,928,071
Potassium perchlorate, kg.	54,500	21,800
Borate, kg.	35,039,038	4,905,465
Salt, kg.	1,625,700	812,873
Sulphur, kg.	2,704,722	324,567
Sulphuric acid, kg.	797,000	79,700
Guano, kg.	870,800	83,173
Coal, met. tons.	939,836	13,157,704

1909.

	Quantity.	Value.
Gold (fine), gm.	1,268,414	$1,175,569
Silver (fine), gm.	44,282,578	1,039,099
Copper (fine), kg.	42,726,145	26,477,516
Manganese ore, kg.	.....	.....
Lead in silver-lead ore, kg.	1,200	104
Ores for collection, kg.	.....	.....
Saltpetre (NO_3Na), met. tons.	2,101,512	208,470,040
Iodine, kg.	474,200	5,571,850
Potassium perchlorate, kg.	92,220	56,888
Borate, kg.	32,218,042	4,510,526
Salt, kg.	2,046,300	1,023,132
Sulphur, kg.	4,507,707	540,925
Sulphuric acid, kg.	1,415,000	141,500
Guano, kg.	10,691,845	425,058
Coal, met. tons.	898,971	11,686,623

The most remarkable fact which may be deduced from these figures is the increase in copper production in both years. Since 1884 there has been no such copper output. The increase as compared with the average for fifteen years past amounts to more than 12,000 tons. This is due to new mining companies operating in Chile, such as those of Collahuasi, Antofagasta, the French companies of Catemu, Naltagua, Chañaral, and others. All of the copper is produced by smelting. There are nine plants with converters. The average grade of ore smelted is about 8 to 10%. The only concentrating mill-plant is at Rancagua, owned by the Braden Copper Co., but it is as yet producing but little. There are two small lixiviating plants. Sulphuric acid is produced at Guayacan smelter by matte roasting and the catalytic process. Nearly 80% of the acid is consumed at the copper-leaching plants. It is probable that the production of Chilean copper will increase next year because European capital, especially French and German, is interested, and the Braden Copper Co. is erecting a new mill to treat 2000 tons of 3 to 4% ore per day.

The production of gold is stationary. Silver has shown some increase as compared with preceding years. Gold and silver are principally treated by amalgamation. There is no cyanide mill in Chile, although many ores refractory to amalgamation have been proved capable of being treated by cyanidation. Gold and silver in copper bars is not refined here. There is practically no production of lead because the copper mines attract the capital.

Production of nitrate of sodium is increasing yearly, but prices are not so good because consumption does not increase at the same rate. Saltpetre deposits are large; enough for 100 years more is known. Pig iron and steel do not appear in production for 1908 and 1909, but the blast-furnaces of Corral have been put in blast this year, using wood (not charcoal) as fuel. The coal mined is all consumed in the country, and one million tons more is imported. Water-power is singularly abundant and favorably situated, and it is being used more and more.

Application for patent to mineral land must be accompanied by a filing fee of $10 and the following papers: (1) A notice which states claimant has filed an application for patent for the claim, and describes it as the field notes, with the exception that the description is condensed. The notice should be signed by the applicant and witnessed by the two witnesses who were present at the posting. This must be at some conspicuous point on the claim, where it isposted with one copy of the plat. (2) Proof of posting notice—The two witnesses who were present when the plat and notice were posted execute an affidavit stating the time and describing the place at which they were posted. (3) Agreement of the publisher—The agreement of the publisher of the paper in which the notice will appear must state that he will make no claim against the United States for the publication, but will look to the claimant only. (4) Location notice—A certified copy of the location notice on which application is made must be procured from the county recorder in whose office it is recorded. (5) Abstract of title—The abstract must be certified by the county recorder in whose office the records appear, and the patent will issue to those shown to be the owners of record at the time the application was filed. (6) Plat and field notes—These consist of one of the plats and the field notes received from the surveyor-general. The application is made and sworn to by either the claimant or his attorney-in-fact, and in addition to the matters in the notice, contains a statement of the claimant's citizenship, his source of title, and specific information as to the area of claim and the price he paid for it, as well as the character, extent, and value of its ore deposits. These papers are all filed with the register and receiver of the United States Land Office in the district where the claim is situated. One copy of the notice is by the register forwarded to the paper for publication, and one copy posted in the land office.

Five 'Parral' tanks, each 25 ft. diam. and 42 ft. high, having a holding capacity of 300 tons of dry pulp under the usual solution-consistence for treatment, are being erected at the milling plant of the Veta Colorado Mining & Smelting Co., at Parral, Chihuahua. The apparatus was designed by Bernard MacDonald as an improvement over existing types of agitation tanks, and he believes that they mark an important forward step in the mechanical improvements of the cyanide process.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Regenerating Copper Cyanide Solution

The Editor:

Sir—In reply to R. P. Wheelock's statement in your issue of March 12, I beg to acknowledge an error in my explanation of February 5. The same result is obtained in restored cyanide, 80% or better, even if an excess of acid were used. I meant that the acid solution should be neutralized with lime before titrating for KCy. What I meant by saturated solution was solution enriched as much as possible with Au + Ag + Cu values before precipitation. By going to excess with acid and causing precipitation, the chemicals will float all the coagulated precipitates to the surface of the solution. These precipitates will remain there if the gas be not expelled. I do not mean, however, to say that the potassium cyanide cannot be restored even if an excess of acid has been added. To cause complete precipitation as Mr. Wheelock did, a small proportion of the solution being taken and filtered and acid added to the filtered solution, it is evident that enough has been used if it does not turn turbid.

Some contend that $\frac{1}{10}$ of 1% of copper sulphate is fatal to a working KCy solution. On that point the following test is instructive: take 1000 c.c. H_2O, add 5 gm. KCy + 10 gm. copper sulphate; slack and grind CaO to 60-mesh, add to convert the K_2SCuCy solution from green to blue. Before the copper sulphate is added to the KCy solution add a known amount of gold, say, at the rate of $20 per ton. Take one assay ton of the filtered solution from the blue; precipitate the Au and Cu; restore with $Ca(OH_2)$; and note the saving of copper and gold and also the restoration of KCy. Filter off a portion of the CuCy solution before $Ca(OH_2)$ is added and read the contents for copper volumetrically; repeat this with the filtered solution after $Ca(OH_2)$ is added and note the results. Test the KCy restored solution for active service by agitating with gold leaf or pulp. A 5-lb. KCy solution, restored or fresh, should dissolve leaf-gold in four minutes when well agitated.

A sulphur-bearing KCy solution can be made that cannot be read with silver nitrate but is still active toward gold, silver, and copper; it may be regenerated. The sulphur can be liberated so that it can be read with $AgNO_3$ by precipitating the sulphur with copper or silver, thrown in solution and precipitated with H_2SO_4. I claim all solutions should be properly treated with lime before precipitation by either the acid or the zinc method. When Cu is present in the working solution my experience is that lime is not added in excess if carbonate of lime does not predominate on the surface of the solution like thin ice after standing six hours or over night on pulp.

In one case I have used 40 lb. of lime to one ton of ore. I did not simply use it to neutralize acid, as we were taught a few years ago, but to take care of the iron, zinc, and other salts as well. A pulp practically alkaline may take 10 lb. of lime. When copper is in solution and is being precipitated on zinc shavings, they are gray or brassy looking. If more lime be added they will change to black and will feel silky.

Referring to Mr. Wheelock's copper-acid-cyanide precipitate, my experience has been that such precipitate from a working solution consists of 40% copper, the balance being sulphur, lime, gold, silver, and a small percentage of cyanates.

I will later send data explaining a case where it takes 26 days to enrich a solution in its gold, silver, and copper content, a method applicable to decanting or percolating. Some of Mr. Wheelock's methods I would like to test, but have not the materials at hand. I have never enriched the solution pound for pound in copper, nor have I ever obtained a precipitate containing 50% cyanogen. It cannot be done if the solution or pulp had been properly treated with lime. Whenever the KCy is broken up by adding H_2SO_4 either in small quantity or in excess, it can be restored by calcium hydrate, but one cannot break up the KCy by adding copper sulphate if the proper amount of lime is present. The KCy will not pick up any more copper, gold, and silver than it will precipitate, or, in other words, it will precipitate all it picks up or a fraction thereof by adding H_2SO_4. The lime protects the potash and allows restoration of 80% or better.

ISAAC ANDERSON.

Prescott, Arizona, March 31.

James Annual Cyanide Letter

The Editor:

Sir—In Mr. James' annual letter on cyaniding in your issue of January 1, he gives a list of different filtering machines with the percentage of recovery of dissolved metal values and costs. The table is headed by the Ridgway with 99.5% recovery, which may be so; but I think the figure is excessive. On the Associated Northern mine we found that when everything was in good order, 95% of the dissolved gold was the average recovery; at the Associated, it was not quite so high; and at the Perseverance about 97%, and, although I have no data on this point from other mines, yet it is doubtful whether 99% would be the average, even with efficient washing. I am not trying to depreciate the working of the filter-press by any means, as it will hold its own here against the vacuum process; but poor washing does go on in the press at times, even when conditions are good for high recovery. The two vacuum plants at work on old dumps in Kalgoorlie, are not doing such extra good work, although the residue being treated is rather refractory. With reference to graphite in cyaniding, Mr. James says that "roasting is the natural remedy." My article on this subject in the MINING AND SCIENTIFIC PRESS shows that this is not the case, and I have had very good opportunities of studying it. Graphite comes through the roasters unchanged, although perhaps a very small percentage may be burned. Mr. James is partly right when he mentions exposure to the sun. We found that,

when the extraction was low on account of graphite, a residue assaying, say, $3 per ton, when re-mixed with sump solution of 0.04 KCN, pumped into a filter-press without any agitation, and washed for only ten minutes at 75-lb. pressure, yielded a final residue would be as low as 70c. to $1 per ton. In most cases, this did not need exposure to the air for many hours, although longer exposure gave a higher extraction at times. Graphite is a peculiar mineral to deal with, and being such a staple thing, it needs much study.

M. W. von Bernewitz.

Kalgoorlie, Western Australia, March 15.

Yerington Rock Names

The Editor:

Sir—In the number of your paper of March 5 there is a re-print in part of Bull. 380 of the U. S. Geological Survey relating to the Yerington copper district. In that bulletin there is a review of a paper by myself. The title of the paper reviewed is the 'Geology of the Upper Region of the Main Walker River, Nevada'. It was written in 1904, and since there is omitted from both the bulletin and the re-print certain antecedents relative to formational terms and rock names, it is thought a note of explanation to the popular reader would not be out of place. I could not communicate with you sooner because my notes were not at hand.

In the bulletin referred to it is said: "This assemblage of rock was called by Smith the 'bedrock complex', a name which it is not desirable to perpetuate." The term is ascribed to geologists of the U. S. Geol. Surv. (Becker, Turner, and Lindgren). The term appears in 'The Pyramid Peak Folio No. 31, 1896 and 1897', seven years before the appearance of the paper reviewed, and it has been used when referring to formations elsewhere in the region of the Sierra Nevada; and when it is said that "it is not desirable to perpetuate" the term, it is evident that subsequent detail work has led the Government geologists to revise their classification. The other objection was to the rock names, and it is said "the granodiorite or monzonite rocks were by him (myself) designated 'granite', 'granite-porphyry', and 'porphyrite', although his own petrographic descriptions appear hardly to suggest these names." The Survey issued a bulletin in 1897, No. 150, which was calculated to be "valuable to educational institutions for the purpose of teaching." The terms granodiorite and monzonite were omitted from it, but the first term was given by Becker in 1891, six years before the bulletin made its appearance, and the second term (monzonite) by de Lapparent in 1864, 33 years before. I found that the terms in Bull. 150 were not satisfactory and did not fit the material in hand. I then referred to some English and German petrographers, and, as all classifications are more or less artificial, I found names that came closer; although not altogether satisfactory, they were used, trusting that the descriptions would be sufficiently accurate to convey a notion of what the rocks are. If accurate names had been available I would not have given so much space to that sort of thing.

D. T. Smith.

Virginia City, Nevada, May 14.

BUREAU OF MINES BILL

Be it enacted by the Senate and House of Representatives of the United States of America in congress assembled, That there is hereby established in the Department of the Interior a Bureau, to be called the Bureau of Mines, and a Director of said Bureau, who shall be thoroughly equipped for the duties of said office by technical education and experience and who shall be appointed by the President, by and with the advice and consent of the Senate, and who shall receive a salary of $6000 per annum; and there shall also be in the said Bureau such experts and other employees as may from time to time be authorized by Congress.

Section 2. That it shall be the province and duty of said Bureau and its Director under the direction of the Secretary of the Interior to make diligent investigation of the methods of mining, especially in relation to the safety of miners, and the appliances best adapted to prevent accidents, the possible improvement of conditions under which mining operations are carried on, the treatment of ores and other mineral substances, the use of explosives and electricity, the prevention of accidents, and other inquiries and technologic investigations pertinent to said industries, and from time to time make such public reports of the work, investigations, and information obtained as the Secretary of said department may direct, with the recommendations of such Bureau.

Section 3. That the Secretary of the Interior shall provide the said Bureau with furnished offices in the city of Washington, with such books, records, stationery, and appliances, and such assistants, clerks, stenographers, typewriters, and other employees as may be necessary for the proper discharge of the duties imposed by this act upon such Bureau, fixing the compensation of such clerks and employees within appropriations made for that purpose.

Section 4. That the Secretary of the Interior is hereby authorized and directed to transfer to the Bureau of Mines from the United States Geological Survey the analyzing and testing of coals, lignites, and other mineral fuel substances and the investigation as to the causes of mine explosions; and the appropriations made for such investigations may be expended under the supervision of the Director of the Bureau of Mines in manner as if the same were so directed in the appropriation acts; and such investigations shall hereafter be within the province of the Bureau of Mines, and shall cease and determine under the organization of the United States Geological Survey; and such experts, employees, property, and equipment as are now employed or used by the Geological Survey in connection with the subjects herewith transferred to the Bureau of Mines are authorized to be transferred to said Bureau.

Section 5. That nothing in this act shall be construed as in any way granting to any officer or employee of the Bureau of Mines any right or authority in connection with the inspection or supervision of mines or metallurgical plants in any State.

Section 6. This act shall take effect and be in force on and after the first day of July, 1910.

Concentrates

Most of these are in reply to questions received by our readers are invited to ask questions and keep ... then dealing with the practice of mining and ...

Aluminum is produced commercially from bauxite and cryolite only. It occurs chemically combined in kaolin and a number of other minerals but no economical method of reducing it has been discovered.

Work on a mining claim for patent need not be done on the claim itself provided the claim participates in a common improvement, such as a shaft or tunnel, which actually benefits the claim in question to the extent of $500.

During 1908 the United States drew its supply of vanadium mostly from the highlands of Peru, where are large deposits of a peculiar carbonaceous sulphide of vanadium known as patronite. These deposits are reported to be controlled largely by the American Vanadium Co. of Pittsburg.

Sodium-amalgam can readily be prepared electrolytically. Special cells for this work can be purchased from dealers in chemical apparatus. Essentially the method consists in passing an electric current through an acidulated solution of common salt in contact with a cathode of mercury. The salt is decomposed, the sodium following to the cathode, where it amalgamates with the quicksilver. At the same time chlorine gas is disengaged, and escapes from the solution.

The supporting power of a pile, two-thirds of which is in the ground, can be determined by the formula given in Baker's 'Masonry Construction',

$$P = 100 (\sqrt{Wh} - 50d^2 - 50d)$$

in which P is supporting power in tons; W, weight of the hammer, in tons; h, height of fall, in feet; and d, penetration of the pile under the last blow, in feet. The test blow must be measured on sound wood, and it is best to use the average of several blows.

Assessment work done outside of the surface boundaries of a mining claim leaves open a question of fact whether the work so done tends to the development of the claim or not. The purpose for which the work is done, if questioned, must always be manifested by the relation which it bears to the claim itself. If the plan pursued can have no reasonable adaptation to its alleged purpose the mere assertion that it was pursued for that purpose will not suffice, even though good faith be conceded.

Water issuing from a spring on a mining claim belongs to the owner of the claim as long as he maintains the validity of his title. The owner of the claim can prevent a subsequent adverse entry on his claim and appropriation of the spring itself, but cannot prevent anyone from lawfully appropriating below the claim whatever water may run from the spring and issue in a defined water-course on adjacent land, and which has not already been devoted to some beneficial use by the owner of the claim.

Lead chlorine vanadate, vanadinite, and related minerals endlichite, descloizite, and others occur in the oxidized zone of lead-bearing veins in Montana, Colorado, New Mexico, Arizona, California, and other States. Some of these ores have been produced commercially in New Mexico and Arizona, but most of the minerals mined have been sold to the smelters for their lead content. The principal known vanadium deposits of this country are at Newmire, near Placerville, Colorado, where the mineral occurs as roscoelite, a green vanadium mica in the soft La Plata Jurassic sandstone. The vanadium content of the ore does not exceed two per cent.

The early giants were swung by block and tackle from side to side. A workman attempting to clean his shovel by holding it at the side of the nozzle accidentally discovered that this deflected the giant. From this was developed first the sleeve and then the double joints now in use. Giants were made with a 9-in. butt and tapered nozzle which was 8¾ in., under a pressure of 460 ft. Washing flumes were also increased to, say, 6 ft. wide, some on as heavy a grade as 18 in. to the box 12 ft. long, some using paving blocks 14 in. deep. Some iron riffles, and some stones of large size, paved the bottoms of the flumes, and where sufficient grade was had large undercurrents were employed to save the fine gold.

Double-ended quartz crystals, magnetite, and many other minerals in their highest state of mineralogical perfection both as to form and purity, and garnets and other precious stones, frequently occur as secondary or accessory minerals. It is interesting to note that certain well known brands of hones or sharpening stones consist of slates or shales full of microscopic garnets or other hard minerals. Garnets are so common in these and other rocks, and in the gravels, produced by their natural disintegration, as to scarcely deserve the title of precious stone, although the beauty of those of good color almost equals that of the ruby. Owing to their hardness, garnets are largely used as abrasives, and probably nearly 10,000 tons of true garnets whose only fault is that they are 'off color' are ground up for that purpose annually.

Oil must be actually discovered by drilling a well and striking oil to validate a placer location applying to oil. Mere oil-seepages and surface indications are not sufficient. Of course, the evidence might in an extreme case be sufficiently convincing to justify a discovery without drilling, but the courts have not yet had such a case called to their attention, and it is doubtful if anything but actual drilling and striking oil would satisfy the courts. A locator must proceed diligently with drilling until he makes a discovery. Ordinarily he is protected only to the extent of the ground which he actually occupies in his drilling operations, and a rival locator may take peaceable possession of another portion of the same location, in which event it becomes a race between the rivals, and he who first discovers oil becomes entitled to the claim. The locating and patenting of oil claims is provided for by the law applying to placer mining.

Special Correspondence

LONDON

Flotation Processes.—Sulphide Corporation.—Sulitjelma Copper.

Flotation processes are comparatively unknown in the United States, a fact which is incomprehensible to me. There are many ores and tailings in various parts of America giving trouble to the metallurgists and miners, and judging by analogy with results obtained in other parts of the world, they should prove amenable to flotation. There are several of these processes, more or less modifications of each other, but the Elmore vacuum process at present takes the lead in successful application. Two notable examples of the plant are to be found at the Zinc Corporation works, where Broken Hill zinc tailing is treated, and at Sulitjelma, Norway, where copper-bearing tailing beneficiated.

The Zinc Corporation was formed by Bewick, Moreing & Co. in 1905. The first processes adopted were not successes and the company's financial position became serious. Finally the Elmore vacuum process was adopted and the company is now a dividend-payer as far as the preference shares are concerned. The history of the various issues and rearrangements of shares need not be recapitulated here; suffice it to say that there are 179,026 preference shares of £1 each and 453,132 ordinary shares of 16s. each. The preference shares take all the profits until they have received 100%; when this has been paid they take a cumulative preferential dividend of 20% and subsequently rank equally with the ordinary in the distribution of further profits. The first dividend was paid in September last, and for the year 1909 the holders of preference shares received 25%. During 1909, 227,502 tons of tailing was treated, averaging 20.38% zinc, 5.8 lead, and 8.82 oz. silver. For the first six months the supply came entirely from the Block 10 dump, and later other material from the British Broken Hill dump was added in a suitable proportion as determined in the experimental plant. The company does not give the figures showing the amount of concentrate produced by the Elmore plant, but states that the average assay value was 43.48% zinc, 10.83% lead, and 16.43 oz. silver. On the removal of the gangue by the Elmore process the concentrate is sent to Wilfley tables in order to effect a further separation of the sulphides, with the special object of reducing the lead content. The final production was 84,698 tons of zinc concentrate averaging 46% zinc, 7.3% lead, and 15.08 oz. silver, together with 6411 tons of lead concentrate averaging 57% lead, 16.3% zinc, and 38½ oz. silver per ton. When the Wilfleys were erected it was supposed that twenty would be sufficient to handle the product from the Elmore plant, but as the capacity of the latter was continually increasing it was found necessary to double the installation of Wilfleys. When the Wilfleys were overtaxed the separation of lead was not done efficiently, with the consequence that the zinc content in the zinc concentrate was not raised as high as it should be. Since the new Wilfleys have been provided the zinc concentrate has been raised once more to the more profitable grade of 47%. The zinc and lead concentrates produced during the year sold for £276,946. The treatment cost, including royalty, was £96,522, and £56,946 was charged toward the cost of purchase. In addition £21,043 was allowed for depreciation, and after paying expenses of administration, a profit of £100,867 was left. The year started with an adverse balance of £59,650, of which £29,650 was written off when the ordinary shares were reduced from £1 to 16s. and the remaining £30,000 has liquidated out of the past year's profit. As already mentioned, £44,756 has been paid as dividend and £21,111 has been carried forward.

The Sulitjelma copper mines are in the north of Norway within the Arctic circle, and were first discovered 25 years ago. They are worked by a Swedish company of which N. Persson, of Helsingborg, is the main spirit. Though so far away, the business is an important one, employing 1600 men altogether, and the managers follow metallurgical progress pretty closely. For instance, the Knudsen pyrite smelting process was invented there and is used on some of the ore. The loss of copper in the jigs and tables is large owing to the friable nature of the ore, and quite 40% was lost in the concentration plant. The flotation process was therefore tried experimentally, and as good results were obtained, a single unit, capable of treating 40 tons per day, was ordered. Subsequently in February, 1909, eleven more units were started. These have been working continuously for over a year with excellent results. The tailing from the tables averages 0.8 to 1.4% copper and the concentrate obtained in the Elmore plant runs from 6 to 8½%; the average assay of the final residue is 0.15 to 0.3%, and the extraction is over 80%. The amount of oil used is 2.7 lb. per ton and curiously enough no acid is found necessary. The capacity of the plant is 500 tons per day, but it will work at a much higher rate. The plant requires little supervision, three men per shift and a general foreman being all that is necessary; in fact a plant double the size would not require any more labor. By means of this plant from 800 to 1000 tons of metallic copper per annum is recovered from material that was formerly dumped into a lake.

TORONTO, CANADA

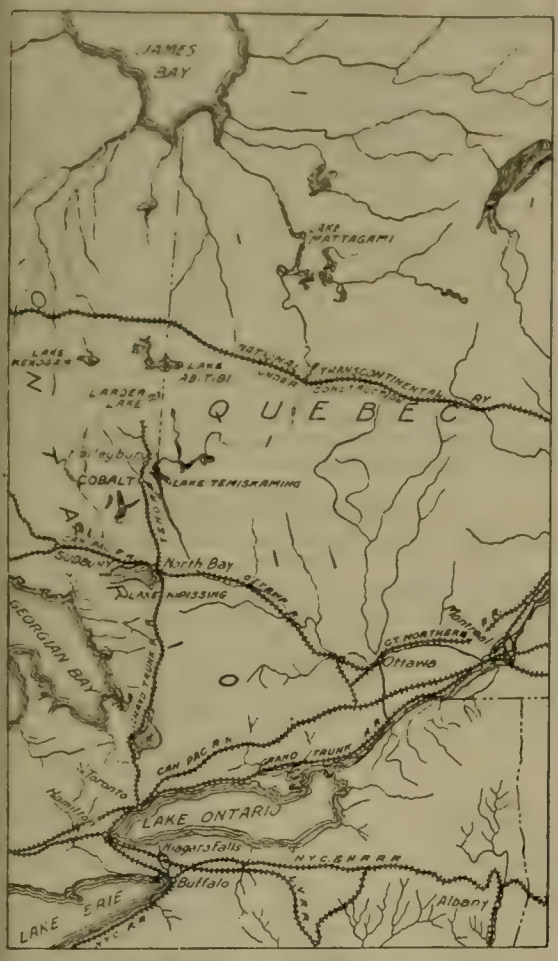
Porcupine Sampling.—Cobalt Prices and Developments. — Canadian Northern and Coalfields. — Iron and Steel Bounties Lapse.—Lake Abitibi Explorations.

As interest in Cobalt declines with a dull and sagging market, Porcupine attracts more attention. The canoe route is now open, and holders of locations are putting large forces of men at work, and many prospectors and mining men are going into the district. The camp has received a decided boost from the results of an assay made by Ledoux & Co. of a consignment of 27 tons from the Hollinger claims, owned by the Timmins and McMartin interests. The shipment consisted of samples of each shooting down to the 60-ft. level, where cross-cuts were made in two shafts 350 ft. apart. The selection was carefully made by competent engineers. The ore assayed $202.75 per ton.

An outbreak of smallpox in Cobalt followed by a rigid quarantine, and the general weakness in the stock market generally, is quite sufficient to account for the depression in Cobalt shares. No material revival is likely to take place until fall. A number of discoveries have recently been reported, but any slight advance in price ensuing is always the signal for a rush of profit-takers, which soon forces the price down to about the former level. The Rochester has opened up some high-grade ore on the 50 and 75-ft. levels, the vein at the latter depth being 6 in. wide. The La Rose has encountered an ore-shoot in No. 3 vein on the 75-ft. level, where the vein is 43 in. wide and carries 4000 oz. silver per ton. On the east side of the Hill shaft an orebody is being stoped for 145 ft., the vein carrying rich ore from the bottom of the open-cut to the 135-ft. level. No. 4 vein has been found to grow stronger with depth running 3800 oz. silver per ton. Driving on the 88-ft. level of vein No. 2 of the Lawson property indicates a good orebody between this level and the surface. When the mill of the Nova Scotia is operated the ore will be treated by amalgamation and cyanidation. Concentrating tables will not be used. The Silver Cliff mill is running on lean ore. The higher grades are not to be touched until the process has been more thoroughly tested. Raises are being put through from the winze to the adit-level a distance of 62 ft. and 270 ft. apart. Good milling ore exists all the way and the mine will have an orebody blocked out 270 ft. long and 62 ft. high, of 4-ft. milling rock with some high grade. Kerr Lake will soon be operated by Montreal River power and No. 9 shaft now at the 100-ft. level will be opened up on an extensive scale. Driving on No. 7 vein at the 200-ft. level shows the vein as rich as ever, running from 20 to 30 in. wide for the last 40 ft. and yielding ore carrying 4500 oz. per ton. No. 3 shaft is being worked at 400 ft. and drifts north and south show rich ore. The new plant of the Bailey is in operation and the shaft is being put down from 100 ft. to a depth of 265 ft. Several feet of good milling ore have been proved. The Trethewey in driving an exploratory cross-cut north from No. 2 shaft at the first level recently cut a new vein 4 in.

wide containing 6000 oz. per ton, the wall rock also showing leaf silver.

The Canadian railroad companies have lately shown great energy in securing the control of Western coal deposits. Two important acquisitions have recently been made by the Canadian Northern interests. A company entitled the Canadian Collieries (Dunsmuir), Ltd., capitalized at $20,000,000, controlled by the Canadian Northern, has secured for a figure stated at $11,000,000 the Dunsmuir collieries and coal lands on Vancouver Island. D. D. Mann, vice-president of the Canadian Northern, has announced that the line will be extended west from Edmonton or that neighborhood, to the Brazeau coalfields in the foothills of the Rocky Mountains, the company having acquired a charter covering this route from the Alberta Midland railway. The coal area is about 10,000 acres in extent and yields a high grade bituminous coal, and will cost about $10,000,000. British and German capitalists are associated in the deal with the Canadian Northern. The opening of the Brazeau coalfield will place



Map Showing Portion of Ontario.

the railroad in an independent position as regards the coal supply for their Western lines, and it is also expected that with the settlement of the region and the development of industrial centres there will be a steady market for their output.

In accordance with a recent announcement of W. S. Fielding, Canadian Finance Minister, the iron and steel bounties paid for some years by the Government have been with one exception allowed to terminate with the present year. The bounty on wire rods, however, will continue for six months longer, ending June 30, 1911. Mr. Fielding stated to Parliament that he expected that the iron and steel interests would press for an increased duty by way of compensation, but intimated that it was as yet too early to forecast the action of the Government in that respect.

There is likely during the coming summer to be considerable activity in the exploration of the northern portion of Ontario with a view to discovering further deposits of valuable mineral. The Provincial Department of Mines is sending out several exploring parties in the course of the next few days. J. B. Tyrrell, of the Canadian Geological Survey, has already left for Fort Matachewan to investigate reported gold discoveries in that region where a considerable amount of snow-shoe prospecting was done during the winter. Prospectors are now going in large numbers into the lower Lake Abitibi region where placer gold is stated to occur, and several outfits are now at work on the lake shore. Molybdenite discoveries are reported at Twinback lake in the eastern Abitibi district near the Grand Trunk Pacific line. It is stated that the veins carry 400 lb. molybdenite per ton, with traces of gold, and outcroppings of the same mineral in smaller quantities have been found in other parts of the district.

TINTIC, UTAH

Lower Mammoth at Deep Levels. — Gemini Orebodies. — Knight Group.

The Lower Mammoth M. Co., of which John Dern, of Salt Lake, is president, is shipping four to five cars of ore per week, returns for which are about $20 per ton. The bulk of this is taken from the stopes between the 1700 and 1800-ft. levels. It consists of lead and silver in a quartz lime gangue, the lead occurring as carbonate and the silver as chloride, ruby, and native. There have been some shipments of copper ore, which is found in certain veins clearly segregated from the lead ore. The principal vein, as shown by the open stopes between the 1700 and 1800-ft. levels, is 15 to 20 ft. wide, and it contains there practically no waste. The oxidized ore extends to and probably below the 1800-ft. level. Sulphide ore, consisting of galena, iron, and copper pyrite, comes in at 2000 ft., as was demonstrated by a 165-ft. drift south on the vein at this level. The major vein on the Lower Mammoth is the same as that of the Mammoth. Both those mines are on a north-south mineral zone, whose orebodies follow closely a brecciated dike in the limestone. The original workings in the Lower Mammoth were opened through the old shaft sunk from the surface. Later, a 700-ft. adit was driven, at the farther end of which a roomy station was cut, and a 2-compartment shaft was sunk from this station to 1200-ft. depth. Beginning December 14, 1908, the work of enlarging the shaft to accommodate three compartments was accomplished by March 27, 1909, which comprised putting in timbers, ladder-way, air-pipes, and the equipping of two compartments for hoisting. The total cost was $11.75 per foot. That work was followed by sinking three compartments from the 1200-ft. station to the 2000-ft., the cost of sinking and equipping from 1200 to 1900 ft. was $23.75 per foot, the last 100 ft., from 1900 to 2000, being $28.75 per foot. This performance was under the direction of E. C. Coffin, who has held the position of superintendent during the last three years. Near the collar of the shaft, at the interior station, is a double-drum electric hoist, operated by a 165-hp. electric motor. A force of 50 men is employed. Some ore is being mined and shipped from the 1000-ft. level by lessees.

The Gemini mine, which has been operated continuously during the last twenty years, has yielded $2,000,000 in dividends. During the greater part of this period it was owned principally by the late J. Q. Packard, and it is now a part of his estate. Jackson C. and John H. McChrystal are now, and for years have been, manager and superintendent, respectively. The Gemini holdings are on one of the great north and south mineral zones of the Tintic district, occupying a position on the northern section of the zone. Extending south from the Gemini, on the same belt, are the Bullion-Beck, Eureka Hill, Centennial-Eureka, and Opex workings. Three parallel fissures have been opened in the Gemini, and these are cut transversely by a number of cross-fissures, making a rather complex system of orebodies. The main fissures have a dip east, the cross veins dip south, the pitch of the ore-shoots being north. The width of the zone, measuring from the west fissure to the east fissure, is about 450 ft. The workings are entered through a 1600-ft.

shaft, and by means of a winze that was sunk 300 ft. from the 1600-ft. level. An electric hoist is operated in the winze between the 1600 and 1700-ft. levels, the latter being the water-level at present. The ore on the middle vein was first opened on the 700-ft. and on the west vein at the 1400-ft. level, the shoots on the latter having been followed down to the 1700. The oxidized ore is found as deep as the 1600-ft. level, but below this most of the ore is sulphide, carrying galena, sulphide of silver, and some copper. A high-power electric pump has been installed at the 1600-ft. station, and the lowering of the water from its present level at 1700 ft. to 1900 ft. may be undertaken soon. In this work other companies may participate; the Centennial-Eureka company is installing a pumping plant at the same water-level in its mine, and it is reported that the Chief Con. may do similar work later on. The Ridge and Valley mine, adjoining the Gemini on the north, is being operated through the workings of the latter, and from it three cars of ore per week are being shipped, running 25 oz. silver and 35% lead.

The Knight group of mines, comprising the Colorado, Beck Tunnel, and Iron Blossom, is situated on the east side of the Tintic range, and part of it covers the eastern limit of the limestone area, and extends to the adjacent porphyry. The three mines of the group are producing and shipping ore. Development on the Iron Blossom is the newest and most interesting. While the main north and south vein here is in limestone, it is within a few hundred feet of the contact of the latter with porphyry. This vein has been opened by levels 400 and 500, which were driven from No. 3 shaft. On the 400-ft. level a drift was run 700 ft. on the vein, showing solid ore 40 to 70 ft. wide. A 50-ft. winze in ore from this level served as the centre from which a chamber 50 ft. high and 8 sets wide was stoped out, resulting in a large tonnage of ore running high in carbonate of lead and chloride of silver. A drift on the vein has been made on the 500-ft. level, a 50-ft. cross-cut on the vein not having exposed either wall. A raise has been made from the 500 to the 400-ft. level, and now all ore stoped between the two levels will be taken out from the 500-ft. station. No. 1 shaft, also on the Iron Blossom, which has reached a depth of 1550 ft., is 3500 ft. southeast from No. 3, and the two are to be connected by drifts which are being run on the vein from both shafts. Most of this work thus far is in ore. Sinking is still in progress in No. 3 shaft, and it is to continue till a depth of 200 ft. is reached. All the shafts of the Knight mines are equipped with electric hoists. Shipments amount to 80 tons of ore per day from Iron Blossom No. 3 shaft, 75 tons from No. 1; four cars per day from the Colorado, and occasional shipments from the Beck Tunnel. The Knight railroad, that extends from Silver City to his own mines on the east side of the range, likewise serves other mines in that part of the district. Charles Zabriskie is superintendent of the Iron Blossom group, and Harvey Ross foreman.

BUTTE, MONTANA

Butte & Superior. — Alex Scott. — Zinc Mining. — Wickes and Radersburg.—Davis-Daly.—East Butte.

The Butte & Superior company will in the next few weeks be treating 500 tons of ore per day at the Basin concentrator. The company has secured a lease on one-half of the concentrator. Machinery has been ordered and will be installed at once. The Butte & Superior's half of the plant will be operated by three shifts of men. Structural steel has arrived and the work of preparing the foundation is being rushed. It is estimated that at the present rate of progress the shaft in the Alex Scott will be down 1600 ft. by June 1, at which depth a station will be cut and an electric pump installed. A cross-cut will be run to intersect all of the veins, and the work of getting ready for shipping ore will be vigorously pushed. From the 500-ft. level to the 1400-ft., a number of veins containing copper and silver in commercial quantities have been opened. On the 1400-ft. level the main vein has been opened and an ore-body more than 20 ft. in width developed. The ore carries considerable bornite and copper glance.

The work of exploring the old Emma mine for zinc ore in paying quantities has been abandoned and the hoist is being dismantled. James Wilcox, formerly superintendent of the Mass Consolidated and now president of the Calumet-Corbin company, has been in Butte. He had been inspecting the company's property, which consists of seven claims in the Wickes district and seven in the Radersburg district, the latter property being known as the Mammoth mine. Mr. Wilcox is very enthusiastic over the Radersburg property. He considers the district the most important gold camp Montana has ever had, on account of the value of the sulphides increasing and the width of the orebodies increasing in depth. He reports the Keating to be down 600 ft. and showing well in gold and copper. The ore at the 500-ft. level of the Black Friday assays $300 per ton in gold. The Ohio Keating is down 300 ft. and a good body of ore has been found. The Ohio Keating is installing an electric hoist. The Mammoth is installing a gasoline hoist and soon will be hoisting ore. At the 50-ft. level an assay shows $8 in gold, 50 oz. in silver, and 63.2% lead per ton. The men associated with Mr. Wilcox in the Calumet-Corbin are residents of Minneapolis and Boston. The work in the Davis-Daly mine is going along as usual, except that the force of miners employed is reduced to 25 owing to the fact that no arrangements have yet been made for the shipment of ore. Cross-cutting is now proceeding on the 1700-ft. level to the vein. Miners who are at work say that large bodies of ore have been blocked. It is announced that Mr. Heinze will arrange for the treatment of his ore either by building a spur from the Colorado to the Great Northern railway or by arrangement with the Pittsmont smelter owners. H. E. Gross, president of the East Butte Copper M. Co., has returned to Boston after making an examination of the mines and smelter of the company. While here he arranged with the Butte-Ballaklava company for treatment. In order to do this another furnace will have to be started in the Pittsmont smelter, and arrangements are progressing toward this end now. A certain amount of custom ore will be treated in addition to the 400 tons per day it is expected that the Butte-Ballaklava will ship.

BRITISH COLUMBIA

Phoenix Items.—Trail Smelter Production.— Nelson and Slocan Outputs.

The Greenwood Miners' Union has called off the strike against the British Columbia Copper Co. and the company announces that it will immediately resume operations. The Granby company is working a diamond-drill on its Gilt Edge property. The ore shipments from the Boundary district for the week ended May 14 and for the year to that date were as follows:

	Week, tons.	Year, tons.
Granby mines	22,509	473,038
Snowshoe	2,500	80,420

At Rossland, the Centre Star, Le Roi No. 2, Ltd., Le Roi, Mayflower, and I. X. L. mines are working steadily, and now the Nickel Plate has been leased by a local syndicate and during the past week shipped 90 tons of select ore. The metallic production at the Trail smelter during the month of March was as follows: gold, 12,487 oz., $254,507; silver, 178,542 oz., $92,368; copper, 468,565 lb., $62,267; lead, 3,766,388 lb., $106,565; making a total value of $515,798. The value of the metallic production for the nine months prior to March 31, was $4,367,420. These figures indicate that the production for the twelve months will exceed those of the previous twelve. The ore shipments from Rossland for the week ended May 14 and for the year to that date were as follows:

	Week, tons.	Year, tons.
Centre Star group	3,110	72,564
Le Roi No. 2, Ltd	390	11,263
Le Roi mine	300	5,294
Nickel Plate	90	90

At Nelson the Consolidated M. & S. Co. of Canada has resumed work on the Queen Victoria property. There is a

large showing of low grade copper gold ore on the claim and it is the intention to make steady shipments to the smelter at Trail. The company is doing a lot of diamond drill work on the Sullivan group which it is working under a lease and bond. A good strike is reported from the Cliffman property, Toad mountain back of Nelson. Three feet of gold bearing ore has been opened up that will assay from $15 to $25 per ton. The following table shows the quantity of ore received from local silver lead mines during April and the lead content:

	Net weight, lb	Lead content, lb
Blue Bell (conc.)	393,178	246,026
Monte Cristo	7,178	2,598
Rambler Cariboo	125,662	53,418
Richmond Eureka	707,351	107,726
St Eugene (conc.)	3,297,835	1,966,772
Standard	133,548	76,248
Sullivan	2,616,384	511,515
Yankee Girl	468,164	20,453
Van Roi	241,080	152,036
Total	7,990,380	3,136,692

The ore and concentrate shipments from the Slocan-Kootenay mining district for the week ended May 14 and for the year to that date were as follows:

Rambler Cariboo	21	378
Richmond Eureka	29	1,719
St Eugene (conc.)	368	7,007
Silver Cup (Ferguson)	60	527
Sullivan	129	4,020
Van Roi (conc.)	122	309
Yankee Girl	128	2,391

NEW YORK

San Cayetano and Other Mexican Issues. — Copper Surplus and Production. — Clark and Butte. — Porphyry Reserves and Values.—Granby.—Union Copper.—Heinze Stocks.—Braden Copper.—Canadian Mines.

The San Cayetano Mines, Ltd., which, about two years ago passed to the control of the Lewisohn interests, is about to be offered to the public. The property is in Guanajuato, Mexico, and the present move marks the entry of the Lewisohns into Guanajuato. In view of the fact that two or three of the biggest producers in Cobalt are controlled by the same people, the move is especially significant. It shows a faith in the future of silver, which warrants the development of immense orebodies of low grade, as contrasted with Cobalt. That the Lewisohns already owning or controlling the Kerr Lake, a leader in the Cobalt dividend list, and the Wettlaufer of South Lorrain, which is held to be a sure profit earner later, should definitely commit themselves to Guanajuato is distinctly a matter for congratulation among Mexican silver producers. San Cayetano has a capital of $250,000, par $5. This is to be increased to $1,500,000 and such shares as are not taken by the stockholders of the General Development Co. and the Silver Mines Exploration Co., both holding companies controlled by Adolph Lewisohn and his friends, will be later offered to the public. The Guanajuato Power & Electric Co. has purchased the Electric Light & Power plant at San Luis Potosí, through its subsidiary the Central Mexico Power Co. The Guanajuato Power & Electric Co. is growing rapidly. It owns hydro-electric plants, one on the Duero and one on the Angulo river. In addition to the mines and the city of Guanajuato, it supplies power to Leon, Irapuato, Celaya, Salamanca, La Barca, Aguascalientes, and is now building into Zacatecas. The report of Russell T. Cornell, who has been examining the properties of the Pacific Mining & Smelting Co., for the General Development Co., has been received.

The copper agencies are once more pointing to the fact that the entire copper surplus and stocks on hand represent only enough metal to meet requirements for from two to four months and that in reality such amount is not excessive. The argument is good were it not for the fact that there are many producers continuing to output copper at little or no profit rather than face the heavier losses of shut down or drastic curtailment. Utah Copper and Nevada Consolidated are barely meeting dividend requirements, reduction of dividend means stock market shrinkage, reduction of output means interest and depreciation charges increasing and dividend reduction as well. In the meantime the deep level mines cannot be philanthropic, there are more steam shovel coppers in the making and so the situation, in a way, aggravates itself and all connected with it, save the consumer, who refuses to be stampeded into filling up the stock yard. The most encouraging feature in the metal market is the report of sales by the larger agencies aggregating upward of 100,000,000 lb. Such sales will make the next month's report of production much more favorable. The elimination of W. A. Clark as a copper producer and smelter at Butte, leaves Anaconda in undisputed possession of almost the whole of Butte, and when the Amalgamated shall have transferred the newly acquired properties in due course, the new Anaconda will have a potential copper output of 325,000,000 lb. Tuolumne, East Butte, East Butte Extension, Butte Ballaklava, and Davis-Daly are the most important mines outside of the merger. North Butte remains off the reservation, but its position is something of a mystery. Mr. Clark sailed for Europe as soon as the deal with the Amalgamated was concluded, announcing in a final interview, however, that he had no intention of retiring from the copper field. New properties have developed near his Arizona mine and it will be no surprise to note the enlargement of the United Verde and the absorption of some of the prospects adjoining it, which bid fair to develop into mines. The ten thousand shares of North Butte recently issued in exchange for the outstanding interests in the Croesus claim have been listed on the Boston Stock Exchange.

A recent report on the ground of the Chino Copper Co. credits the property with ore reserves, as of May 1, of 17,948,566 tons, averaging 2.6% copper. Some recent calculations made show the tremendous figures into which the prophyries run. Utah is figured to have 150,000,000 tons of ore in sight which on a 13c. copper market, is estimated to have a net value of $1.20 per ton giving Utah a net valuation of $180,000,000, or, a book value, so to speak, of $117 per share on its issued capital of $1,540,000, against a market value of $42 to $46. Nevada Con. is estimated to have ore in sight of 32,000,000 tons, of a net value of $1.65 per ton, giving this property a net value of $52,800,000 or $26 per share against a market price of $18. Ray Con. with a capital of 1,200,000 shares including the 200,000 shares to be exchanged for Gila, has an estimated tonnage of 67,000,000 tons, of a net value of $1.25, net value of the property $83,700,000 or a figure of $70 per share against a market price of $17. While these figures make a most imposing showing for the porphyries, the fact remains that Nevada Con. and Utah are only meeting dividend requirements on the present market and at present prices Utah returns about 7½% on the investment, while Nevada pays 8⅓% at $1.50 per annum on a market of $18. Since mining dividends must mean return of both principal and interest, whether the property be one of short or long life, the deduction is unavoidable that, in spite of the showing made, as to the values to be handled before the properties shall have been exhausted, the two principal porphyries, which have reached the stage of production are selling too high.

J. P. Graves, vice-president and general manager of the Granby, is in New York and is preparing a complete detailed report on the Granby property, to be submitted to the directors in a few days, and later, to the stockholders. The examination upon which the report is based was a very minute one, and the forthcoming document is expected to throw much light on prevailing conditions; in fact, to show the Granby shareholders just where they stand. The report will also be of much interest to the public at large as an aid in analyzing the future of some of the other low-grade milling coppers. A pool is being formed in Union Copper Mines. Union Copper of North Carolina has been the vehicle or the medium for almost every kind of market tactics known. This most recent move in the issue is a

request to the shareholders to place their stock in bank, under option to an alleged English syndicate supposed to be seeking control of the property. As the option is to run until November 1, 1910, the interim may be profitably employed in carrying out a few market manipulations, rendered wholly safe by having the outstanding stock locked up in the safety vault. The acquittal of F. Augustus Heinze was expected to be the signal for a few stock market pyrotechnics in Ohio, United Copper, Stewart Mining, and Davis-Daly, issues in which the Heinze interest is supposed to predominate. United Copper made an advance on a small sale, but otherwise the Heinze specialties were quiet. The request made to the United shareholders a few days ago by the Western Development Co., a concern which succeeded the defunct firm of Otto Heinze & Co., for agreements to exchange their preferred stock for Anaconda, has been followed by a letter from the same concern agreeing to exchange, on or before July 31, 1910, one share of Anaconda for each share of United Copper preferred the recipient might purchase in the open market, in good faith, within ten days from the date of the letter. All of the officials of the Anaconda deny guilty knowledge, and while the Western Development Co. officers declare the proposition was made in good faith and was not a stock jobbing scheme, they explain, at the same time, that as the public holds but very little of the preferred issue of United Copper, any widespread buying movement that might be incited would push the price above that of Anaconda. There has been no advance in United, and it is evident that the ruse failed to work.

Pope Yeatman has returned from the Braden Copper mines in Chile, where he has been engaged in an exhaustive examination. There is now under construction on the ground a smelter and a concentrating plant, to have a capacity of 2000 tons per day; ore reserves, as developed in the two orebodies now being opened, are estimated at 7,000,000 tons, averaging 2.7% copper. Mr. Yeatman figures costs at 7 to 7½c. per pound when the plant is completed, and a further saving of ½ to 1c. per pound is thought possible by the adoption of a leaching process for the concentrate in connection with electrolytic precipitation. An experimental leaching plant is being built. The annual report of the Tonopah Extension shows a deficit of $40,405 for the year ended March 31. Generally speaking, the improvement shown in the Tonopah has been one of the bright spots in the mining market and the great interest shown is indicative of the welcome which would be given any general revival of activity in the Nevada camps. The Eastern public prefers any of the Goldfield prospects, if at all active, to a Cobalt dividend payer. Such preference is almost purely a matter of sentiment, but nevertheless as strong a market factor as if based on the most careful analysis of mine values. The Standard Consolidated of Bodie, California, an old time producer, has been admitted to trading privileges on the New York Curb. Cobalt Central, which has been something of a stock market performer, much advertised, and the shares widely scattered, is said to be going into the hands of a receiver, following the recent failure to place a $400,000 bond issue. The report of such action cannot at the moment be verified, but a reorganization is a certainty. There is good progress being made at Porcupine. The surface showings are so big that in all cases judgment is withheld awaiting exploration at greater depth. Veins 5 ft. wide, stripped for a length of 400 ft., with a pay-streak in the centre 2 ft. wide, and showing free gold in practically all of this length, seem out of all reason. It is to the credit of the operators at Porcupine that no runaway boom market has been attempted. Options on prospects are held at prohibitive figures, but there has been no attempt at wholesale promotions. On the ground of the Porcupine Gold Mines Co. sinking is progressing on the vein above described, with a view to running a drift under the outcrop and proving its value at a depth of 75 to 100 ft. The road problem is troublesome. The Timmins people, working the Hollinger group, are ready to make another shipment of ore as soon as a wagon-road can be completed from Porcupine to the railroad. On this property, as well as on the 'Home Claim', which is operated by people interested in International Nickel, sinking is in progress, and as free gold continues to be found wherever development is in progress, the outlook for the moment is exceedingly bright; so bright, in fact, that the general attitude is a waiting one.

JOHANNESBURG, TRANSVAAL

Administrative Changes.—Marriot System.—Faulty Shafts.

Very important changes in the technical administration and some of the most important mining and financial houses operating in the Transvaal are taking place. Mr. Leslie Simson has resigned his position as superintending engineer of the Consolidated Gold Fields of South Africa, and his place has been taken by C. D. Leslie, who has managed the Simmer & Jack and Robinson Deep mines. T. W. Craig, who has been in charge of the Knights Deep and Simmer East properties at Germiston, has been appointed assistant superintending engineer. Although no definite announcements have yet been made, it has been an open secret for some time past that changes were pending in the engineering staff of H. Eckstein & Co. and the Johannesburg Consolidated Investment Co. (otherwise Barnato Brothers). It is anticipated that some definite statement will be communicated at an early date. In the meantime it is premature to discuss this subject at any length. H. F. Marriott, who is chief technical adviser to the firm of Wernher, Beit & Co., has endeavored to introduce a new system of accounting mining returns on the Rand. In so far as the mines of the Eckstein group are concerned, it was stated that the new method would be carried into effect immediately and that instead of monthly returns being issued as heretofore quarterly reports would be prepared on the new basis. The idea underlying the scheme was of course to encourage cleaner mining and to induce managers to pay less heed to low working costs and to give more attention to high profits. The general opinion among mining engineers here seems to be that by closer supervision the aims and objects of Mr. Marriott's system can be attained without resorting to such a radical departure as is entailed in the square fathom method. The general opinion seems to be that the 'Marriott method' is open to just as many abuses as was the old, that the new system will greatly increase the labors of mine staffs, and that a large amount of statistical data will be published which the average shareholder will entirely fail to understand, and that the publication of quarterly instead of monthly statements will tend toward diminished confidence in the industry on the part of European investors.

Two or three shafts in the central section of the Witwatersrand goldfields have of late proved defective, and although it cannot be said that there is at the present day any cause for undue anxiety regarding these shafts they will have to be carefully watched. At the Ferriera Deep the No. 2 shaft has given trouble for months past, and the company's tonnage and profit earnings have suffered in consequence. Quite recently the shaft was repaired, but a few days ago further 'creeping' took place and a few of the timbers gave way. Hoisting was then suspended for some time and the shaft is now in proper working order again. At the Robinson Central Deep shaft of the Crown Mines hoisting has been interrupted lately through the breaking away of a skip in the shaft and the tearing up of a good deal of rail and timber. This, too, has been remedied. There can be no denial of the fact that in some of the mines on the Rand—especially those in the more central section of the fields—the state of the underground workings is not satisfactory. This condition of affairs is to a large extent a legacy of the faulty mining methods of the earlier days, and it cannot be said that the present policy of accelerated production and the raising of a maximum tonnage each month irrespective of some other important considerations tends to improve matters. Sand filling should do much toward bettering the state of underground workings. All the mines of the Central Rand are adopting sand filling on a large scale, so large in fact that it is predicted that within five years all or practically all of the unsightly dump heaps which now cover the central portion of the main reef fields will have disappeared.

General Mining News

ARIZONA

COCHISE COUNTY

At the Bisbee Extension three shifts are working on the 400 and 700 ft. levels. Considerable difficulty is being experienced with the heavy flow of water and the hoist has been kept busy hailing when not hoisting ore or waste. Another boiler and pump is at Lewis Springs seven miles from the property, and will be installed in a short time.—At the Junction shaft of the Superior & Pittsburg, development is centered on the 1500 ft. level where the orebody has been opened to a width of 65 ft. It is reported that the company is now planning to install a large compressor plant at this shaft that will act as a central air distributing point.

GILA COUNTY

(Special Correspondence.)—An option on the property of the Globe Mining Co., consisting of 338 acres of mineral land, best known as Mineral Farm, and situated three miles northwest of Globe, was given to W. A. Canode as representative of Chicago capital, at a stockholder's meeting held in Globe May 19. The purchase price named is $500,000, which is to be paid in cash installments distributed over a period of five years. The first and second payments of $5000 each fall due August 1 and January 1, respectively, and October 1, 1911, has been set as the date of the third payment of $35,000. It is provided that the holders of the option shall begin development work by January 1, 1911, and that within one year from that date, at least $100,000 must be expended in operations. The present workings on the property consist chiefly of a shaft 415 ft. deep, with about 100 ft. of cross-cutting completed on the fourth level and of an adit several hundred feet long. It is further provided that a royalty, amounting to 5% of the proceeds from any ore mined and shipped by the purchasers before making the final payment, shall be paid to the Globe Mining Co.——Of two churn-drill holes being put down on the Colorado claim of the Inspiration property, one has struck chalcocite ore of good grade at a depth of 500 ft., and the other is still passing through the capping.——The National Mining Exploration Company has discontinued work on the 660-ft. level temporarily at the Williams shaft and has resumed shaft sinking with a view to establishing a level at a depth of 778 ft.——The Warrior Development Co. has recently increased its shipments of 10% ore from 90 to over 100 tons per day.——Two 40-hp. hoists are expected to reach the Copper Reef Consolidated mines by June 1.

Globe, May 21.

MOHAVE COUNTY

The Gold Hills Mining Company has let a contract to sink a shaft 200 ft. on its property in Weaver district. These mines were recently taken over by the company from Barney McCall and are considered among the best properties in that portion of the country.——It is reported that a new company is to take over and operate the old Lone Star mine, near Mineral park. The mine at one time was one of the richest producers of ore in the county, but after the surface ores were worked out little was done with the property on account of the difficulty in handling the water.——On the Last Chance mine, in the Wallapai Springs district, W. E. Frost, O. D. M. Gaddis, Walter Meyers, and Harry Mehaffy have a fine showing of gold ore.——In cutting the station at the 150-ft. level of the Keystone mine the S. R. Porter Mining Co. opened a 2-ft. vein. The ore is said to be of a high grade and something similar to the cross vein from which a large part of the rich ore produced by the mine was taken in early days.

YAVAPAI COUNTY

The United Verde Copper Co. is now using the tailing from the Henrietta mill in the Big Bug district for converter lining. It is estimated that there is an accumulation of approximately 20,000 tons of this material which is very silicious and will assay between $4 and $6 per ton.——The shaft at the Monte Carlo mine has been retimbered and a 10 ton mill is being installed.——The Big Bug Placer Mining Co. has made the final payment on the T. F. Averill placer claims at Mayer and will build a dredge on the ground.——It is reported that a rich vein of silver ore has been opened in the May Day mine in the Bradshaw mountains.——A 6 ft. Huntington mill is being installed at the Big Pine group in the Hassayampa district.

CALIFORNIA

CALAVERAS COUNTY

At the Good Hope mine, near West Point, there are about 50 tons of milling ore on the dump and 10 tons of high grade that will be shipped to the smelter.——Louis Lloyd cleaned up $1000 from the milling of 10 tons of ore.——Arthur French is now working the Austrian mine which he purchased recently.——There are 15 tons of milling and 5 tons of smelting ore on the dump of the Great Bend property that will soon be treated.——Sterling & Wickman are running their cyanide plant in Mott's gulch treating the old tailing that has accumulated from the mills.

INYO COUNTY

A new shoot of silver-lead ore has been opened in the Monster mine at Big Pine, in the White mountains, and shipping will be resumed. The severity of the winters and the remoteness of the district has prevented the Monster from becoming a regular shipper as it now promises to do.

NEVADA COUNTY

(Special Correspondence).—Work on the new cyanide plant at the Empire mine is progressing rapidly.——Good ore has been cut near the shaft in the Union Hill where the company is developing on two veins.——The Central Consolidated is extracting ore running $10 to $100 per ton from the middle vein. It lies between slate and porphyry and is over three feet wide.——At the Champion mine a large force is at work under the old management and 35 stamps are dropping steadily.——Hugh Craney is arranging for the re-opening of the Oro Grande mine, 15 miles north of Nevada City.——Operations have been resumed at the Kenosha mine with a small force of men and the shaft will be deepened.

Grass Valley, May 23.

At the Cassidy claims in the Grass Valley district where work was resumed a short time ago new machinery has been installed and the vein opened in two places. An average of a number of assays showed the ore to have a value of a little over $10 per ton.——The Prudential Mining Co. has secured an injunction against the Tarr Mining Co. restraining the latter from turning the water from the ditch that supplies the Prudential mill. The water was turned off the early part of the month stopping the work at the Prudential. The two lower levels of the mine filled while the power was cut off and will have to be unwatered before active work can be resumed.——The final payment on the bond on the Native Son mine in the Nevada City district has been made by J. H. Bishop who represents the new owners. Work will be started in the adit now in 180 ft., and continued about 600 ft. to intersect the vein.

SHASTA COUNTY

The Mountain Copper Co. is shipping on an average of four cars of ore per day to its reduction plant at Martinez. This ore is all taken from the Iron Mountain mine as very little is being done at the Hornet.——The Mount Shasta Power Co. is installing a compressor at the tunnel which it is driving at the Big Bend of Pit river and will continue the work with machine-drills. The tunnel will be approximately seven miles long when completed, and carry 25,000 miners' inches of water, obtaining a fall of about 900 ft.——H. O. Cummins has purchased the Kinger, Keswick View, Lucky Smoke, Golden West, Poverty Hill, Big Spring claims, and Golden Eagle mill-site in the Lower Springs district from H. A. Wiser for $15,000.——The Cave Creek Mining Co., which now owns the McClure group, adjoining the Bully Hill, has installed a compressor and let a contract to drive a 500-ft. adit. E. J. McLaggan is in charge of the work.

SIERRA COUNTY

The raise at the South Fork gravel mine, at Forest, cut

through the rim of the channel into the lava and a drift will be started to tap the bottom of the channel.——The gravel at the White Bear mine that has been washed recently has yielded from $5 to $10 per day per man working in the breast.——A 5-stamp mortar and some other mining machinery were hauled from the Downieville foundry a few days ago to the Swastika mine near Sierra City. This equipment is part of the 10-stamp mill that is being erected on the property.——Two shifts are now working in the Sovereign adit in Ladies canyon and good progress is being made.

SISKIYOU COUNTY

Walter Gillis, one of the lessees of the old Summerville mine near Callahan, shipped 98 oz. of bullion which represented the clean-up for a little less than a month. Work for the month previous yielded 109 oz.——The Black Bear mine, which has been idle for several years, is to be reopened by B. F. Daggett.——William Schell, operating near Greenview, on the old channel that parallels the Scott river, has cleaned up all the gravel that was partly worked out by drifting in early days and is now washing new ground. Considerable coarse gold has been found on the bedrock and a good clean-up is expected.

TRINITY COUNTY

Reed & Chapman have installed a Huntington mill on their Windy Camp claim in the Coffee Creek district.——Charles Heath opened a $6000 pocket recently while prospecting in the neighborhood of Minersville.

TUOLUMNE COUNTY

W. T. Forsman, E. R. Argersinger, and Charles Saunders have taken a bond on South Black Oak mine near Soulsbyville for $20,000. The same parties have also secured a bond on the Ralph property between Soulsbyville and Tuolumne on the Cherokee road for $50,000.——The remodeling of the 20-stamp mill at the Dutch mine has been completed and the stamps are now dropping.——The Quail mine, which is a short distance from Coulterville, will be operated this summer. Little work had been done on it for several years until last fall when several cross-cuts were driven from the main adit and some good ore opened.——Robert Fish and Alfred White, working the McGinn lease on the Golden Rule mine, have extracted 60 tons of ore from an old adit on the property and will shortly put it through the mill.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence).—The new mill for the Mint mine on Covode mountain will be started some time this week.——E. J. Butts, manager of the Big Indian mine on Leavenworth mountain, is preparing to start a new adit, the portal of which will be situated close to the base of the hill. Machinery is to be purchased at an early date. ——G. F. Milliken, of New York, has completed an examination of the Kelly adit workings on Democrat mountain, and it is reported that work will be resumed during the next 30 days.——The Alaska mine at Freeland, owned by V. Jaensen, has been sold to A. Nelson and E. M. Moscript. ——The Ristedt mill on Fall river has been started and will be run on ores from the dumps of the Kinda mine, owned by G. F. Crawford.——Heavy shipments of ore are being made by Jones & Polaro, who are running a number of old stopes in the Franklin workings. Previously the ore was shipped to the Modern smelter, but with the closing down of that plant shipments have been started to the Golden pyritic plant. Returns averaging $340, net, per car on 20-ton shipments have been realized in the past.

Idaho Springs, May 21.

GILPIN COUNTY

(Special Correspondence).—A shipment of five tons of ore made from the Mitchell mine, on Quartz hill, brought a settlement of 1.4 oz. gold, 8.84 oz. silver, and 2.80% copper, or a total value of $28 per ton.——A carload of smelting ore from the Egyptian mine in Nevada district was sent to the Golden smelter the latter part of last week.——Work will soon be resumed on the Next President mine in Gregory district. The property is operated by the Great Bonanza Gold Mining Co.——A carload shipment of smelting ore made last week from the Gilpin King mine brought a settlement at the local sampler of $44 per ton, the copper content being 15%. G. Knutzen is operating under bond and lease.

Central City, May 20.

GUNNISON COUNTY

The new 200-ton mill of the United Colorado Mines Co. is now running and while not operating to its full capacity it is making an excellent saving on the plates and a good concentrate on ore that assays as low as $6 per ton. The company is working about 100 men though the roads are bad and it is almost impossible to haul freight in.——A drift has been run 20 ft. on the ore that was recently opened by the adit at the Dupont property in Crystal basin showing the vein to be about 9 ft. wide.——A gasoline engine and compressor is to be installed at the Hard Cash mine on Galena mountain and work resumed in the adit which is now in 800 ft. There is a large amount of ore opened in the group and the company may erect a small furnace to make copper matte.——Arrangements have been made for the resumption of work at the old Excelsior mine in Baxter basin. The Yankee Blade adit is to be extended through Cascade mountain to tap the shoots of the Excelsior which have yielded large profits from the upper levels.

LAKE COUNTY

Considerable work is planned for the Tennessee Park district this summer and it is probable that several new properties will be in operation in addition to the older ones. The Jennie June, which is the principal producer of the district, will be worked by Al Ganz and associates who have controlled it for the past few years. It is equipped with a first-class plant and would be operated the entire year were it not for the severity of the winters.——The Helen Gould will also be active the coming season and it is probable that a number of shipments will be made as considerable ore was opened last year.——At Leadville, George Cramer and associates have been operating the Waterloo mine on Carbonate hill and shipping ore the entire winter. The ore is a fair grade of galena containing some iron.——Work has been started on the Miller group in Lackawanna gulch on which a good showing of gold ore was made last summer. ——The old adit on the Badger fraction in upper California gulch is being extended and drifts are to be started on the vein that was opened a short time ago.——The old workings of the Colonel Sellers mine are soon to be worked through the shaft at the foot of the hill which was opened a few months ago. Hoisting has been started through this shaft and shipments are being made regularly.

OURAY COUNTY

The Wanakah Mining Co., which recently secured a bond on the American Nettie mill, is overhauling the plant and putting in the foundation for a new compressor that has been ordered from St. Louis. A pipe-line will be laid from the mill to the mine to carry the air that will furnish power for the drills. Machinery for the terminals of the new tram has been shipped and it is expected that it will be in working order early this summer. The company has enough ore blocked out in the mine to keep the mill running for some time and a new adit has been started on the Ironclad lode to develop that portion of the property.——It is reported that the money to carry on the work on the Joker and Genesee groups has been raised in the East and that these properties will be in active operation by the time the Silverton railroad is completed to Red Mountain which should be within a short time.——Machinery for the completion of the Mono-Baltic smelter at Ironton will be shipped as soon as the railroad is opened and work on the plant will be rushed. The building of this smelter will mean much to the Ironton district this coming summer as the Kentucky, Indiana, and a number of other properties will be in a position to operate profitably.——At the Thistledown a large amount of ore has been blocked out in the mine and the mill has been started for the season.

SAN JUAN COUNTY

S. F. Anderson, Ole Erickson, and Ed Anderson have se-

cured a lease on the second level of the Little Maud mine in the Silverton district and will commence shipping ore within the next few weeks. Considerable high grade ore has been taken from the Little Maud property and it is probable that the present operators will erect a mill and cyanide plant if the average of the ore can be kept up to a fair standard.——H. C. Branch, representing the Kuenzel smelter, has been in Silverton recently looking over the field with a view to establishing a plant in Silverton similar to the one at Bella Vista which is reported to be operating successfully on $5 ore.

SAN MIGUEL COUNTY

Alex Righino has secured a lease on a large block of ground in levels No. 5 and 7 in the Smuggler Union mine at Telluride and is working a force of from 35 to 40 men. The ground is on the old Smuggler and Sheridan locations, and while the lease includes a small piece of virgin ground the most of the work is in re-opening the old stopes that were made in early days when the ore was hauled to Montrose in wagons and forwarded from there to the smelters.

SUMMIT COUNTY

Wineland & Ellwood are crushing the ore from the New York mine which they opened a short time ago in the Johannesburg mill. The ore is free milling and a large portion of the value is saved on the plates.——At the Wellington mine in the Breckenridge district a station is being cut in the adit and a new working shaft is to be sunk. Of the products from the mill only the lead and zinc concentrate is being shipped, the middling being stored for future treatment.——At the O'Reilly work is progressing in a satisfactory manner. The new drills have been placed in the working face and the adit is rapidly being completed.

TELLER COUNTY

A. Osburg, operating a sub-lease in the Victor mine, opened a shoot of ore on the eighth level that assays between $1200 and $1400 per ton, and is sacking it for shipment.——A head-frame has been hauled over to the Fountain Valley claim of the Banner Gold Mining Co. on Rosebud hill, and as soon as it can be erected the machinery installed by the Union Leasing Co. will be started and active mining operations resumed underground. The water has been lowered nearly to the bottom of the shaft, and there will be no hindrance to the operation of the bottom level.——The Republic Gold Mining Co.'s property south of the El Paso is being prospected, but no ore in paying quantities has been found since the present lessees took charge.——The Pinnacle Leasing Co., operating on the Mitchell claim of the Pinnacle company on Bull hill, is breaking ore of a smelting grade 3 ft. wide and making regular shipments. One car shipped a few days ago assayed over $80 per ton, and another containing ore of higher value will be shipped in a few days.——The Maggie property, in the saddle between Bull and Raven hills, is making a production of three cars per week with the ore running from 2½ to 3½ oz. This claim is operated under lease by Carl Johnson, who has opened two distinct shoots. One of the orebodies is 2½ ft. in width, while the other measures a trifle over 3 ft. between walls. The better grade of mineral is coming from the smaller vein under development at a depth of 350 feet.

MISSOURI

JASPER COUNTY

(Special Correspondence).—The low ore prices of the last two weeks has caused the temporary shut-down of a number of the sheet-ground mines in the vicinity of Webb City, Joplin, and Duenweg. Most of these mines have kept the pumps operating that the ground may be well drained when operations are resumed, as it is thought the depression will be of short duration. Other sheet-ground mines have reduced wages or employed men on half time and are storing the ore, where it is possible, and are waiting to sell it until prices rise. The low prices have not affected materially the soft-ground mines, as they can still run at a profit even with ore below the $40 mark.——The John Jackson land at Chitwood, which was bought last fall by a St. Louis company, is being worked now and the A. B. C. mine has been started. The old John Jackson mine was one of the best producers of the district when it was operated several years ago.——Northwest of Joplin in the vicinity of Toms Station a new camp is being formed. For a number of years some mining has been done here, but new prospecting has opened some splendid deposits.——A fine deposit has been opened in the Porto Rico camp on the Knool land, operations being conducted by the Nowata No. 2. The deposit was a pocket at a depth of 100 ft., a type of formation which is common in this camp.——In the eastern end of the county some good shallow discoveries have been made in the vicinity of Reeds and Sarcoxie.

Joplin, May 21.

MONTANA

SILVER BOW COUNTY

(Special Correspondence).—The Pittsmont smelter of the East Butte Copper Mining Co. is now operating two furnaces and handling 250 tons per day of the Butte Ballaklava ore.——W. A. Clark, who has great faith in the future of the zinc properties in this district, has directed that the Elm Orlu be worked to its full capacity. He has by arrangement with the Amalgamated secured the use of the concentrator at the Butte Reduction Works for the treatment of the ore.——The work of getting the Ophir mine, the property of the Butte Central Copper Co., ready for actual mining operations, is progressing favorably and it will not be long before the work of sinking the shaft to a depth of 1000 ft. will be commenced. An electrically driven air-compressor is to be installed and an electrically driven pump placed at the station on the 500-ft. level.——Just what hitch has occurred in the erection of the Butte & Superior concentrator cannot be ascertained, but all work has been stopped and even the mine surface men have been laid off. The underground work is proceeding as usual and the mine is shipping in the vicinity of 350 tons of ore per day to the Basin concentrator. It is stated that a 7-ft. vein of zinc ore has been cut on the 1600-ft. level that assays 50% zinc per ton. It is pointed out that this ore does not have to be sent to the concentrator, but will be shipped direct to the smelter for treatment and that it will net the company $30 per ton.——Rapid progress is being made with the sinking of the Belmont shaft which is now 1500 ft. from the surface. It will be sunk 500 ft. farther and connections made with the Anaconda 2400-ft. level. This shaft is to be used as an auxiliary to the Anaconda, Never Sweat, and St. Lawrence shafts.——One piece of welcome news which is the direct result of the merger is the announcement that copper is being produced already at 9c. per lb. At all the mines of the Anaconda company development is proceeding and the shipments are up to normal conditions.

Butte, May 23.

It is reported that the Carlisle and Protection claims, situated between the North Butte group and that of the Butte & Superior Mining Co., in the northwestern portion of the Butte district, have been bonded to Pittsburg interests for $400,000. These claims are owned by George Casey, P. J. Brophy, Charles Mattison, Mrs. Martha Fish, W. O. Speer, and others, and have been sought by the companies owning adjoining claims. Little work has been done, but some valuable veins have been proved to the boundaries of these mines.——The Never Sweat mine, one of the Anaconda properties, has resumed operations. It has been closed about two months on account of an accident to the engine, which was wrecked by a runaway.

NEVADA

CHURCHILL COUNTY

A body of ore 4 ft. wide, averaging $117 per ton, two-thirds silver and one-third gold, was cut on the 470-ft. level in the Nevada Hills mine last week.

CLARK COUNTY

(Special Correspondence).—The Ninety-nine Copper Mining Co., opening a mine 20 miles west from Las Vegas, has a contact vein of copper ore between dolomite and blue limestone, which has been partly developed by a 250-ft. shaft and a 70-ft. drift on ore at the 200-ft. level. The ore

consists of copper carbonate, with some tetrahedrite. J. B. Jensen, superintendent, says shipping will be started in June.

Las Vegas, May 20.

ELKO COUNTY

A 40-ton Lane mill is to be installed at the Sleeping Beauty mine in the Gold Circle district and the work of putting the road in shape from Golconda has been started. Two mills, the Rex and the Hartley, have been in continuous operation for some time, and it is thought that the Gold Circle Crown Mining Co. will erect a plant shortly after the Sleeping Beauty is started. In the Rex property the vein has been opened to the 100-ft. level, showing it to be 14 ft. wide, and has an average assay value of $20 per ton.——It is reported that the affairs of the Gueyman have been adjusted and that the mill will resume operations soon. ——The drift on the vein at the Judge is now in 200 ft., on an 18-in. vein of high-grade ore and the winze is down 50 ft. on the same vein, samples of which have assayed over $125 per ton.

ESMERALDA COUNTY

A sill-floor has been established on the 500-ft. level of the Combination Fraction at Goldfield on the orebody opened recently near the Mohawk line, and stoping is now in progress in connection with the extension of the development work. Drifts and cross-cuts are in progress on the 750-ft. level, and the raise that is being driven from the 380-ft. level to re-open the rich shoot that was lost on the 280 is now in ore from which some fair assays have been obtained.

NYE COUNTY

(Special Correspondence).—The Tybo Mining Co., controlled by Max Bernheimer of New York, owns mining property at Tybo, having the Two-G vein that was located about 1864, and which was a profitable producer of silver and lead in early days of high-priced metals. This vein consists of a fault-fissure in limestone, having a westerly strike and a dip of 75° north. It has been opened by a shaft to a depth of 400 ft., and a great deal of the ore has been stoped out to the 300-ft. level for a distance of 1200 ft. on the strike. The vein is said to be as wide as 25 ft. in some places, and narrows to a few inches in others. The ore consists of galena, silver, zinc blende, and iron sulphide, in a lime and silica gangue. It is estimated there are 300,000 tons exposed by present workings. No attempt is now made to ship this ore, because of the long distance from a railroad, Tybo being about equidistant from Goldfield and Ely. An effort is being made to induce the Tonopah & Tidewater interests to build to Tybo and Hamilton, both of which camps could probably supply a considerable tonnage of sulphide ore containing silver, lead, and iron. ——In Tybo district the Metals Exploration Co., controlled by S. F. Hunt, W. S. Larsh, and E. Opdyke, has claims covering 5000 ft. of a vein that is considered the extension of the Two-G vein, on which a number of open-cuts have been made and shafts sunk by which the continuity of the vein is said to have been proved.

Tybo, May 20.

The Independent mill at Manhattan has just completed a run on 39 tons of ore from the Santos-Michael-Schubert lease on the Durant ground and returned to the lessees an average of $40 per ton. Most of this ore was taken out near the surface.——The Canyon mill, which was started a few days ago on ore from the Union No. 9, is crushing 18 tons per day and will increase this to 5 or 6 tons as soon as one of the mullers which was broken some time ago has been repaired. About 300 tons of the ore is to be treated at the mill, all of which is being taken from the lease of Walter Lamb.——The camp of Pioneer is again on the up grade after a dull seasan. The Pioneer lease is working and milling considerable low-grade ore, and the leasing company which was formed to take over the Mayflower holdings is developing the lower levels of the group. ——J. R. Bryan is operating a lease on the K. K. claim and is sacking ore that averages $100 per ton. He has also taken a lease on the Rickard-Garber lease and expects to start shipping ore from that property in a short time.

STOREY COUNTY

The new pumping plant in the C. & C. shaft at the 2300-ft. level has been started again and is apparently working successfully. The column pipes have been lengthened and the water is being lowered rapidly. Thus far no serious obstacles have been found below the water-level in the pump compartment from the old Cornish system, and the shaft is found to be in good condition. As the bottom of the shaft is at the 2650-ft. level it will not require any great time to drain it if there is room for the pumps. The raising of the water from the 2350 and 2450-ft. levels by the auxiliary system has resulted in cooling the workings and it will soon be possible to repair the shaft and get into the 2450-ft. workings of the Consolidated Virginia.——At a recent meeting of the Ophir board of directors the Ophir portion of a joint lease was granted Charles C. Derby to work the Ophir-Mexican croppings on royalties graded from 10 to 25% of the gross value of the ore extracted. The directors also voted to cut down the amount which the Ophir is paying to the Comstock Pumping Association. This cut will amount to 35% and will be made up by the companies operating on the north end.——Good progress is being made on the sub-

Ely, Nevada.

lease which Joseph Dietrich recently secured on the upper workings of the Chollar, and a 4-ft. shoot is being opened. Over 100 tons of ore are in the bins and the tramway to the Butters plant will be started in a few days.

WHITE PINE COUNTY

(Special Correspondence).—The Ely Centennial Copper Co., controlled by John Dern, Samuel Newhouse, H. B. Cole, D. C. McDonald, W. V. Rice, E. V. Vanderhoef, G. F. Boreman, B. G. Hite, and others, is developing its group of claims, situated a quarter of a mile north of Ely, by a cross-cut that starts at the south limit of the property, and runs northerly to cut a series of veins which strike east and west. The heading is now in 850 ft. and in this distance two or three minor veins have been intersected. By driving 200 to 250 ft. farther, it is thought, the principal vein will be struck at a depth of about 550 ft. on its dip. These veins, which outcrop in the limestone cap-rock, having a dip north of about 50°, have been explored to a limited extent by shallow surface workings. In a 55-ft. shaft and a 15-ft. cross-cut from it ore was found assaying 4 to 5% copper and 7 to 10 oz. silver; in a 45-ft. shaft and a 10-ft. drift from it a 15-in. streak of ore was found assaying 30% copper. Another shaft, 35 ft. deep, opened a 4-ft. orebody. Work began here last December, and is in charge of Saul Snyder. A gasoline engine and a 3-drill air-compressor have been installed.

Ely, May 21.

NEW MEXICO

BERNALILLO COUNTY

There has been quite a revival of mining interests in the Sandia and Manzano mountains east of Albuquerque and a number of properties are being explored. In the Soda Springs district the ores are found in a limestone which overlies a granite and are silver-bearing galena with occasional gold-quartz veins. Among the companies actively engaged in developing this district are the Swastika, Bear, Octoroon, and Ruppe. In the Hell Canyon district there is more copper in evidence. The Providence, McKinney, Grey Eagle, and Pittsburg have all opened veins containing a fair amount of copper in the lower levels.

SAN JUAN COUNTY

(Special Correspondence.)—The Sonora Mines Co. made its second shipment of concentrate and bullion this week, bringing the total production of refined gold and silver to 2000 lb. for the past 30 days.——The mill bunk house, shaft house and a portion of the shaft timbering of the Mogollon Gold & Copper Co. was destroyed recently by fire, the loss being partly covered by insurance.——During the week the Ernestine Mining Co. milled 704 tons of ore, smelted 6350 oz. of bullion and shipped 56 sacks of concentrate.——The drift on the 300 ft. level of the Deadwood mine is now 500 ft. from the shaft, and has been in ore the entire distance. The plant has been handicapped by lack of water, but a supply has been obtained at the springs two miles distant and will be piped to the mine before the mill is completed.

Mogollon, May 21.

UTAH

BEAVER COUNTY

(Special Correspondence.)—The Horn Silver mine, at Frisco, is shipping 1000 tons of ore per month. This runs 15 to 20% lead, and 15 to 25 oz. silver per ton, and is mined on the 500, 600, 700, and 800 ft. levels. A small tonnage of zinc is shipped, which is taken from different parts of the same levels. This ore, which is sent to Colorado and Kansas zinc plants, contains 30 to 35% zinc.——The Cupric Mines Co., controlled largely by the same interests that control the Horn Silver, is developing a copper property situated a mile south of Newhouse. A 412 ft. shaft has been sunk and from this some driving has been done in ore.

Frisco, May 20.

JUAB COUNTY

(Special Correspondence).—Shipments from the Mammoth mine, at Mammoth, amount to an average of 500 tons per month of ore assaying 12 to 18 oz. silver, 0.25 to 4 oz. gold per ton, and 3 to 4% copper, the most of which is mined between the 900 and 2200-ft. levels. The matter of special interest concerning this mine is the increase of the gold content of the ores which have been taken out in the last year or two. It is understood that shipments are light at present because of the management's dissatisfaction with the smelting charges. A great deal of development is in progress, with a force of 80 men, and much ore is said to be blocked out. Samuel McIntyre, Jr., is superintendent.

Mammoth, May 21.

SUMMIT COUNTY

At the regular annual stockholders' meeting of the Silver King Coalition Mines Co. recently held in Salt Lake, 998,546 shares of the 1,250,000 were represented. There was no change in the board of directors, and after the election of the board the directors selected the same officers for another year. The company is now engaged in installing an electric haulage system in the property, and the main shaft is being given its first relining throughout in many years. In spite of these improvements, the company is maintaining a steady output of ore, and there has been no reduction of working force by the management.

TOOELE COUNTY

At a meeting of the stockholders of the Ibex Standard Mining Co. and the owners of the Vindicator properties held at Mercur recently the consolidation of the Ibex and Vindicator mines was ratified. The Ibex Standard will increase its capitalization from 125,000 shares to 500,000 shares, par value 25c. per share. There will be besides the original 125,000 shares of the old stock, 175,000 shares to be given to L. E. Kramer, S. D. Gordon, and James W. Sloane, in payment for the three Vindicator claims. The remaining 200,000 shares are to be placed in the treasury and sold to develop the property which has been opened to a depth of 100 ft. developing a vein of lead-copper-silver ore. The company will install a compressor and carry on the development work with machine-drills.

UTAH COUNTY

At a meeting of the stockholders of the Koyle Mining Co., operating the Dream mine near Salem, held in Spanish Fork, the following directors and officers were elected for the ensuing year: John H. Koyle, president; Henry O. Petersen, vice-president; B. F. Woodward, Isaac Hansen, and George Hales with W. A. Jones secretary and treasurer. The report from the management was to the effect that there are 30 men working at the property, the mine is in good condition and the company has sufficient money in the treasury to continue operations all summer.——The Huish Mining & Milling Co., with Payson City as its headquarters, has filed articles of incorporation with the county clerk. The company owns the Lucky Lady No. 1, 2, and 3, Treasure and Treasure No. 1 mining claims in Santaquin mining district which are made the basis of capitalization. The following are the directors and officers: Carl A. Erickson, president, Joseph L. Olson, vice president, Royal T. Huish secretary and treasurer, Rudolph Peterson and Alfred Peterson.

MEXICO

CHIHUAHUA

The output of the Rio Plata mine, in the Arteaga mining district, last month was 55,501 oz. of silver, as compared with 53,393 oz. the month before. The management is putting the large accumulation of tailing through the cyanide plant as rapidly as possible before the rainy season. When the stamp mills are put in operation again on July 1, the amount of silver recovered will increase to its usual proportions. For the year, the net monthly profits are estimated at $20,000.

OAXACA

(Special Correspondence).—J. W. Brill, of the Victoria y Tapada Mines Co., has recently taken up 75 additional pertenencias in the Totolapa district.——E. H. Hamilton, general manager for the Virginia Smelting Co., of West Norfolk, Virginia, is making a tour of the Oaxaca camps. Mr. Hamilton is endeavoring to contract for several thousand tons per month of siliceous ores, for the smelter he represents.——A. R. Wren, until recently employed with the Monterey smelter, has returned to Oaxaca, and is opening an ore buying agency at Taviche, for the A. S. & R. interests.

Oaxaca, May 20.

SONORA

(Special Correspondence).—The Tharsis York company, the stock of which is held by New York interests, has developed a fine showing of high-grade copper ore in the 130-ft. shaft put down on the company's group adjoining the Pilares mine of the Moctezuma Copper Co., at Nacozari.——Henry C. Carr, of New York, continues development on the body of silver ore in the Antigua mine, which he purchased last December.——A. J. King and associates have re-built

Northern Portion of Sonora.

the wagon-road from the Tigre road to the Cinco de Mayo, recently purchased from Francisco Garcia for $500,000, and operations have been renewed at the mine. The old cyanide plant has been repaired at the Roy mine, and medium ore is now being treated while the high-grade is stacked for shipment to the El Paso smelter.——Frank J. Nichols, of Douglas, and Clifford Robertson, of El Paso, who have an option on the Agua Buena mine, 18 miles south of Nacozari, are now cleaning out the old workings and dewatering them preparatory to examination for Chicago and Kansas City operators.——Herbert Walters has 200 sacks of gold quartz ready for shipment from the Barigon goldfield, recently discovered west of Nacozari.

Nacozari, May 20.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

C. W. MERRILL is at New York.

C. W. PURINGTON is in San Francisco.

FRANK H. PROBERT is in Los Angeles.

A. H. ELFTMAN was in San Francisco.

E. W. PARKER sails for Europe June 7.

ADOLPH KNOPF has been in San Francisco.

W. H. EMMONS is at Ducktown, Tennessee.

WALTER HARVEY WEED has returned to New York.

FRANCIS DRAKE has gone to Bakersfield, California.

PERCY E. BARBOUR has returned to Salt Lake, Utah.

PHILIP ARGALL has returned to Denver from Mexico.

J. E. SPURR passed through San Francisco this week.

POPE YEATMAN has returned to New York from Chile.

ELWYN STEBBINS has returned from Calaveras county.

NEWTON B. KNOX leaves San Francisco for Brazil today.

VICTOR G. HILLS has returned to Denver from Montana.

H. W. TURNER has gone to Vancouver, British Columbia.

M. M. JOHNSON has returned to Salt Lake from New York.

W. E. DEFTY is in Cochise county, Arizona, on professional work.

EDWIN E. CHASE is in South Dakota examining gold properties.

MYRON K. RODGERS has recently been at Guanajuato, Mexico.

A. C. SPENCER, of the U. S. Geological Survey, is at Ely, Nevada.

HERBERT HAAS is designing the experimental mill for the Inspiration Copper Co. at Globe, Arizona.

E. T. WRIGHT, president of the National Ore Concentration Co., of Chicago, Illinois, is at Joplin, Missouri.

H. V. WINCHELL is in Shasta county, California. He will sail for Europe June 9 to be gone three months.

H. D. MCCASKEY has been visiting the Texas quicksilver district. He is expected soon in San Francisco.

R. B. LAMB, now connected with the Proprietary Mines Company of America, has returned from Elk City, Idaho.

CHARLES S. HERZIG, of the Constant-Herzig Co., is making an extended professional visit to the Porcupine gold camp.

S. E. BRETHERTON has returned to his office in the Mills building from a two weeks' professional trip through Plumas county.

M. K. SHALER will leave Antwerp June 16 for two years in the upper Aruwimi country. His address will be Kinshasa, Belgian Congo.

H. W. HARDINGE is now in Colorado on his way to California on professional business, having already visited the Cobalt district of Canada.

W. H. SEAGRAVE, for several years superintendent of the Veteran mine of the Cumberland-Ely Co., Ely, Nevada, has gone to Prince William Sound, Alaska.

M. J. DALY has resigned the superintendency of the Silver King mine, Park City, Utah, and will be succeeded July 1 by GEORGE D. BLOOD, of Salt Lake, Utah.

H. KENYON BURCH, mechanical engineer for the Miami Copper Co., has just returned from a trip through the northern part of Mexico and Arizona. The trip was made by automobile and covered about 900 miles.

GEORGE E. FARISH, of Denver, Colorado, sailed from Seattle, Washington, May 21, to examine some placer properties in southern Alaska. His address until August 1 will be, care of Postmaster, Juneau, Alaska.

S. B. CHRISTY gave a dinner to GARDNER HUBBARD at the Palace Hotel May 19, at which were present W. C. RALSTON, F. W. BRADLEY, J. R. FARRELL, E. H. BENJAMIN, A. C. LAWSON, M. L. REQUA, CHARLES BUTTERS, ROSS E. BROWNE, CLINTON DAY, and H. F. BAIN.

Market Reports

LOCAL METAL PRICES.

San Francisco, May 26.

Antimony	12—12¾c	Quicksilver (flask)	47½—48½
Electrolytic Copper	14½—15¼c	Spelter	7—7¾c
Pig Lead	4.70—5.65c	Tin	35¼—36¼c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
May 19	12.63	4.30	5.15	53⅞
" 20	12.63	4.30	5.15	53⅞
" 21	12.63	4.30	5.15	53⅞
" 22	Sunday.	No market.		
" 23	12.63	4.30	5.15	53⅞
" 24	12.63	4.33	5.15	53¾
" 25	12.63	4.33	5.15	53⅞

ANGLO-AMERICAN SHARES.

Cabled from London.

	May 19. £ s. d.	May 26 £ s. d.
Camp Bird	1 11 0	1 9 6
El Oro	1 7 0	1 7 3
Esperanza	2 18 9	2 14 [illegible]
Dolores	1 8 9	1 8 9
Oroville Dredging	0 9 4½	0 9 4½
Mexico Mines	8 11 3	8 11 [illegible]
Tomboy	0 18 9	0 19 3

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, May 26.		Closing prices, May 26.
Adventure	6½	Mohawk	51
Allouez	45	North Butte	33⅛
Atlantic	7½	Old Dominion	37
Calumet & Arizona	64	Osceola	139
Calumet & Hecla	584	Parrot	15½
Centennial	17½	Santa Fe	1⅜
Copper Range	66½	Shannon	11
Daly West	8	Superior & Pittsburg	12
Franklin	13¼	Tamarack	54
Granby	40	Trinity	57⅛
Greene-Cananea, ctf	8	Utah Con	23¼
Isle Royale	20½	Victoria	3
La Salle	12½	Winona	7⅞
Mass Copper	7	Wolverine	117

(By courtesy of J. C. Wilson, Mills Building.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, May 26.		Closing prices, May 26.
Amalgamated Copper	69⅝	Miami Copper	21¾
A. S. & R. Co.	79	Mines Co. of America	9/16
Boston Copper	19	Montgomery-Shoshone	⅜
B. C. Copper Co	5⅞	Nevada Con	20⅝
Butte Coalition	19⅜	Nevada Utah	1
Chino	12¼	Nipissing	11¼
Davis-Daly	1⅞	Ohio Copper	2⅝
Dolores	6⅛	Ray Central	2 1/32
El Rayo	3⅞	Ray Con	18⅛
Ely Central	⅞	South Utah	1¾
First National	3⅞	Superior & Pittsburg	12⅜
Giroux	7¾	Tenn. Copper	27¼
Guanajuato Con	1¼	Trinity	6
Inspiration	7⅛	Tuolumne Copper	3⅜
Kerr Lake	9⅛	United Copper	6¼
La Rose	4⅝	Utah Copper	46
Mason Valley	7⅞	Yukon Gold	4⅜

SOUTHERN NEVADA STOCKS.

San Francisco, May 26.

Atlanta	$ 14	Mayflower	$ 3
Belmont	3.75	Midway	28
Booth	13	Montana Tonopah	98
Columbia Mtn	6	Nevada Hills	84
Combination Fraction	52	Pittsburg Silver Peak	70
Daisy	6	Rawhide Coalition	30
Fairview Eagle	14	Rawhide Queen	34
Florence	2.50	Round Mountain	60
Goldfield Con	8 47	Sandstorm	4
Gold Kewenas	6	Silver Pick	8
Great Bend	3	St. Ives	11
Jim Butler	26	Tonopah Extension	95
Jumbo Extension	21	Tonopah of Nevada	8 60
MacNamara	26	West End	45

(By courtesy of the San Francisco Stock & Exchange Board.)

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EDITORIAL.

CHITINA is now connected with Cordova. The Copper River railroad extends from the latter place to Mile 104 at which point connection is made with river steamers running up to the copper region. The *Nizina* made the initial trip May 27 and within six weeks railway connection through is promised.

THE ARTICLE on the genesis of ores by Joseph LeConte, appearing on another page of this issue, is republished in abbreviated form from a lecture of his printed in the MINING AND SCIENTIFIC PRESS in 1871. This was several years before he printed in the *American Journal of Science* the article usually quoted.

ZINC PRODUCTION by the Sulphide Corporation at Broken Hill, New South Wales, amounted in 1909 to 84,689 tons of concentrate containing 46 per cent zinc, 7 per cent lead, and 15 ounces silver. This single company, therefore, took from old tailing more zinc than was produced by the mines of the Wisconsin district, and had some advantage in the silver content. The zinc concentrate, with 6411 tons of lead product, sold for £276,946.

MINORITY stockholders of the Greene Consolidated Copper Company have instituted suit in the New York Supreme Court against Mr. Thomas F. Cole, Mr. John D. Ryan, the Greene-Cananea Copper Company, the Cananea Central Copper Company, the Greene Consolidated Copper Company, the Cananea Consolidated Copper Company, Mr. William C. Greene, and others, praying for a restoration to the Greene Consolidated Company of certain properties alleged to have been wrongfully taken from it, and furthermore demanding an accounting. The Sierra Madre Land & Lumber Company is also involved in the litigation, and an injunction is sought to prevent the suggested merger of the Greene Consolidated with other Cole-Ryan properties. The case is as complicated a tangle as is the Greene maze of company names through which the court must trace responsibility and obligation in the proceedings now beginning.

HAVING JUST CELEBRATED an anniversary of our own we have a particularly keen eye for those of others and have read with especial interest the retrospect with which the editor of *Harpers Magazine* marks the close of the sixtieth year of that publication. 'Harpers' is indeed an institution and most Americans of this generation can not remember when it was not. It seemed to come out of the legendary past—the great past in which 'The War' was a real event, and to go back almost to the time when "your grandfather shot a bear in the front

yard''—for this, the oldest of the great American monthlies, had readers while pioneering was still common. In our own childhood the little cupids on the cover scattered a never ending stream of roses and blew perpetually fresh soap bubbles. Later a time came when in the rush for modernity and the first fierce struggle with newly risen competitors, 'Harpers' lost poise and scrambled. The cupids disappeared and we were grieved and lonely while the magazine followed strange paths. It was not a success, being too much like grand opera in vaudeville or a Salome dance in church—to give the reader his choice of figures. Fortunately the publishers repented and for some time the old magazine, from the cupids on the cover to the ancient jokes in the 'Editor's Drawer', has been restored. We have often, by the way, tried to determine the period of that drawer, so as to predict the return of certain jokes as the astronomer foretells the return of a comet. Success has so far failed to crown our efforts. We think it must be because some heavy jokes filter down through and get out of place when the editor turns the drawer over. However, the old departments, and the old spirit, are back; and that is the great thing. Not all, however, is old; the form and substance are new and as the magazine is now conducted, modern life and conditions are discussed and illustrated in the light of the best traditions. A periodical, as the editor says, is ''not a planned machine, but a living organism''. It is something which the readers make quite as much as does the editor. His, the dignified position of family coachman; he guards the traditions and guides the horse though the latter goes of its own force and at times shows a will of its own. None knows this better than the editor of our centemporary, and *Harpers Magazine*, therefore, is interesting less as an example of what its editor wants to publish than of what the public wants to read. Judged by this test it proves that in the general field of literature, as we have found true in technical journalism, soundness is appreciated and pays.

South American Trade

A dedication number of the Bulletin of the International Bureau of American Republics has been issued, corresponding to the month of May. The number does credit to Mr. John Barrett, the energetic Director of the Bureau, and fitly celebrates the entry into new palatial quarters of this branch of the Government, a branch which is distinctly that of propaganda, looking toward more intimate cultural, social, and commercial relations between the western family of nations. The development of this instrument for promoting pan-American affiliation was due to the patriotic initiative of James G. Blaine. He believed in the power and worth of an American destiny for the United States. As a world-power we find ourselves weak by not being first of all the accepted leader of the Americas. Leaving political errors aside, it is a lamentable fact that we still shut our eyes to opportunity in Latin America. The close ties existing between this country and Mexico are the result of propinquity—which has been responsible for a good many marriages; it has also been promoted by the cordial and forgiving spirit of the Mexican. This friendly alliance should serve as a model for the extension of our influence. We need the commerce of South America; she needs not only our goods but our aid in developing her resources. The spirit of both North and South should unite in the promotion of American enterprise—and we use 'American' here in its broad and proper sense.

The trade of South America today is larger than that of the Orient, but we let it go to foreigners and sit down to that intricate game of chess, Oriental diplomacy. The genius of our people has been that of the pioneer; we could develop South America as could no other nation in the world. We are not so adept in exploiting people as in exploiting natural resources. It is to be hoped that the Bureau of American Republics may become more widely appreciated; that our manufacturers, wholesale merchants, and capitalists may have the opportunities lying to the south of us so driven into their understanding that the campaign may go forward with energy and may bring results. The possibilities of providing enormous quantities of food-stuffs from Latin-America are but feebly comprehended, and this, quite as much as mineral development, needs our attention. We should strike a balance between the output of foods and metals. When that is done a healthier economic condition will prevail in the United States. It will relieve the copper miner, give courage to the producer of lead, and stop the upward soaring cost of producing iron and steel, that now stands $5 per ton above the level of three years ago. A brighter future lies before us if we turn toward the South with the same conviction that animated Mr. Blaine when he called the western nations into conclave at Washington.

Bureau of Mines Appointment

Competition for the position of Director of the new Bureau of Mines is becoming keen. Apparently it is a case of Mr. J. A. Holmes against the field. We have seen no reason to change our opinion, already expressed, to the effect that Mr. Holmes is the best man available for the position. His promotion would insure close connection with the work already begun and his skill and energy are too well known to require comment. He has the powerful antagonism of Mr. J. G. Cannon, Mr. J. A. Tawney, and the ruling spirits of the House organization. He has been altogether too active to suit these eminent standpatters who have repeatedly felt that their hands have been forced in the matter of appropriations for the work under his charge. This opposition may cost him the position, but ability to get appropriations for needed and useful work, will hardly be held by the public to be a proper bar against his appointment. The candidate of the standpat Congressmen is Mr. David Ross, the present secretary of the Bureau of Labor Statistics of Illinois. He is not a technical man but has come up from the ranks of the coal miners and is a man of ability. His candidacy, however, is frankly political and is being urged by politicians, especially Mr. W. B. McKinley, chairman of the Congressional Campaign Committee. Mr. Ross was one of the organizers of the United Mine Work-

ers of America and has many friends, particularly among labor union men and mine inspectors. If the appointment is to be made a political one, he would doubtless give as good administration as possible—but we protest that this is no place for politics. If the Bureau is to accomplish the good for which it is designed, it should be kept as rigorously free from politics as has been the Geological Survey. Miners and engineers should promptly register their protest against any such attempts to defeat the purpose of the work.

Another cause of opposition to Mr. Holmes is his well known friendship and long close association with Mr. Pinchot, Mr. Newell, and Mr. Garfield. No evidence that he has not loyally supported the present Secretary to the full extent that the situation demanded, is offered, and if this is to be seriously urged it begins to look like a war of proscription against Mr. Pinchot and his friends; a war which could only result in great damage to the public service and which would be certain, incidentally, to react disastrously on the administration. Mr. George Otis Smith, Director of the Geological Survey, is opposed to his appointment, and favors Mr. E. W. Parker, the well known statistician of the Survey. While having a high opinion of Mr. Parker and his ability, we do not consider this a good selection. There has been some jealousy and disagreement between the men of the Technological and the other Branches of the Survey. Some of the members of the Survey have been opposed to the organization of a Bureau of Mines at all, and Mr. Parker has not been in harmony with the plans and purposes of those who have been active in securing the establishment of the new Bureau. His appointment will certainly be considered to be an attempt to control the situation in the special interest of the Geological Survey rather than of the mining industry. Bureau and Department jealousy works havoc enough at Washington and the better part is to look beyond the present and to measure the good to the country and the work rather than to a particular Bureau. We have no desire to insist further than that the best possible man be appointed to the new post. Among the men who have been mentioned no one, we think, so measures up to the position as does Mr. J. A. Holmes.

Copper Prices

Regularization of the copper market has been much demanded, but the difficulties in the way have loomed large. It is beginning to appear that stability will come in the good old fashioned way through operation of the ordinary laws of trade rather than through mergers and combinations. The result is likely to be more satisfactory to consumers than producers, though not necessarily bad for the latter. At present, production is running about 10 per cent ahead of consumption. The visible stock of metal, while large, is not out of proportion to the volume of business transacted. It has, however, the great disadvantage from the point of view of those who would raise prices, of being all visible. In the new order of things the producer and not the consumer carries the stock. The great copper companies have got into the position of merchants who carry shelves stocked with goods and must perforce wait for customers. In the meantime the pressure to sell is enormous and steady and back of it lies a story of the new order of things in mining.

In former times mines generally paid for themselves. The prospector with his grub-stake was succeeded by the partnership or the local development syndicate, and it in turn by the company, but all along the way the amount of money brought in from outside was small. Usually it was not beyond the means of some single group whose members might readily keep informed as to intimate details and were thus ready to accept temporary loss of interest for the sake of future profits. With the development, however, of the larger mines of today, and especially of the porphyry coppers, it has become necessary to advance large sums of money and to resolutely face the fact that returns can not be expected for some five or six years. This narrows the field. Relatively few people have the necessary money and are ready to invest on these terms. The pressure to get the properties on a dividend basis has naturally been great, and since to permit full development usually requires repeated bond or stock issues, the pressure to keep dividends going has been greater. To get and keep a clientele of investors in these properties it is necessary to make the securities good collateral as promptly as possible. Dividends and listing on the stock exchange are potent factors, but especially dividends. The men who control the properties are frequently not the main owners and even the money they put up is often borrowed, with the stock or similar securities as collateral.

The new Ray is capitalized at $12,000,000, Nevada Consolidated has $9,923,530 outstanding, the larger Utah stands at $25,000,000, and the new Anaconda at $150,000,000; a far cry that from the simple prospect of early days. As modern business is now organized such sums are only commanded through Wall Street, and Wall Street has no continued interest in non-dividend paying properties. Whether the stock be held for real investment or be counted merely as chips in the game, dividends are essential. Talk of curtailment is idle. Each company must produce and sell, making what profit it can, else the promoters and managers lose control and their following; the latter a valued asset for the future. Therefore the Butte mines consolidate, economies are effected, and such copper as can be, is produced on a 9-cent basis; that being the price fixed by the effective competition of the porphyries. If prices rise, a larger amount of higher-priced copper will be made; if they fall, a small amount of lower-priced. In this the Butte mines but exemplify the whole. Here and there a single property may suspend but the big mines can, within limits, produce some copper at any price fixed by the market. The scale of modern operations is so large and new copper mines of any importance are so slowly brought to production, that only slow changes in copper prices are likely to occur. Manipulation may occasionally and for short times raise copper to an artificial price, but regularity of price, the best basis for industry, seems likely to rule.

Australia's Premier Tin-Mine

By John Plummer

Each of the Australian States appears to be richer than the others in some form or other of mineral production. Thus Victoria formerly, and Western Australia lately, leads in the auriferous output; New South Wales in silver and coal; South Australia in copper; Queensland in copper-gold; and Tasmania in tin and galena. In Tasmania Mount Bischoff and the Briseis mines are among the richest in existence. The former was discovered in 1871, and is worked largely as an open quarry, a considerable proportion of the hill having been removed in the course of development. From the very outset the mine has been a consistent producer until some little time ago, when it was reported that only a few months work at a largely reduced rate of output remained. This was serious news for the shareholders, who, up to date, have secured over £2,124.000 in dividends. Considering that the number of shares is limited, only 12,000 having been issued, of which 4400 paid up to £5 each were given to the discoverer, while on the remaining 7600 shares not more than £1 each was paid by the purchasers, the mine may be regarded as one of the most profitable in the Commonwealth. It paid almost from the start. Of the £7500 actually subscribed, £1500 was paid to the discoverer, the remaining £6100 being sufficient to commence working operations.

Mount Bischoff is described as being a huge peak rising several hundred feet above the township at its base. The main outcrop is an irregular porphyry dike, trending approximately east. "From the township vast quarry-like excavations can be seen on the southern slope of the hill. These give some indications of the extent of the mine, the white faces being a land-mark for miles. They are, however, only a minor portion of the workings, as beyond them to the north, but shut out from view by a strip of rock, lie the brown faces from which immense quantities of tin have been won in the past. Excavations here run up to 190 ft. in depth and hundreds of feet in length." Mining is also carried on extensively underground. The brown faces consist very largely of iron-stained sand material cemented together by limonite derived from the decomposition of the pyrite in the adjoining rock. Detritus is described as being most interesting, lying under a capping of solid rock in places. There are also large deposits of granular gossan, carrying rich pockets of tin. These are of use in maintaining the high average grade of the ore milled. Sulphurous smelling bands of pyrite also add to the variety of coloring in the mine, "even if they do not make working conditions pleasant."

When it was rumored that the mine was becoming exhausted, the scientific adviser of the company, J. D. Millen, now general manager, decided upon a thorough investigation, and determined that possibly some of the evidence relied on by the miners for guidance was incorrect. He therefore commenced collecting evidence respecting the genesis of the ore. This was a most elaborate process, involving a careful microscopic examination of the porphyries to ascertain whether supposed barren rock carried elements necessary for the existence of staniferous ore, as did the rocks in which the ore was found. In his researches Mr. Millen followed on the lines of Daubeè's theories with regard to the sublimation of vapors in connection with the deposition of tin. The result was to demonstrate conclusively that 'topazization' noticeable in rocks known to contain tin ore existed also in porphyries which are supposed to carry no tin. The next step consisted in commencing a system of prospecting with a view to ascertaining, after microscopic work, which of the porphyries did and which did not show topaz. The results were most satisfactory, and the mine, instead of having only a few month's life, has now reserves proved for at least another ten years, based on the present output of about 90 tons of tin oxide per month, and the ore-faces generally promise that these reserves will be increased. It is, in a sense, the story of the waste heaps at Broken Hill over again. But for the investigations conducted by Mr. Millen the Mount Bischoff might have been abandoned a few months hence and forgotten like many other mines in the Commonwealth. Some have supposed that Mr. Millen simply discovered fresh deposits where tin-bearing rocks were supposed to have been worked out, but he explains that the ore is found at many points where it was assumed not to exist. Wherever the topazization of the porphyries has occurred tin is to be found. The success of his investigations induced Mr. Millen vigorously to explore the mine in directions where work had been suspended. He drove through masses of ink-black decomposed pyrites, notwithstanding the repeated assertion that they indicated the termination of the run of good ore. Boring was carried on below the floor, cross-cuts made to ascertain the existence of unsuspected orebodies, and a lot of other work done, with the result that the continued productiveness of the mine became assured, and there will be no interruption in the payment of dividends. The whole milling plant has been remodeled, and Mount Bischoff made practically a new mine. It has already been enabled to double its output, and is one of the finest examples of science applied to mining yet afforded in Australia.

An immense amount of work has been done by Mr. Millen and his predecessor. "The country," we are told, "is so abrupt, and the Mount itself of such extent, that a lengthy inspection is necessary to appreciate the amount of work effected. For instance, huge stanniferous gossan boulders exist, not only on the southwestern slope, but also far away on the opposite or northern slope. Do these point to the fact that they have been shed from some lode formation on that side of the hill? If so, further deposits of tin-bearing ore may exist there to be opened up." Practically, there exist great possibilities on the northern side, which still remains unworked save near the summit. Lately, however, the productiveness of Mount Bischoff has been exceeded by that of the Briseis mines, the dividend paid by the former in 1908 being £36,000, and those of the latter amounting to £112.500.

CANADIAN MINING INSTITUTE MEETING

The eighth general meeting of the Western Branch of the Canadian Mining Institute was held at Grand Forks, British Columbia, on May 26. W. Fleet Robertson, of Victoria, B. C., Provincial Mineralogist, who is this year's chairman, presided, and E. Jacobs, branch secretary, was also in attendance. Several papers were read as follows: By O. E. LeRoy, on 'The Geology of the Ores of Phoenix Camp, B. C.'; by L. Reinecke, on 'Silver and Gold Deposits on the West Fork of Kettle River'; by Charles Camsell, on 'The Mineral Resources of a Part of Yale District, B. C.' The writers of these papers are members of the staff of the Geological Survey of Canada. A summary of O. E. LeRoy's account of the geology of Phoenix may be given as follows: The mineral zones in which the Granby and other large mines are situated are in structural basins with a well marked floor of highly silicious rocks termed jasperoids. The mineral zone itself consists mainly of garnet and epidote, with a few other lime-iron silicates in smaller quantities. Water and gas, highly heated, carrying iron and silica, have combined with the lime to form these silicates, which are essentially self-fluxing. The orebodies are enormous, irregular, lense-shaped masses, from a few hundred to more than 2000 ft. in length, with a width of 100 ft. and more. These lie, as a rule, on the bottoms of the basins with the jasperoid foot-wall. The hanging wall, unlike the foot-wall, which is structural, shows no clear definition, the ore gradually grading into the gangue minerals. The average ore is a copper and iron pyrite, evenly distributed with hematite, and, in certain places, magnetite in a gangue of garnet, epidote, quartz, and calcite. The topography of the country and the attitude of the orebodies favor the most economic methods of mining. Some of the orebodies do not outcrop at the surface, so can only be found by diamond-drilling. Throughout the Boundary district there occur isolated areas of limestone replaced in part by the above-mentioned minerals, so it is possible that careful prospecting will lead to the finding of other orebodies of commercial importance. Charles Camsell described the Yale district as being for the most part in the belt of interior plateaus but embracing also the northern prolongation of the Cascade mountains. The metallic ores lie generally in the sedimentary rocks of Cambrian, Carboniferous, and Triassic ages, and are genetically connected with the plutonic eruptive rocks. The volcanic rocks, on the other hand, rarely hold deposits of economic value. The Tertiary sedimentary rocks generally yield coals, but the Cretaceous sediments have not been shown to contain any. The mineral resources of the district include ores of gold, silver, platinum, copper, lead, iron, zinc, chromite, mercury, and a few others of less importance. Of the non-metallic substances, coal is by far the most important. Gold has yielded most largely as yet. The annual output of placer gold has for many years been decreasing. The production of lode gold, however, is increasing and is now more than $500,000 per annum. The total production of platinum to be from 11,000 to 20,000 ounces.

SOUTHERN PACIFIC AND OIL

*Proceeds of the sale by the Southern Pacific Co. of the valuable oil properties included among its 14,000,000 acres of unsold lands, in whatever form it may be made, bid fair to run into millions. Another and prominent feature of the Southern Pacific's position in the California oil situation is yet to be considered. It will still control the oil it has sold, by virtue of its intrenched position as the leading marketer of California oil. Through its $20,069,003 of the $40,000,000 stock of the Associated Oil Co. the Southern Pacific controls a vast estimated storage of over 600,000,000 bbl. of fuel oil on grounds of the Associated Oil Co., entirely distinct from the lands it proposes to sell, which are lands granted to the Southern Pacific Railroad Co. But what may be accepted as the even better reason why the Southern Pacific will not part with its Associated Oil stock is the fact that the Associated company is the owner and operator of a pipe-line system through which is marketed 40% of the entire output of California.

California produced during 1909 some 56,000,000 bbl. net of oil, or approximately 30% of the output of the United States, which yields 70% of the world's production. With California's importance as the chief source of fuel oil rapidly increasing, it would seem a foregone conclusion that the Associated will not easily yield its relative importance as the leading marketer of California oil. In this connection an official of the Associated points to the $8,445,978 expended on development from the earnings of the company since its organization in 1901, this in addition to the proceeds of approximately $28,000,000 par value of securities also consumed in development.

With the Kern Trading & Oil Co., a Southern Pacific subsidiary, the Associated has joint control of the Associated Pipe Line Co., capital stock $7,000,000, no bonds, which owns and operates a 280-mile pipe-line from the Kern field to Port Costa on San Francisco bay, daily capacity, 16,000 bbl.; and a 256-mile pipe-line from the McKittrick field by way of Coalinga to Port Costa, daily capacity 16,000 bbl., together with extensive terminal facilities at Port Costa. The 72-mile section from the McKittrick and Midway fields to Coalinga is to be placed in operation about July 1 next, the remainder of the line being already in operation. These pipe-lines are valued on the company's balance sheet at $7,142,279.

All of the $4,222,461 outstanding stock of the Associated Transportation Co. is owned by the Associated Oil, the remainder of an authorized issue of $10,000,000 being held in treasury to issue for the acquisition of new ships, pipe-lines, and other equipment. The company has no bonded indebtedness. It owns a 106-mile pipe-line from Coalinga to Monterey, about 100 miles below San Francisco on the coast, daily capacity 13,000 bbl.; terminal facilities at Monterey; a 50-mile pipe-line from Santa Maria to Gaviota, Santa Barbara county, daily capacity 18,000 bbl.; terminal facilities and a refinery of 7000 bbl. daily capacity at Gaviota.

*Abstract from *Boston News Bureau*.

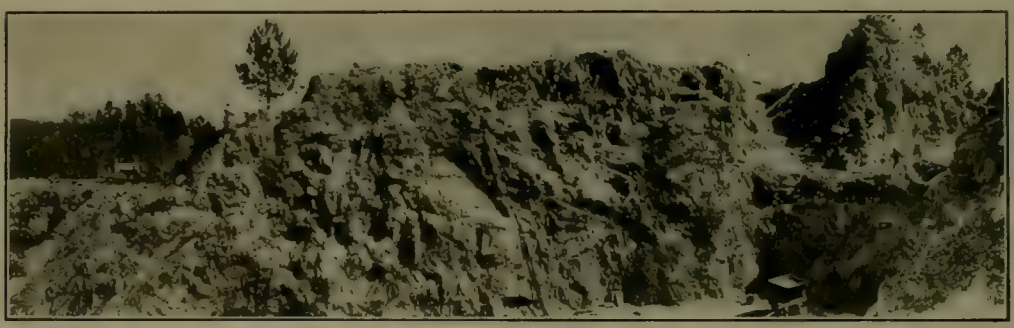
Lithium and Its Sources

By Frank L. Hess

*Lithium is one of the alkaline metals and is the lightest known solid element. Its specific gravity (0.595) is so low that the metal will float on kerosene. Although lithium minerals are not at all common, notable quantities of several occur in the United States at widely separated points. Traces of lithium are found in nearly all igneous rocks[1], and in many mineral springs. In all places where lithium minerals occur visibly, they are associated with granitic rocks and generally, if not always, with the latest phases of granitic intrusions, either in pegmatite, or in granites and adjacent rocks which have been altered by hot gaseous emanations, a process known as pneumatolysis or pneumatolytic action. In some places large masses of lithium minerals which can be worked commercially are found in the pegmatites; in the altered granites only minor quantities of lithium are found. The places of occurrence are practically those of tin, but the largest deposits of tin are found under the conditions which mean small deposits of lithium; that is, where pneumatolysis or other last fluidal processes accompanying the intrusions of granite have acted largely. In the pegmatites which carry large quantities of lithium, the tin content is generally small. Tourmaline, wolframite, columbite, beryl, and many other comparatively rare minerals generally occur in lithia-bearing pegmatites.

The most important lithium minerals are the following: *Lepidolite*, a lithium mica, ordinarily containing from 4 to 5% of lithia. *Lithiophilite*, a phosphate of iron, manganese, and lithium, containing 8.15 to 9.36% of lithia. *Triphylite*, a variety of lithiophilite, containing little or no manganese. *Spodumene*, a silicate of aluminum and lithium, containing from 4.49 to 7.62% of lithia. *Amblygonite*, a fluo-phosphate of aluminum and lithium, containing ordinarily from 7.92 to 9.52% of lithia. While there are a number of other lithium minerals, they are unimportant as a commercial source of lithia, either containing too small a quantity of lithia, or occurring in deposits which are not large enough to be worked commercially.

In color lepidolite is glistening white, yellow, violet, lilac, pink, rose red, or gray. It is generally in small indistinct plates, but in places forms six-sided crystals belonging to the monoclinic system. At Pala, California, and at other places, it forms an outer rim around muscovite mica plates several inches across. In this country lepidolite is found in Hebron, Auburn, Norway, Paris, Rumford, and other places in western Maine; in South Dakota in considerable quantities in connection with the tin deposits of the southern Black Hills; and in great amount with rubellite, a beautiful red tourmaline, in the neighborhood of Pala, southern California. At the Stewart mine, two miles northeast of Pala, in 1907,[2] there was exposed a lenticular mass of delicately tinted, lilac colored lepidolite, 90 ft. long, and 20 to 25 thick, in which a tunnel 125 ft. long had been driven. Several hundred tons were mined and shipped from this deposit. In the lepidolite, rubellite, which also contains some lithia, forms beautiful radial aggregates. Many thousand specimens have been obtained here for mineral collections all over the world. After the spodumene and amblygonite deposits of South Dakota were opened up it no longer paid to operate the Pala deposits. In the Black Hills also lepidolite has been worked to a small extent for its lithia content. There are many other localities where lepidolite is found in occasional flakes or small masses. At Wakefield, Quebec, it occurs in plates several inches across. Other lithium micas are cookeite, zinnwaldite, cryophilite, polylithionite, and protolithionite.



Open Cut in Etta Mine, Keystone, South Dakota, Showing Impressions Left by Spodumene Crystals.

Lithiophilite occurs in small amount at Peru, Maine; Grafton, New Hampshire; in the tin-bearing pegmatite dikes of Kings Mountain, North Carolina; near Pala, and in the Black Hills. In the Black Hills, lithiophilite occurs in many pegmatite dikes, probably in all which carry lepidolite, spodumene, or amblygonite. The masses are very irregular in size and shape, and are of a brownish or blackish color, the latter probably resulting from oxidation of the manganese. In places, both in South Dakota and North Carolina, surfaces are coated with a fine purple film of purpurite, a decomposition product. In the Etta mine, pieces of lithiophilite 6 to 8 in. diameter have decomposed centres partly filled with lilac, blue, and dark green vivianite, probably accompanied by another iron phosphate, dufrenite.

*Published by permission of the Director of the United States Geological Survey.

[1]Clark, F. W. 'The Data of Geochemistry'. Bull. U. S. Geol. Surv., No. 330, 1908, p. 17.

[2]This statement is made on the authority of W. T. Schaller, U. S. Geological Survey.

In both the Etta and Peerless mines lithiophilite occurs in such quantity that while mining for other minerals a few tons may be gathered together for shipment each season. As stated, it contains from 8.15 to 9.36% of lithia, and if it occurred in large amount would be equal to amblygonite as a lithia ore. When it contains little manganese it is lighter colored and is called triphylite. Probably both varieties occur in the Black Hills. Alluaudite is a mineral closely related to lithiophilite, but of no commercial value.

Spodumene occurs in the same general localities mentioned for lepidolite, but is found in greatest quantity in the pegmatites of the Black Hills. In the Etta mine, 1½ miles south of Keystone, the crystals of spodumene are immense, reaching 42 ft. in length with a cross-section of approximately 3 by 6 ft., and so far as known are approached in size by no crystals outside of the Black Hills. In many places mining has exposed cross-sections which are rectangles with truncated corners. It is said that 37 tons of spodumene was mined from one crystal. The dike at the Etta mine is oval in shape, and about 100 by 150 ft. in horizontal measurement.

Tin was first discovered in the early eighties in the Black Hills at this mine, and previous to that the mine had been worked for mica. After the Harney Peak Tin Mining, Milling & Manufacturing Co. was organized, a large mill was put up near the property, and an unsuccessful effort made to exploit the tin. It has been stated that one reason for this was the mistaking of columbite for cassiterite. At any rate, after a very short run, operations ceased, the company went into the hands of a receiver, and the mine lay idle for a number of years. Meanwhile, spodumene had attracted attention as a source of lithium, and the court allowed the receiver to lease the claim to be worked for this mineral. The crystals are considerably decayed, and have an earthy appearance and the odor of a fresh clay pipe. Owing to the decay, the crystals have a fibrous, woody structure, and from this and their size, the workmen ordinarily refer to them as 'logs', which they much resemble. Along cracks in the spodumene cassiterite has been deposited and is evidently of later crystallization.

For a number of years the deposit has been worked by the Standard Essence Co., of Maywood, New Jersey. No amblygonite has been found in this deposit though in the Peerless claim, half a mile away, it occurs in large masses, with some spodumene. Spodumene is found in many other dikes of the region, in some places, such as that on the Dewey claim at the northwestern foot of Harney peak, and on the Louise claim, one mile south of Oreville, it is fresh, glassy, and hard. On these latter claims the crystals are smaller, reaching only 2 or 3 ft. in length, and a few inches in breadth and thickness. An occurrence is reported from the vicinity of Custer in which cross-sections of crystals are exposed that rival those of the Etta mine.

Although amblygonite is found in crystals reaching a few inches in length at Pala and several other places in the United States, and in foreign countries, no other large deposits are known. No work was done at the Etta mine during 1909 beyond shipping several carloads of 'spod', as it is locally called, which had been mined during 1908. Spodumene of an emerald green color, when fresh enough to be glassy and clear, is known as hiddenite, and sells for very high prices as a gem. As with most gems, the price is largely artificial and they are merely held until sold for the amount asked. It is found at Hiddenite, North Carolina. A beautiful pink or lilac variety found near Pala and Rincon, San Diego county, California, is known as kunzite and also sells at high prices. Some jewelers say that the stones lose their color, probably from strong light, and one jeweler showed the writer a stone which he said had faded in a comparatively short time. Kunzite, when of a good clear color, is one of the most beautiful of gem stones. In hiddenite and kunzite the refraction of light is high, so that the stones have considerable brilliancy. Both varieties are reported from Madagascar.[3]

Beta-spodumene, cymatolite, and killinite are minerals formed through the alteration of spodumene, which have only mineralogical importance. The minerals petalite, castorite, and hydro-castorite, are related to spodumene but are without commercial value as a source of lithia.

Amblygonite is found in the same general localities that have been noted for lepidolite and spodumene. It contains a higher percentage of lithia than any mineral except lithiophilite, and, as it occurs in large masses which can be easily and cheaply worked, other conditions being equal, it is more valuable as a source of lithia than either of the other minerals. As found in South Dakota and California, it is a pearly white mineral with one good cleavage, and looks like a very fresh feldspar. In other places it has pale greenish, bluish, yellowish, or brownish tints. Recently, Herman Reinbold, of the Western Chemical Reduction Co., Omaha, Nebraska, mined a large deposit of amblygonite of excellent quality on the Peerless claim, one-half mile northeast of the Etta claim, and one mile from Keystone, South Dakota. As opened in the fall of 1908, the shoot or mass was about 20 ft. wide, and had been excavated more than the same amount in depth and in length. Since then this mass has been mined out, and is said to have produced a total of 900 tons. Amblygonite in fair amount is found on the Tin Queen claim, 1½ miles east of Oreville, from which about two carloads are said to have been shipped by Mr. Reinbold several years ago. At present the company is mining from a claim a short distance east of the Peerless, where the mineral, accompanied by spodumene, is said to occur in large amount. There is some amblygonite on the Ingersoll and probably on other claims in the vicinity. In the Pala locality a mass containing a few hundred tons was mined several years ago, but no other large mass has been found. Amblygonite has been mined at Montebras, central France, in a tin mine; the San Finx tin mine, northwestern Spain; near Perig, Saxony, and in 1906, about 45 tons, valued at $1000 were exported from northern Australia.

[3]Sterrett, Douglas B. 'Mineral Resources of the United States, 1907'. U. S. Geol. Surv., Vol. II, 1908, p. 826.

After opening up the amblygonite on the Peerless claim, Mr. Reinbold began to lower the price of lithia until from $2 to $2.50 per pound, it had tumbled to 50c., and later large quantities were sold at an even lower price. The market for lithium minerals and salts in respect to uses, manufacturers, and consumers, has been a very restricted one. The product most manufactured is lithium carbonate, and for some time it was not known what was being done with the bulk of the salt. It was known that a part was used in the manufacture of artificial lithia waters and for medicinal purposes, but this would account for only a few hundred pounds per year. It is now known that it is used in a storage battery of Edison's manufacture. A small quantity probably also goes into the manufacture of fireworks. Lithium (the metal) is so easily oxidized that no practical use is known for it. Of the lithium salts, lithium bromide is used in photography and in medicine, and various other salts are used for lithiasis (gravel), arthritis (inflammation of the joints), chronic rheumatism, and gout.

By many, the use of natural lithium-bearing waters for various diseases is highly valued, especially in lithiasis, and a large trade is carried on in water from 'lithia springs' in many parts of the United States. Concerning the medicinal use of lithium-bearing spring waters, Haywood and Smith[4] make this remark: "While lithium seldom or never occurs in waters in large enough quantities to be a predominating basic constituent, still it does often appear in sufficient quantities to have a decided therapeutic action. These compounds are active diuretics and form a very soluble urate which is easily eliminated from the system. Waters of the above class, therefore, find their greatest application in the treatment of rheumatism, rheumatic tendencies, and gout. In cases of gravel and calculi they are also valuable disintegrating agents".

The most widely known of these waters are probably from the springs at Saratoga, New York, and they are also of the best. The mineral content of springs varies from time to time owing to drought, excessive rainfall, or other conditions, so that analyses of samples taken at different periods do not agree closely, especially in the lithium content. As sampled by Haywood and Smith,[5] the Carlsbad water of Saratoga carried 31.8 parts per million of lithium chloride. This water was the richest in lithium of any analyzed by the authors who gathered samples of the prominently advertised lithia waters of the country for testing. Some of these waters contain so little lithia that barrels of the water would have to be drunk to get a dose of lithia. The proprietor of one spring, in order that his guests might have no doubts as to the lithium content of the water, imported lepidolite from a well known locality and scattered it carelessly around the spring, even putting some in the forks of a tree. But the man who really knew rocks came along one day and the fraud was made known.

[4]Haywood, J. K., and Smith, B. H. 'Mineral Waters of the United States'. Bureau of Chemistry, Bull. 91, 1905, p. 12.

[5]Op. cit., p. 97.

Methods of Pulp Agitation

By Lloyd M. Kniffen

It is good to see that more attention is being paid to the question of agitating pulp during cyanide treatment and that the metallurgist is not now limited to centrifugal pumps and arm agitators. The waste of energy with these methods is enormous. At one plant 40 hp. are required to agitate a pulp containing 100 tons of dry slime, and power there costs 3c. per horse-power hour. The proper choice of an agitating device depends upon the amount of aeration that the ore requires during treatment, and, therefore, upon the form in which the silver is combined, because, the gold usually submits to any treatment required for the silver, and for this reason no one system is applicable to all ores.

In the following analysis I have tried to arrange the various systems in the order of their aerating capacity, for it should not be forgotten that length of treatment required with any system must enter into the question of cost. A system which would extract the silver from an ore in half as much time as some other system, would have an even chance, though it required twice as much energy.

If the ore only requires that fresh molecules of cyanide be brought continually to the particles of metal, and that the air which is included in the solution be sufficient for the reaction, there is no system at present better than arm agitators, raised a few feet above the bottom of the tank, and driven at 800 linear feet per minute. At this speed no difficulty is experienced in starting, because, during operation the pulp is picked up far enough below the arms to leave space for the sand to settle when the arms are stopped. This method is giving excellent results on many Mexican silver ores, but other ores require a varying amount of aeration. For these other systems of agitation must be used. As one means, the centrifugal pump in conjunction with arms does the work, and the pulp often contains as much as 2% atomized air which is discharged on standing. The disadvantages of high cost of operation, and wear on linings, however, usually prohibits its use. By introducing compressed air into the suction more aeration may be obtained with less expenditure of energy.

The Pachuca system is the cheapest in operation of all that have been devised. A pulp containing 100 tons of dry slime and 150 of solution, can be treated with 4½ hp. This is cheap work, but as an aerator the Pachuca tank is not in the first class, as the pulp usually contains little absorbed air. Most of the air used for agitation escapes as large bubbles at the top of the column-pipe, and does not come in contact with the ore. The expansion of this large quantity of air abstracts heat from the charge. Also Pachuca tanks as at present built leave room for a large amount of sand to accumulate on the sides of the cone, which does not get agitated, and the circulation takes place in a limited cross-section. When the tank is emptied part of this sand slides out through the discharging pipe so that its true amount it not really known. Where Pachuca tanks are not

required for such aerating function as they can perform they should not be installed because they present the disadvantage of introducing air that is not available for treatment, but from which carbon dioxide enters the solution and precipitates and wastes the lime. Part of the calcium carbonate formed is deposited on the canvas of the filter presses, if these are employed, and in this way makes an unnecessary cost for acid treating. Herein lies a hint for selecting an agitator, namely, employ that system which will give the proper amount of aeration but no more, as an excess will be expensive.

The Hendryx system gives good aeration, and on one ore is doing more rapid work than the Trent. This function is principally due to the use of the apron around the column pipe, whereby a new quantity of pulp is being continually brought into contact with the atmosphere. It might be of interest that this apron has been used at one plant on Pachuca tanks, and it is deserving of an extended trial on silver ores in Mexico. The principal disadvantages of the Hendryx agitator are: high cost of installation, high cost of operation, 18 hp. per 100 tons of dry slime, and cost of wear of the moving parts.

Next in order, as an efficient aerator, I would put the system employed at the Pinguico mill at Guanajuato, Mexico. There the treatment-tank is equipped with arms for agitation and an air-pipe with a coupling, to allow rotation, is taken down the shaft and out upon the arms. Small vents let the air escape, and the motion of the arms breaks it up and gives intimate contact of the pulp with the air. The amount of air used is thus easily controlled.

The Trent agitation system is one in which the pulp is taken from the top of the charge and pumped through arms, which revolve near the bottom, due to their reaction from the force of the flow. This gives excellent aeration. The air if admitted through the centrifugal pumps gets thoroughly atomized and uniformly mixed with the pulp. The quantity of air can be regulated so that a small excess will be evolved gradually over the whole top of the charge. The disadvantage in the use of centrifugal pumps is with their low efficiency. Also, as many ores admit of treatment with a pulp of heavy consistence (sometimes one of solution to one of ore), it is hard to see why the sand would not reach the top of the charge and then the wear on the pumps would have to be contended with. Per 100 tons of dry slime 12 hp. is required for this method. The pulp contains 3% of free air in the tank. The Just process seems to employ an excellent principle, although it has not been tried long enough to prove it thoroughly. Both this and the Trent agitator possess the advantage of being able to be installed in existing tanks with only slight modifications. In the Just system a false bottom of patented porous brick is laid, which supports the charge. Air from a rotary blower is forced beneath the brick and finds its way through the pores. In this way it becomes very finely divided and agitates the charge uniformly. It is claimed that pulp 9 ft. deep can be agitated with 5 lb. of air. If the mechanical difficulties of holding the brick securely, and keeping the pores open, can be overcome this process ought to have a wide application as many silver ores need all the aeration possible. Where it is necessary to carry a high protective alkalinity it might be necessary to acid treat the bricks which would be a troublesome operation.

Some plants are now making steam for the purpose of heating the charge during treatment. The condensation of this steam dilutes the charge and decreases the quantity of water that can be used for washing on the filter presses. The use of pre heated air for the agitation would overcome these difficulties, and offers a good field for investigation. For overcoming the difficulty in the use of air in treatment tanks, namely, the precipitation of the lime, an apparatus using calcium oxide or other means for removing the carbon dioxide from the air before compression might be a valuable adjunct. Some of the foregoing remarks may meet with objections but they are open to discussion. They may help to clarify a subject which is more unsettled than any other branch of cyanidation at present.

Low-lift pumping is now done so generally by centrifugal units operated by reciprocating engines that the use of steam turbines for the steam-ends has been an inevitable development of the field for some time. A number of years ago Dabney H. Maury read a paper on such units before the American Water Works Association, and since then a few of them have been put in service, with results which are kept remarkably confidential by everybody in a position to understand their details. That there has been some measure of success in connection with such plants is shown by the fact that at least one steam-turbine manufacturer is now urging for certain uses a unit consisting of a submerged centrifugal pump with a vertical axis carrying a vertical steam turbine at the upper end. It is claimed that the bearing for such a unit can be built in a thoroughly reliable way which will cause no trouble in operation, but up to the present time the engineers to whom the unit has been proposed have hardly been favorable toward it. It is one of those novelties which, in order to be introduced successfully, must be presented in a particularly careful manner and backed by long-time guarantees, leaving no points open for serious criticism. The importance of low-lift pumping apparatus is increasing rapidly.—*Engineering Record.*

Drillings should not be relied upon too closely in estimating the value of ground prospected. Raises have been put up on a number of holes both at Ray and Miami, and while in some cases the drill returns and those from the raise check satisfactorily, in other cases poor results are obtained. A variation as great as 0.5% has been found to occur in ores averaging 3% or less. As a rule, the drill returns are low, a fact which is rather hard to explain. It is possible that the heavy sulphides tend to settle in the bottom of the hole and in fissures and pockets in the sides where they are undisturbed by the churning of the tools. In uncased holes, cavings from the overburden would lower the percentage of copper, and on the other hand, it has been found that after the hole has passed through a sulphide body, the samples may still indicate good ore. Under such conditions, casing changes the grade of samples materially.

Shaft Sinking at the Giroux

STAFF CORRESPONDENCE

The Giroux Consolidated Mines Co. at Ely, Nevada, under the general management of Frank P. Mills, has finished its new 5-compartment shaft at Kimberly, in Ely district, its location being on the southern slope of Old Glory hill, 750 ft. southwest from the company's Alpha shaft. The size of the new shaft, which is in limestone, is 17 ft. 2¾ in. by 10 ft., measured inside the timbers. A cage compartment is 10 ft. by 5 ft. 8 in.; two skip compartments are each 5½ by 5 ft.; two others, for pipes and ladder-way, are each 5 ft. by 4 ft. ½ in. In opening this shaft 948 ft. of the work was done by raising, the starting point having been on a cross-cut that had been driven from the 1000-ft. station of the Alpha shaft. After cutting a 14 by 18-ft. station and installing an air-hoist, the raising began July 5, 1909. The raise was made 13 by 12 ft. in the clear, was supported by timbering in square sets, which divided the space into four compartments, the one at each end being used as a chute. The chute lining was braced by 8 by 8-in. stiffeners. The lagging on the wall-sides of the cage, ladder, and pipe compartments was likewise stiffened by 4 by 6-in. timbers. Everard Arnold, construction engineer at this property, in describing this work, says: "Over the two centre compartments the last two sets were always bulkheaded with 8 by 12-in. timbers, and from the lower bulkhead the cage sheave-wheel was suspended. After a round of holes had been blasted and the loose ground picked down, the average time required to hoist, plumb, and block a set of timbers was 2 hr., although the operation was occasionally performed in 1 hr. 30 min. When possible the chutes were kept almost full in order to minimize the chances of injury should men have happened to fall. For the purpose of protecting the lower timbers of the chute, breakers or platforms of 10 by 10-in. timbers were spiked to the girts at intervals of seven sets. On these breakers the rock piled up and formed its own slope. Trouble was often caused by large rocks dropping into the chute, and on reaching the gate they would have to be blasted."

The air-hoist was used in raising timbers from the foot of the raise; and two pressure blowers, running in tandem, served to keep up ventilation. When the raise reached a place as high as the 770-ft. level from the Alpha shaft, a connection was made and this level then served for the removal of rock and as an entrance to the raise instead of the 1000-ft. level. In accomplishing the 948 ft. of raising, three shifts per day for 180 days were required, the work having been in direct charge of William Hogan, mine superintendent. The raise cost $71.21 per foot, classified as follows: raising, $16.69; tramming, $5.09; timber framing, $1.76; blacksmithing $1.19; machine shop, 11c.; teaming, 54c.; air-compressor, $10; supplies, $17.24; hoisting, $15.15; proportion of general underground expenses, $3.44. As it is estimated that 75% of the timber used in raising will be available for other work, the ultimate cost of the raise will be thus reduced to $63.71 per foot.

The part of the shaft from the surface to a depth of 15 ft. was opened by sinking, so that the collar-set and three shaft-sets could be installed and concreted. With the raise finished to the surface, and the installation of temporary hoisting equipment, sinking was commenced at the 1000-ft. station, and a compartment 10 by 5 ft. 8 in. was sunk 200 ft., and this was temporarily timbered. After cutting a sump below the 1200-ft. station the lower 200 ft. of the shaft was enlarged to the size of the upper part by raising. A pump station is to be excavated at the 1200-ft. level, where two Prescott pumps of 600 gal. each, and one of 1200 gal. capacity are to be installed. The pump station will be protected by steel and concrete. The temporary head-frame of wood is soon to be replaced by a steel frame, 94 ft. high, the material for which is on the ground. Each of the two ore-hoisting compartments is to have a 100-cu. ft. skip, the two to be operated in balance. There are two 12-ft. sheave-wheels for the skips and one for the cage, the cable to be 1⅜ in. The power-plant, under construction, is 400 ft. southwest from the shaft, at a lower elevation. The engine house, 120 by 47 ft., to be of concrete and steel, is to contain one duplex, first-motion Corliss engine, 26 by 48-in. cylinder, for operating the skips; one geared hoist, 20 by 48 in. for operating the cage; both engines are of Allis-Chalmers make. An air-compressor of large capacity is to have a place in the engine room. The maximum depth to which the duplex hoist may operate is 2500 ft., its speed 1670 ft. per minute. The geared hoist is capable of operating to the same depth, speed 540 ft. per minute. The boiler house will consist of a steel building, 103 by 53 ft., and will contain eight horizontal return tubular boilers, which are on the ground ready for installation. The stack, to be built of radial brick, will be 150 ft. high, erected on a concrete foundation 21½ by 21½ ft., 9 ft. high. Close to the power plant is a wood-water tank, set upon a sub-structure of steel, to hold 25,000 gal. A new piece of equipment to be tried here in sinking is a Hulett grab-bucket for handling débris. The bucket, to be suspended from a skip, is designed to take up the rock from the bottom of the shaft, after the blast, then to be hoisted to the first station above, and there dumped into a loading pocket. Mr. Mills plans to experiment with it here as a possible means of more economical shaft sinking.

Exports from the United States to Canada show a larger growth in the current fiscal year than those to any other of the important countries of the world. For the ten months ended with April, for which the Bureau of Statistics has just prepared a detailed record of the commercial movements, the exports to Canada amount to $174,500,000, against $129,000,000 in the corresponding month of last year, and for the month of April alone, $22,000,000, against $15,000,000 in April of last year. The increase in exports for the ten months in question is thus $45,000,000, while the total increase in exports to all parts of the world during the same period is but $55,000,000, the figures in each case relating to exports of domestic merchandise. To France the export figures show for the period in question an increase of $9,000,000.

Prospecting and Testing of Clay Deposits

By E. K. Soper

Every geologist and mining engineer is well aware of the vast economic importance of the clay deposits of this country, and knows that there is hardly a State in the Union that does not contain valuable deposits. This importance may be better realized by a comparison of figures. In 1907 the value of the clay products produced by the United States alone for that year was $158,942,367, and was exceeded only by three other mineral products, pig iron, coal, and copper, while petroleum followed clay products with a value of $120,106,749. In prospecting for the metalliferous minerals these clay deposits are often overlooked, either because the prospector in his search for a mine is prone to pass by such unromantic material as clay, or else because of a failure to appreciate its possible value. In some regions it would be useless and foolish to attach much importance to an occurrence of clay, even though it be of good quality, but there are valuable clay deposits awaiting development in districts where they could be put to profitable use. Many clays are especially suited to some particular use, depending upon their characteristic properties and also to a large extent upon the location and the prevailing industry of the region.

Considering clays in a broader sense, there may be included deposits which have become consolidated so as to exhibit all of the properties of a shale. These shales when ground and mixed with water will often be found to possess as great a degree of plasticity as the soft unconsolidated clays and may be used in the manufacture of the same materials as could clays. In prospecting for clays, a knowledge of their methods of origin and the consequent shapes of the deposits, will be of much aid if borne in mind. Several classifications of clays have been made, some based upon their physical properties, and others upon their methods of origin. The following classification by H. Ries[1] is given and will be found, I think, to be of most value to the prospector.

A. Residual clays (by decomposition of rocks *in situ*). I. Kaolins or china clays (white burning). (*a*) Veins, derived from pegmatite; (*b*) blanket deposits, derived from extensive areas of igneous or metamorphic rocks; (*c*) pockets in limestone, as indianaite. II. Red-burning residuals, derived from different kinds of rock.

B. Alluvial clays, representing deposits formed by wash from the foregoing and of either refractory or non-refractory character.

C. Transported clays. I. Deposited in water; (*a*) marine clays or shales (deposits often of great extent), white-burning clays, ball clays, fire clays or shales, buff-burning, impure clays, or shales including both calcareous and non-calcareous; (*b*) lacustrine clays (deposited in lakes or swamps), fire clays or shales, impure clays or shales, red-burning calcareous clays, usually of surface character; (*c*) flood-plain clays, usually impure and sandy; (*d*) estuarine clays (deposited in estuaries), mostly impure and finely laminated. II. Glacial clays, found in the drift, and often stony; may be either red or cream burning. III. Wind formed deposits (some loess). IV. Chemical deposits (some flint-clays).

The third class of the transported clays is of little importance. The residual clays are found chiefly south of the southern margin of the ice-sheet of the glacial period and east of the Mississippi, especially in the Piedmont and Appalachian areas of the Southern States. There are, however, some valuable deposits of clays of this type in Wisconsin occupying areas which were protected from glacial erosion. The transported or sedimentary clays are widely distributed throughout the United States, but certain types occur oftener in some localities than in others. The most valuable of these in this country are the fire-clays, and in general it may be said that the distribution of the fire-clays in the United States will conform somewhat with the distribution of the coal deposits. It should not be inferred because a clay is found along, or close to a coal seam that it must be a fire-clay, although the term 'fire-clay' is widely used by miners to designate any clay found along the seam, regardless of the refractory properties, just as the term 'slate' is used by them when in truth it is often shale. On the other hand, fire-clays are not restricted in distribution to the coalfields. There are important deposits of fire-clay in Tertiary-Cretaceous formations in the Atlantic and Gulf coastal plains which are rarely associated with coal-beds. But the most important occurrences of fire-clay are found in the Carboniferous rocks. The geological and geographical distribution of the more important types of clays is shown briefly in the following table:

GEOLOGICAL AND GEOGRAPHICAL DISTRIBUTION OF CLAYS IN THE UNITED STATES

Fire clays	1. Carboniferous—Appalachians and Central States. 2. Cretaceous—New Jersey and West. 3. Tertiary—Pacific Coast, Missouri, Texas, and Mississippi.
Pottery clays	1. Kaolins or china clays—Georgia, South Carolina, North Carolina, Pennsylvania, and Delaware (older rocks). 2. Ball-clays (sedimentary) Tertiary—Kentucky, Tennessee, and Florida. 3. Stoneware clays: (a) Carboniferous—Appalachians and Central States; (b) Tertiary—In the West; Cretaceous also. 4. Earthenware clays—Found anywhere.
Vitrifiable clay (Sewer-pipe clay)	1. Devonian—In Eastern States. 2. Carboniferous—In Central States. 3. Cretaceous and Tertiary—In the West.
Brick and tile clays	Impure surface clays and shales. Very wide distribution geologically and geographically.

In prospecting, the outcrop is the most practical means of detecting a clay-bed, except in the case of fire-clays, which are often found only when mining operations have exposed the underlying strata. The

[1] 'Clays, Occurrence, Properties and Uses', H. Ries, 2nd ed., 1908, p. 27.

outcrops are oftenest found on steep inclined surfaces or in natural or artificial cuts, such as stream banks, railroad or wagon-road cuts, ditch lines, etc. Springs often indicate the presence of a clay-bed, especially if several springs issue from a hillside all along the same level. The clay, acting as an impervious stratum or dam diverts the downward moving water to the surface of the bank. In glacial drift, the presence of ponds is often indicative of clay beneath. Again, clay deposits are often found as the result of the weathering of certain rocks, such as granite, limestone, sandstone, etc. These residual clays are often characterized by their extreme irregularity in depth, and the prospector should bear this in mind when searching in such regions. Lastly, in some localities, clays produce vegetation of a different character from the growth on other soils, but this cannot be relied upon as a criterion.

Residual clays are apt to be irregular in depth, due to uneven weathering along joints and fissures in the original rock. Especially is this so in clays derived from crystalline rocks, and we would expect to find in such a deposit three principle zones: (*a*) a layer of fully formed clay; (*b*) clay of an impure nature with partly decomposed rock fragments; (*c*) a zone of many rock fragments (more or less decomposed) with some clay, grading into solid bedrock. Clay formed from limestone is an exception to this rule, for here the change from clay to hard rock will be sudden, due to the different manner in which the clay was formed. In granite the change from hard rock to residual clay is due to a gradual breaking down of the minerals in the original rock, while in limestone, solution is responsible for the transition. Hence it is important to determine the consistence of the deposit from top to bottom. An exceedingly irregular bottom may preclude steam-shovel work in mining operations. The form of the deposits will depend on the rock from which it was derived. Granites may yield great masses covering large areas, whereas pegmatites (feldspar and quartz) will yield comparatively narrow belts, which will follow the course of the original dike or vein. The depth of the deposit will depend upon the climatic conditions, the topography, and the parent rock.

All sedimentary clays present a stratified structure. Aside from this, however, different deposits may exhibit extreme irregularity of structure. Such a deposit may be consolidated into a hard shale; it may have had its surface greatly eroded and an entirely new material laid down on top of this; the deposit may be of irregular thickness; there may be 'pits' or 'chimneys' extending down and filling old depressions which will lead to false conclusions as to the extent of the bed. All of these possibilities should be guarded against before arriving at a definite conclusion regarding the value of the deposit.

Assuming that a deposit of clay has been found and proved to be of such a quality as to warrant further testing, what should be the method of procedure? The first facts to get at are its shape and extent. Next, an accurate knowledge of its texture and uniformity must be had. Clays are not often of absolutely uniform grade, but contain many impurities, such as concretions, gravel, and sand. If these are widespread and scattered it is a bad indication. If the impurities occur in streaks or layers it may be possible to avoid them in excavating. The character and thickness of the overburden is an important factor influencing the cost of extraction. If the bed is exposed across its entire thickness it should be carefully examined to note whether it is of uniform texture or whether it contains streaks or layers of sand or other injurious materials. The presence of gravel or pebbles is a common occurrence and is a great detraction from the value of the deposit if they occur in large quantity. If the clay is not exposed across its depth, holes should be bored through it at several points and the borings carefully preserved for samples. A post-hole auger, cutting a hole 3 or 4 in. diam. can easily be employed for this purpose to a depth of from 30 to 40 ft. Any variation in the texture at the surface and deeper down should be carefully noted. Some clays are much more plastic at the surface. Samples of about 50 to 75 lb. each should be taken from several points on the clay-bed and from the bore-holes, for testing in the laboratory. If large samples are desired for making tests on a working scale, pits should be dug at the points where the borings were made.

Having got the samples in the laboratory the problem is to determine to what use the clay can be most profitably put. Much has been written regarding the chemical analyses of clays, but for most purposes, and certainly for the purpose of determining the value of clay for making burned clay products, the chemical analysis is of little value. Only a careful consideration of the physical properties can determine the value of most clays. The most important tests to make are the following: (1) Water required to attain maximum plasticity, (2) the air shrinkage, (3) the fire shrinkage, (4) percentage of absorption after burning at different temperatures, (5) color after burning at different temperatures, (6) fusibility, (7) tensile strength, (8) plasticity. In some cases it may be desirable to make a mechanical analysis to determine the relative amounts and sizes of the constituent grains. Another test often made is to determine whether the clay will stand fast drying when freshly mixed, without warping or cracking. This is important where bricks are to be artificially dried as they are in the larger yards. Many clays will not stand rapid drying. Occasionally a few simple chemical tests may be desirable, as, for instance, getting the percentage of soluble salts present, or determining in clays to be used in the manufacture of portland cement the quantity of $CaCO_3$.

To determine the percentage of water required for mixing, a 5-lb. sample should be weighed out, dried, ground through a 40-mesh sieve, and enough water added, little by little, until the mass has attained its maximum plasticity. This cannot be determined absolutely, but with a little practice an approximation may be reached sufficiently close for all practical purposes. The plastic mass is next worked thoroughly to permit all lumps to slake down. This can be quickly done by kneading the mass like dough for a few minutes. When the clay is thoroughly mixed, eight or ten small bricklets are made in a

brass mold. A convenient size is 4 by 1 by $\frac{3}{4}$ in. A fine line is ruled along one side of each bricklet and two marks placed on this line exactly 3 in. apart, to be used in determining the shrinkage. The bricklets are then set aside in a warm place and allowed to stand until thoroughly dry. This will usually require four or five days in the ordinary temperature of the laboratory. They are then placed on a hot-air bath and heated to about 100° C. to drive off the remaining moisture. The bricklets are then measured and the air shrinkage is expressed in percentage of the original measurements. After burning the bricklets the fire shrinkage is found by subtracting the air shrinkage from the total shrinkage.

For laboratory work a variety of kilns or furnaces are used. Some gas furnaces, such as the Segar furnace, when slowly fired and properly handled give excellent results. Certain oil kilns are now also much used, but cannot reach as high a temperature as the Segar furnace. This gas furnace is circular in form, and the gas enters through six or eight burners and passes upward through a small slit near the bottom. The air is pre-heated and as it comes from below unites with the gas at the burners. Inside the furnace is placed a cylinder and in this cylinder a crucible in which the tests are confined. The mixture of air and gas passes between the wall of the furnace and the fire bridge, over the cylinder and then downward between it and the crucible.[2]

The absorption is determined simply by getting the difference in weight between the dry and saturated bricklet. This is commonly expressed in terms of the original dry weight. After each burning at a different temperature any variation in the color of the clay should be carefully noted. The color of the raw or unburned clay does not always indicate the color of the burned product. Red clays usually burn red; deep yellow clays may burn either buff or red; chocolate ones often become reddish brown; white clays will usually remain white, but may turn yellowish; and gray or black ones may turn almost any color, but commonly red, buff, or white. Calcareous clays may burn red at first but turn cream or yellowish as the vitrifying temperature is approached. Alumina present in excess has a bleaching effect similar to lime. When clays rich in iron are burned to vitrification, greens, browns, and blacks are often obtained.

The most convenient method of measuring the temperature of the kiln during burning is by means of Seger cones, which are mixtures of clays with fluxes, so graded that they represent a series of fusion points, each of which is a few degrees higher than the preceding. They are classified by number and the fusion point of each number is given. They range from cone 022 (590°C.) to cone 39 (1940°C.), advancing by intervals of about 20° each. These cones are not only used in testing in the laboratory, but many of the large plants manufacturing burned clay wares of all kinds employ them in controlling the temperature of the kilns.

The tensile strength of a clay is determined in the same way as that of a cement. Small briquettes are molded, each being 1 in. in cross-section at the waist. These are thoroughly dried and tested to failure in a tension testing machine of the usual type. Care must be taken to correct the results for shrinkage of the cross-section of the briquette upon drying.

The question will doubtless be raised as to how these laboratory results compare with the results of practice on a large scale. In general they are very close. Some deviations, however, should be admitted. The air shrinkage in the laboratory is sometimes higher than in the factory on account of the better mixing facilities at the latter place. This is an error on the side of safety. In the case of very sandy clays the error, if any, will be the other way. In practice, brighter colors are apt to be obtained on burning than in the laboratory, because firing in a large kiln is slower, which gives the iron in the clay a better chance to oxidize. This is especially true during cooling. Slow cooling tends toward brighter colors. To minimize this error, do not stop the kiln suddenly when the fusion point of the test cone has been reached. The application of this principle is seen in the burning of pure white chinaware. The iron is counteracted by adding cobalt, which gives a bluish tint. The kiln is also cooled as rapidly as possible to prevent any further oxidation of the iron.

Clay for common brick must burn to a fairly hard body with a good 'ring' at about cone 010 (950°C.), or even less. It should burn rather dense with an absorption of not more than 15%. The color of the brick is not important, but red-burning clays are preferable. Cream-burning calcareous clays are good, but there is danger of not getting to a dense body at cone 010 unless the clay is very plastic. The method by which bricks are to be manufactured is important in the choice of a clay, or, stated in the opposite manner, the character of the clay will largely determine the method which must be employed. Any clay will work for the 'soft-mud' process, but the 'stiff-mud' process requires a clay of medium plasticity. The tensile strength should be around 100 lb. per square inch, but a clay with a tensile strength as low as 60 is often used with success. If artificial heat is to be used in drying, the clay must not crack when dried rapidly. If it does, this may be overcome by mixing with it 25% of sand. The air shrinkage should be from 3 to 5%. The fire shrinkage should be low, but it is desirable to have a little fire shrinkage, since this gives the brick a denser and harder body. For drain-tile the same class of clay may be used as for common brick, but it should be smooth and plastic. Sandy clay is undesirable. Earthenware, flower-pots, and similar products require a clay that is smooth and of good plasticity. The tensile strength should be 100-125 lb. per square inch. The clay should burn moderately hard and dense at temperatures from 950 to 1050°C., with an absorption of 14 to 15%. It should have a low air and fire shrinkage to prevent warping in burning. The color is not important, but red is commonly used. Stoneware clay must be of a better grade than the foregoing. It is often molded on the potter's wheel, so it should have a high plas-

[2]For a complete description of this furnace, with sectional views, see 'A Report on the Clays of Maryland,' by H. Ries. Maryland Geol. Surv., 1902, p. 284.

ticity and good tensile strength of not less than 125 lb. per square inch. The combined air and fire shrinkage should not be less than 12%. Stoneware is commonly burned at temperatures ranging from 1230 to 1250°C. The clay must burn to a tight, dense, impervious body at 1250°C., and it should be fairly refractory, not fusing under cone 27 (1670°C. or 3038°F.). Since it is not common to find a clay that exhibits all of these requirements, mixtures are usually made in the factories of two or more clays to get the proper qualities.

Fire brick requires a very refractory clay which is burned to about 1310°C. (2390°F.). High plasticity is not required in fire clays, only sufficient being necessary to permit molding. The air and fire shrinkage should be low and the clay should burn fairly hard, but without vitrifying. The tensile strength should be higher than for common brick. Fire-clays are among the most valuable of all clays, and many factories employ mixtures to obtain the required properties. In fact, few fire bricks are made from one kind of clay, but are usually mixed with 'grog' (ground brick). Grog reduces the shrinkage if it is too high. In order to test the fusibility of fire-clays a special furnace will be required. The Deville[3] furnace is widely used. This is constructed of a hollow fire-brick vertical cylinder encased in a cast-iron shell, over which a bell-shaped chimney is hung like that of a blacksmith's forge. A small blower forces air through the chimney. The clay to be tested is enclosed in a small fire-clay crucible and placed on a base at the bottom of the hollow fire-clay cylinder and the cylinder is then filled up with coke, completely covering the crucible containing the clay. The principal disadvantage of this furnace is the fact that the test-piece cannot be watched and the temperature reached must be determined by placing in with the clay several cones which fuse at different temperatures. By observing the cone which remained unaffected by the heat and the cone which melted last, a close approximation can be made of the temperature reached.

Paving brick are usually made by the stiff-mud process, and therefore require a clay or shale of not too high plasticity and one which will vitrify at cone 2 to 3 (about 1119°C.). It is desirable to have the tensile strength greater than 100 lb. per square inch, but not necessary. A low air and fire shrinkage is required. Sewer pipe requires the same clay as is used for paving brick, but a low-grade fire-clay is often added. Porcelain and white granite-ware take a clay that burns snow white and stands a high degree of heat. Kaolins and ball-clays mixed with quartz and feldspar are used. Owing to the high refractory nature of kaolins they burn to a porous body and are low in tensile strength and plasticity. Ball-clays supply what kaolins lack, hence all potters use a mixture of ball-clay and kaolin. There are a few clays which melt to a natural enamel or glass at a temperature of about 1250°C. These are especially valuable as 'slip clays' and are used for natural glazes on other clay products, such as decorative tiling and facing brick.

[3]See 'A Report on the Clays of Maryland', H. Ries. Maryland Geol. Surv., 1902, p. 284.

In recent years the manufacture of portland cement in this country has undergone such rapid and wonderful development that a new and extensive field has been opened for the development of clay deposits. Portland cement is made from one of the following mixtures: clay and limestone, limestone and shale, marl and clay, chalk and clay, pure limestone and argillaceous limestone, alkali waste and clay, and limestone and slag. Out of these seven possible combinations it is seen at once that clay is an important constituent in all but two. The final mixture from which the portland cement is made consists of about 75% lime carbonate and 25% clay. Clays for use in portland cement should be as free as possible from sand, gravel, and concretions. Usually silicious clays are used, the silica ranging as high as 70%, but calcareous clays are often employed in which the silica content falls far under 50%. In testing clay for this purpose the chemical analyses will be of use in many cases.

There are many other uses of clays and much has been written on the methods of preparing the raw material for the manufacture of these various clay products and upon the subject of ceramics in general.[4] Summing up, it is seen that the geological examination of clay deposits should embrace not only a thorough inspection of conditions in the field, but should be supplemented by a series of careful tests in the laboratory. These are chiefly of a physical nature, but chemical analyses should be employed where required. Ores are not bought upon an inspection of their structural features alone, but only after careful assays and mill tests have been made. So, clays, which may vary as much in grade and value as ores, should be put to practical tests before money and energy are expended on their exploitation.

[4]See 'A Bibliography of Clays and the Ceramic Arts', J. C. Branner. Published by Am. Ceramic Soc., 1906.

Argentina, in its Andean provinces, is known to be rich in minerals. R. M. Bartleman, United States Consul at Buenos Aires, reports that gold, silver, lead, copper, iron, tin, zinc, and antimony are found at various places in the territory of Los Andes. The ore in La Concordia group of mines contains, on an average, 2.62% of copper, 12% of lead, and 2034 gr. of silver to the ton. The mineral of the Recuerdo mines, a mile from the Concordia, has given 33 to 41 grains of gold and 635 to 1679 of silver per ton, besides lead, iron, copper, tin, zinc, and antimony. The borate of lime mines in Los Andes have not yet been worked. During 1908 a gold mine company obtained $16,234 worth of gold from 5690 tons of ore in the Nilla Michi-Co and Malal Caballo district. A limestone quarry was worked in 1908 in the Rio Negro territory, and numerous concessions for salt mines were granted in the Territory of Santa Cruz. The auriferous sands of Tierra del Fuego are being worked, but by primitive methods. Copper ore has been discovered in Missiones territory, for the working of which applications have been made. The completion of the railway to Posadas, together with the good river communication of this territory, will greatly assist in marketing this copper.

Dredging Possibilities in Korea

By R. Y. Haxton

Korea today affords one of the most promising fields for mining capital to exploit. Not only is this true in regard to copper and gold in veins, but especially as regards placers, which cover immense areas throughout the country from Masanpo in the south to Mantaikol in the north. It is with the placers entirely that this article will deal.

Korea is a peninsula some 600 miles long, situated between latitudes 35 and 42 north, and stretching down into the Yellow Sea from the southern boundary of Siberia and the eastern boundary of Manchuria. It enjoys a climate very similar to that found in the Middle Atlantic States of America. The

Ancient Transportation—Hauling Mine Timbers.

inception of placer mining in the country is lost in antiquity. Hundreds of years before Japan acquired a protectorate over the country, the Koreans paid to China large sums annually as a tribute, practically all of which was won from the placers. I have had

Electric Power Plant, Unsan Gold Mines.

occasion during the past four years to examine five large deposits in widely separated parts of the country, and while not at liberty to make public all of the data acquired during these examinations, can give an account of the physical characteristics of the deposits and other material which may prove of interest.

The Oriental Consolidated Mining Co. controls a concession which covers about 30 lineal miles of river bottom land ranging in width from 500 to 3000 ft. They have had this ground prospected with a Keystone No. 3 traction drill to the extent of some 300 holes, covering an area of about 1500 acres, and although the average gold content in the deposit, as shown by the above work, is not high, it is not inferior to that contained in a large part of the California deposits which are being worked today at a good profit by 8½ and 13½ cu. ft. dredges. The ground is a loose wash, contains no clay or large boulders, and overlies a soft, fairly level, decomposed granite or schist bedrock—principally granite. The average depth from surface to bedrock is about 18 ft., and the natural water-level stands at about 5 ft. below the surface. All Korean placer deposits are cleared land, often agricultural, and when such

Modern Transportation—Wood Road of Oriental Con.

Constructing a Dam in Korea.

is the case they must be purchased from the owners at a price ranging from $18 to $30 per acre.

In the southern part of the country, 60 miles south of Seoul, the capital, and 300 miles south of the Oriental Consolidated concession at Unsan, is situated the Chicksan concession controlled by an American-Japanese syndicate—the Korean Exploration Co. and the Shibusawa-Asano Mining Partnership. This concession covers about 400 square miles, and contains within its boundaries many excellent veins and an immense area of alluvial deposit, of which only about 1000 acres has been prospected. The ground is about 20 ft. deep, and has a topping of soil and clay ranging in thickness from 5 to 9 ft., overlying 8 ft. of barren gravel, and from 3 to 7 ft. of pay-gravel. The clay is tough and stands up easily in a bank, the natives in their operations are in the habit of undercutting it from 5 to 8 ft. and prying it off in large sections from the surface. They use for this purpose long iron-shod poles. This deposit contains about 60% sand and the gravel is so fine that little

or no drilling is necessary when prospecting with a 5-in. (inside diameter) pipe. The bedrock is a soft decomposed biotite rock somewhat sticky, but easily washed.

The natural water-level is usually on the line of demarkation, between the clay and gravel, the change between these being abrupt. This concession is ideally situated as regards transportation and enjoys a climate more equable than that of the northern part of the country. The Imperial railway passes through the concession, and within five miles of the principal placer fields. In addition to this, there is a good bay 15 miles away at which coal of good calorific power may be delivered at a cost not exceeding $5 per ton.

Transportation facilities throughout Korea, with the exception of parts of the east coast and the extreme north, are good. The railway passes nearly through the centre of the peninsula for a long distance, and directly through the principal mineralized zone in Pyeng Yang Do province. All of the properties now under exploration in the country, with the exception of the copper concessions at Kangai and Kapsan, are within 75 miles of the railway or near some port upon the east coast. In addition to this nearly all of the rivers upon which any placers are located are navigable for three to six months of the year, and furnish a cheap method of transportation by means of native junks or flat boats. Parts of the country north of Pyeng Yang are heavily timbered, oak and pine predominating, and afford fairly good fuel at $2 to $3 per cord. In the south, however, it is necessary either to transport the wood long distances or to use coal or oil. Upon the completion of the railway between Wijos and Moukden, Manchuria, it will be possible to procure an excellent grade of coal for $3 to $5 per ton delivered upon the ground. The price, of course, will depend to a great extent upon the accessibility of the property. The Oriental Consolidated is operating a 500-kw. plant, generated from a stream, about five miles from the main camp. It was necessary to build a dam some 300 ft. long and 80 ft. high in order to form a reservoir large enough to warrant the installation. There are many streams in the mountains which are capable of generating large power, but as yet they are entirely undeveloped.

The climatic conditions, although by no means ideal, offer no serious difficulties to dredging. During the months of July and August heavy rains prevail. The precipitation during these months has averaged about 20 inches for the past eight years, as against an average annual fall of about 42 inches, but owing to the flatness of the country and the great width of the principal river beds and valleys, these heavy rains seldom do any damage. The winters in northern Korea are quite severe, but of short duration—from January until the middle of March. The average temperature in January and February for the years 1907 and 1908, at Pyeng Yang, in latitude 39°N., was 29.5°F., and in latitude 36°N. only 37°F. Dredging is now being carried on near the mouth of the Amur in Siberia even farther north.

Many of these Korean placers have a topping of from 4 to 8 ft. of soil and clay over several feet of barren gravel, and from 2 to 5 ft. of pay-gravel. Today there are about ten of these deposits, ranging in area from 100 to 3000 acres, and scattered throughout the country, being worked by antiquated methods and yielding in the neighborhood of $1,500,000 in gold per annum. The Koreans handle about 1½ cu. yd. per diem for every man employed upon the work and upon this basis one is safe in assuming that they cannot work and gain a living from gravel averaging less than 8c. per cubic yard, actual extraction. Tests which I made of ground covered by some of their operations showed that their actual extraction has been less than 70%, and in many instances less than 60%. The lower extraction was made usually in gravel through which the gold was quite evenly disseminated, and a large part of which ground they had discarded with the overburden. By their system of passing the pay-gravel over short lengths of riffles placed at a pitch of 3 to 5 in. to the foot, they invariably lose nearly all of the fine gold. This forms no inconsiderable part of the total, and nearly all could and would be saved by a modern gold dredge.

As yet there are no dredges operating in the country but several companies are considering installations and it is only a matter of a short time until several of the most promising and better known fields may be expected to be producing and paying good dividends upon the capital invested.

TUNNELING UNDER AIR PRESSURE

There is considerable difference between horizontal and vertical excavation. In vertical work there are no overlying strata. In the case of the tunnel the weight of material overhead becomes a very serious factor indeed. An air tension equal to the hydraulic pressure will keep the water out from every direction. But the solid material overhead may, under exceptional circumstances, be pressed down by a pressure comparable with its actual weight. This is about two and one-half times that of water. Under ordinary conditions the overlying strata are self-supporting a short distance above a tunnel. Between the lowest point of self-support and the roof of the tunnel lies material whose fall is to be expected. The air pressure, whether great or small, cannot be relied on to support this. The reason for this circumstance is the porosity of the soil. If the compressed air could not penetrate the earth and get above it and the imbedded boulders, then the air pressure might be expected, ordinarily, to assist in keeping the roof intact. But with the air pressure above and below its particles the same, the material will fall under the influence of gravitation. It is necessary, then, to provide an air pressure to withstand hydraulic thrusts and a mechanical support to oppose the weight of overlying loose material. To meet the conditions outlined the usual modern practice in subaqueous tunneling is to operate a device known as a shield, to support the roof permanently to the rear of the shield and temporarily in advance of it, and to carry out the excavation and introduction of supports under pneumatic pressure.—*Cassier's Magazine.*

Genesis of Ores

From the MINING AND SCIENTIFIC PRESS, January 24, 1871

By JOSEPH LECONTE

The true theory of ore genesis, in my opinion, has been touched on in some of its relations in published works, but has not been made public in its entirety heretofore. It is this: That the fissures were filled by deposits from *hot alkaline solutions* circulating through them, even from the greatest depths. It is proposed now to show that the veins were filled: (1) from solutions; (2) from hot solutions, and (3) from hot alkaline solutions.

1. From solutions.—The peculiar ribbon structure is as characteristic of mineral vein matter as the columnar structure is of basalt. This point tells very strongly against the fire theories and for the water theory. From the same cause we find the same structure in veins of infiltration. Again, the most common of all vein-stones is quartz, which occurs nine times out of ten; yes, ninety-nine times out of a hundred. Now there are two kinds of quartz. One has a specific gravity of 2.8, the other a specific gravity of 2.1 to 2.2. The first is formed only by deposition from solution, the second only on cooling after fusion. The first is found invariably in metallic veins, while the second is never found there. There are many other contents of mineral veins which cannot possibly be formed by fire, but only by water. These are the minerals containing water, the hydrates. In vein-stones, we very often find fluid cavities. In rocks formed by aqueous action, any such cavities contain water, while in those formed by the action of fire, the cavities contain only air. Vein-quartz and all vein-stuff, have the fluid-cavities.

2. From hot solutions.—A fissure reaching downwards is always filled with percolating waters. Now as our mineral veins extend down a great distance, these waters must be hot. The solvent power of hot (super-heated) water is well known. It dissolves many substances generally considered insoluble. In the case, referred to above, of cavities filled with a fluid, if these were filled while hot and then cooled, as the containing crystals cannot give and the fluid contracts on getting cold, a vacuous space is left which presents the appearance of a bubble. This last we find a common occurrence. If we put such a crystal with such a cavity under the microscope, and apply heat, we can determine the temperature at which the crystal was formed; for on reaching this temperature, the fluid will have expanded to its original volume and will exactly fill the cavity, the bubble then disappearing. This fact opens a field of research of the greatest importance and interest. In this way it has been found that actual deposits have been formed at 150°, 212°, 250°, up to 400°, 600°, 800°, and 1000°. Now quartz and other vein-stuff have such cavities which have been shown to have been formed at 180° to 212° and even 300° and 400°. It may be remarked that such cavities occur often in crystals, when, on account of the imperfect transparency or opacity of the material, they are not apparent.

3. From hot alkaline solutions.—We need a powerful solvent to get our vein-matter in solution. Our hot water probably is not sufficiently powerful. We find it in nature in an alkali,—a carbonate, particularly carbonate of soda. Alkaline waters and springs are known everywhere, and are especially frequent on our coast. Quartz is one of the most insoluble substances known. Only a few substances will dissolve it. Its natural solvents are alkalies. In making artificial stone this fact is taken advantage of. Again, as the metal is enclosed in the quartz, we must believe that it was deposited from the same solution. It has been shown before that most metallic minerals occur in nature originally as sulphides. Now alkaline sulphides will dissolve metallic sulphides. These alkaline sulphides are abundant in California and elsewhere. Most of the sulphuretted-hydrogen springs derive their sulphur from these sulphides, this combining with the hydrogen. More probably, however, the metals were in solution as sulphates, many of which are easily soluble. These coming in contact with organic matter (so common in nature), were then reduced to sulphides. Such reactions are occurring all the time under our eyes.

A study of the veins of California and the hot springs of this State and Nevada, has done much to put this theory on a solid foundation. Thus, the fact that gold, the most insoluble of all metals, is dissolved only in free chlorine, which doesn't exist in nature, has been the great stumbling block hitherto to the theory of solution. But the explanation of this can be found by examining the deposits on our coast. The gold mines of California (and all gold mines) are of two kinds—quartz and placer. The first are on true auriferous veins, where the vein-stuff is invariably and almost entirely quartz. The minerals contained are sulphides of iron, lead, zinc, and copper, and perhaps quicksilver. The most common is sulphide of iron, and the gold occurs always in connection with iron pyrites. If we take sulphide of iron, gold-bearing pyrites, and dissolve it in nitric acid, we find the gold left untouched in the original state, and as little threads and crystals. It was then deposited from a solution. Now, in an ordinary quartz vein, the effect produced by us with the acid has been produced by the meteoric agencies of nature, and the gold is found at the surface in the same shape. The quartz vein is denuded and the placer mines are formed, in which we find rounded blocks and boulders and rounded nuggets as evidences thereof.

We have two kinds of placers—the deep and the superficial. The deep placers were formed in the beds of ancient rivers, as they existed many years ago. Then streams of lava poured down from the Sierras, and these naturally flowed into and along the river channels, covering the gold deposits and dispossessing the waters of their beds. The waters were forced to run elsewhere, and formed what are the present superficial deposits. We find in the deep placers certain phenomena which advance our theory. We frequently find gravels cemented with silica, and we also find wood silicified. These circumstances were induced by soluble silicates, and

point to alkaline waters. Again, we find often gravels cemented with iron pyrites, and wood petrified with this material. Waters, holding sulphate of iron in solution, percolated through the drifts, and meeting the wood or other organic matter, deposited sulphide of iron. If we dissolve this sulphide of iron in nitric acid, we find the contained gold sometimes in the form of rounded granules. In this case, it was washed here, and then the sulphide formed around it. But we also find it as fine threads and crystals, as in veins, and, therefore, it was deposited from the same solution as the enclosing sulphide. We are thus almost driven to the conclusion that the solvent was a solution of sulphate of iron. We enquire then—will this dissolve gold? We must remember in this connection the difference between the operations of the chemist and those of nature. The chemist calls a substance insoluble, if it is not dissolved to any considerable extent in a limited space of time. But nature has the infinite ages of geological time to work in. Hence, a substance dissolved only in very small part by the chemist, may be entirely dissolved by nature. Now, gold is soluble to a limited extent in solutions of salts of iron, mostly in chloride of iron, but to a smaller degree in the sulphate.

The action then is this: The alkaline and percolating waters dissolve the quartz, which is afterwards deposited in its present position. The sulphate of iron held in the waters dissolves the gold, and when organic matter is met, the sulphate is reduced to sulphide and, as such, is deposited with the gold. This whole process is now going on, and we have a good example of it in the well-known 'Steamboat Springs' of Washoe county, Nevada. Here, through fissures, some being 2000 ft. long, boiling alkaline waters issue from the earth. These waters holding carbonate of soda, contain in solution silica which is deposited all around. The process of vein formation is going on here, and we can trace every stage of gradation. Some of the fissures are merely lined on each side with the deposits, some are nearly closed the same way, and some are quite filled (no further water issuing from them consequently) and are just like our known mineral veins. Here, too, are found iron sulphide and other metallic sulphides just as in a quartz vein, and it has been stated by a man of considerable scientific attainments, Mr. Lauer, that he has *found gold in the pyrites* here. This lacks further confirmation, but is still worthy of attention.

Some may ask, in this connection, where the iron sulphate comes from. We cannot go back to the origin of everything. We can only say that the sulphate comes from the sulphide and the sulphide from the sulphate, under oxidizing and reducing agencies. And where does the alkali come from? From the soda granites of the Sierras. The soda granite is that granite which contains soda feldspar. Soda granite is easily decomposed. In decomposition, the soda is changed to carbonate of soda, of which we have had so much to say. The waters leach out the soda carbonate (in small quantities at a time) and (for example) run into a lake. Many lakes, as Mono and Owens, having no outlet, their waters are concentrated by evaporation. The distilled water falls again on the granite, takes up more alkali and runs into the lake again, and in this way we in time get bodies of strong alkaline water. There was a time when California was more volcanic than it is now; when hot springs, carbonate alkali springs, were almost everywhere; and thus the vein formation could have been carried on to a large extent, just as we see it done now in the present example. I believe that this idea is the foundation of the true theory of the formation of veins. It may be, probably will be, modified and perfected as our knowledge increases, but the essential portion will remain.

LOS ANGELES MEETING OF THE AMERICAN MINING CONGRESS

The 1910 convention, which is the thirteenth annual, is to be held at Los Angeles, California, September 26 to October 1. Sidney Norman, secretary of the Los Angeles branch, has been named as director of local arrangements and is at the head of the Los Angeles committee. There will be nothing lacking in the local preparations to make this meeting a great and memorable one, and all members and delegates who attend will have good reason to remember the hospitality and welcome of the mining and business men of this metropolis of the Southwest. The consent of all railroads to a round-trip rate of one and a third fares from all points, for the meeting has already been secured, and even some concessions from this rate are expected. Excursions, arranged so as not to conflict with the program of the convention, will be run to the oilfields in the Bakersfield district, and to some of the mining districts of Arizona. An excursion to the Catalina Islands will be arranged for the wives and lady friends of the delegates. The official call will shortly be issued.

Direct communication between New York and the West Coast is announced by the Woermann Line, which is about to operate on a new steamship route. The first steamer, the *Otavi*, will leave New York on July 25, 1910, with a monthly sailing thereafter, touching at Las Palmas and Teneriffe in Canary Islands, Secondi, Accra, Lagos, Calabar, Duala (Camaroon), and at intermediate ports, providing freights are offered. On the return voyage mineral ores will be taken from German Southwest Africa to the United States, the vessels coaling at Las Palmas. Freight on return voyages to the United States will not be accepted. A few passengers to these islands and other ports on the West Coast of Africa will be accepted, some steamers having accommodation for about ten.

Metavanadic acid has been used to some extent as a substitute for gold bronze in paint. Vanadium chloride is used as a mordant in printing fabrics, and the trioxide as a mordant in dyeing. Vanadic anhydride (V_2O_5) has been used in the reduction of various organic compounds in an acid bath, for example, the manufacture of quinine from aniline. It also greatly accelerates certain oxidation processes, such as the action of nitric acid on sugar or the oxidation of alcohol by atmospheric oxygen. .

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling and smelting.

Pay sand varies greatly in thickness in the various oilfields. In West Virginia, I. C. White considers 5 ft. to be a safe estimate in good territory, and D. T. Day gives the same figure for Pennsylvania. In Illinois the pay sands vary from 2 to 30 ft. in thickness. At Spindle Top, in Texas, the average was 75 ft. In California, particularly in the Kern River field, thicknesses of 100 ft. have been found.

Edison's new storage battery car itself weighs about one-half as much as an ordinary car, or about 10,000 pounds. Its carrying capacity is two tons. One of the greatest savings in weight is in the building of the roof, which, not having to carry the weight of a trolley pole, is only 10% as heavy as one that does, so it is made out of a thin wood veneer. The vestibule doors are omitted and the car is made as light as possible throughout.

Sandstones change by the action of intense pressure into quartzite, a hard, compact, granular material composed of adherent quartz grains which have been re-crystallized, so that the rock breaks with a characteristic lustrous fracture. The production of most quartzites has, however, been aided by the infiltration of silica in solution into quartz-sand, and its deposition upon the quartz grains so as to bind the rock into a mass almost as compact as vein-quartz.

Vanadium finds by far its most important use in steel. Remarkable claims are made for the toughness imparted through the use of small quantities of it. This effect is said to be due to its removing oxygen and nitrogen, to its forming a solid solution with the iron, and to its forming carbides which have a beneficial effect. It is claimed that after treatment with vanadium, steel has great resistance to shock and fatigue caused by constant bending; that it makes better saws and springs; and that high-carbon vanadium steels also make better tools, such as cutters and riveting dies.

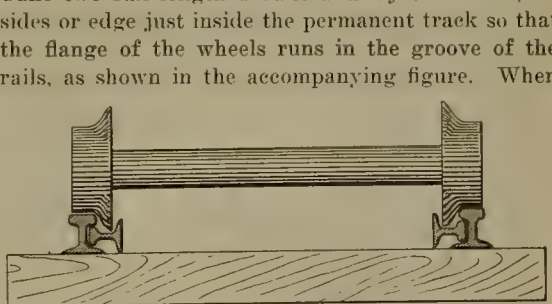
A close-connected bucket dredge operating on Shoalhaven river, New South Wales, showed at a recent clean-up, after 20 days' work that 88% of the gold was caught before it traveled 20 ft., 8% 50 ft., 4% was taken off the mats of the last 30 ft. of boxes, and only a few pennyweights went to within a few feet of the end. The dredge is now running 18 buckets per minute, but when an increase in the pumping capacity of from 3000 gal. to 4500 gal. per minute has been arranged, it is hoped to run 20 or more to the minute, and get the costs down to 1d. per yard.

Dry rot, which affects mine timber is due to the growth of a fungus of which the fruit presents the appearance of irregularly shaped, flattened, or undulating patches of variable size, adhering by their entire under-surface to the substance on which they are growing. When mature the central portion of the patch is covered with an irregular network formed by slightly raised anastomosing ribs, and is of a rich brown color due to the enormous quantity of spores which are deposited on surrounding objects under the form of snuff-colored powder. These spores are diffused by currents of air, or by rats, mice, and insects.

Powder headache is due to breathing poisonous gas resulting from the explosion of the powder. The best cure is to get into the fresh air and the best preventive is to secure adequate ventilation. When a man is overcome by powder smoke he should be carried promptly into fresh air and if necessary artificial breathing should be induced as in cases of drowning. When it is available, oxygen may be administered to advantage. It is worth remembering that a man once overcome by gas is for a long time subsequently peculiarly susceptible to its influence. Such a person may be seriously affected by an amount of gas that is not noticed by others.

High cost of living, according to B. F. Yoakum, is largely due to the middlemen. He presents the following interesting examples of how costs grow on the journey from producer to consumer: The Florida farmer receives $2.25 for a bushel of green beans, the railroad gets 50c. for the 800-mile haul to New York, and the consumer pays $6.40 for this same bushel of beans. There is 35% for the grower, 8 for the carrier, and 57 for the dealer. This is not a fair division. Thirty cents a dozen was the average price of eggs in New York last year, while the farmers of Arkansas and Missouri received 15c. The freight was 2c. per dozen. The men who receive the eggs at the station in New York and deliver them to the consumer take 13c. profit. The rice farmer of Texas, Louisiana, and Arkansas gets 2½c. per lb. New York pays 10c. for this rice. The freight is ½c. If the rice farmer were paid 3½c. (1c. more than he is now getting), and the dealer took 1c. profit (which is 25%) the New York consumer would get 20 lb. of rice for a dollar, instead of 10 lb. as now.

Temporary track may be laid easily and quickly by the following method, described to us by Elton J. Simmonds. Lay permanent ties as you advance. Take two full length T rails and lay them on their sides or edge just inside the permanent track so that the flange of the wheels runs in the groove of the rails, as shown in the accompanying figure. When



the drift has advanced to the end of the long lengths, turn them over on their proper base and spike. This method obviates short lengths, false rails spiked to ties, and other devices, and entails no unnecessary labor; not even an extra spike driven, as the long lengths have sufficient weight and bearing to steady themselves.

Special Correspondence

LONDON

Great Boulder Perseverance at Kalgoorlie. — Crown Mines and Ferreira at Johannesburg.—Frontenac Consolidated of Gilpin County, Colorado.

The Great Boulder Perseverance is one of the most interesting mines in Kalgoorlie, though not now of high grade. In its earlier years it produced rich ore, but in 1905 the reserve was found to have been exaggerated, and the control and management passed from the hands of F. L. Gardner and Ralph Nichols to others. Hooper & Speak were appointed consulting engineers and subsequently general managers, their Australian partner, Ernest Williams, assuming local responsibility. Under their direction extensive prospecting and development revealed the presence of orebodies averaging 7 dwt., and under the new conditions the company has continued to make profits. One of the last acts of the old management was to expand the nominal capital to £1,500,000, and on this exaggerated figure the present rate of dividends looks small, though on the original capitalization of £175,000 it would have been handsome. The company had a bad stroke of luck last year in the form of an outbreak of fire in the grinding and adjacent departments. This fire occurred on November 19, and destroyed the Griffin mills, the main driving engine, two air-compressors, electrical plant, and part of the boiler-house, roasting furnaces, and belt-conveyor. A sum of £22,340 has been recovered from the insurance companies, but the total cost of renewals will be over £40,000. Milling operations have been suspended and cannot be resumed until the new plant is ready for work in July next. In the meantime development has been prosecuted actively; 11,395 ft. of work was done in 1909, as compared with 7699 ft. in 1908. The ore reserve on December 31 was estimated at 380,772 tons averaging 6½ dwt., and there was also 249,080 tons in the mine averaging 4.94 dwt. classed as probably profitable. Other bodies of ore are known to exist, but as their content is not sufficiently investigated they are not included in the estimate. The main shaft is down to 2074 ft. During the year 1909, that is, from January 1 to November 10, the tonnage treated was 192,178, and the production was 70,681 oz. gold and 7829 oz. silver, with a total value of £300,949. The working cost was £185,422 and expenditure on development £40,263. The disposable balance of profit for the year was £56,837. The directors have decided to write off as lost the loan of £46,938 which F. L. Gardner as director and controller lent to himself personally in years gone by. It may seem remarkable that a director should be able to draw on his company to this extent, but in justice to Mr. Gardner it must be remembered that in early days when the sulpho-telluride ore caused such difficulties he spent out of his own pocket and without recompense more than this sum of money for the purpose of putting the company into a paying condition. After writing off this amount as lost, the profit for the year is reduced to £9899. In order to equalize dividends the sum of £50,000 has been taken from reserves and a dividend of 2½%, absorbing £34,986, has been paid. It had been intended to pay double this rate for the year, but the fire in November rendered this impossible. The treatment at this mine differs from that usual at Kalgoorlie. The ore is first crushed to the finest slime, then roasted, sent to amalgamating pans, and finally to cyanide plant and filter presses. In the destroyed plant, the comminution was done in Griffin mills, but in the new plant these are to be replaced by Krupp ball-mills and tube-mills.

The mines in South Africa have been attracting much attention recently owing to the various consolidations. One of the most interesting is the Crown Mines, which was formed on July 1 of last year as a consolidation of Crown Reef, Crown Deep, Langlaagte Deep, Robinson Central Deep, and Langlaagte Royal, all dividend-payers, Paarl Central, a producer not yet paying a dividend, together with other properties on the dip not yet developed. The control is with the Wernher-Beit group, G. E. Webber is consulting engineer, and R. C. Warriner is general manager. The company is in law a continuation of the Crown Deep company, so that the present report for the year 1909 is a composite one, covering as to the first half year the doings of the Crown Deep mine, and as to the second half the operations of the new company. As regards the second half of the year, the report shows that 740,924 tons of ore was treated by 675 stamps. The yield was 8.128 dwt. per ton or 34s. 1d., and the working expenditure was 17s. per ton, leaving a profit of 17s. 1d. The total working profit was £634,084, and £611,068 was distributed as dividend for the half year, being at the rate of 130% per annum. The reserve of developed ore on December 31 was 3,916,593 tons with an average content of 7.7 dwt. This figure does not show a great increase, a fact accounted for by the nature of the development during the half-year, attention having been concentrated on the preparation of the consolidated properties for the new system of exploitation rather than to the extension of the ore reserves. Five new tube-mills and additional cyanide plant have been provided, and the monthly output will be increased to 157,000 tons. Two pumping stations have been added and a new steel headframe has been erected at one of the shafts. The reorganization will not be finally completed for another two years. The cost of working has not yet been reduced and will not be until the reorganization is more nearly complete. In fact, the costs during the past half-year have necessarily been a trifle higher than when the mines were working individually, owing to the many temporary expenses. The benefit of this extra expenditure will be felt later. The life of the consolidated mines is estimated at 50 years. The market quotation of the shares, nominally 10s., is £8¼.

The Ferreira is one of the oldest mines on the Rand, having started operations in 1887. It is on the outcrop between Robinson and Village Main Reef. In the earlier days the content used to average 1¼ oz. or £5 per ton, and the cost of mining and milling varied from 35s. to 55s. per ton. Before the war the average profit per ton milled was over 50s. per ton. Since then the equipment has been increased; the yield per ton has gradually decreased from 13½ dwt. in 1902 to 9.6 dwt. in 1909. The cost per ton has decreased from 33s. in 1902 to 15s. 6d. in 1909. The life of the mine is drawing to a close and will probably come to an end at the beginning of 1913. The present equipment consists of 120 stamps and 3 tube-mills, of which latter one was put into commission during June of last year. The report for 1909 shows that during the year 339,150 tons of ore was treated in the mill, with an average content of 10 dwt. The yield by amalgamation was 113,740 oz., being an extraction of 6.7 dwt., leaving 3.3 dwt. on the tailing. This was subsequently treated in the cyanide plant and yielded 45,376 oz. In addition, accumulated sand and slime produced 3810 oz., and brought the total production to 162,926 oz., the value of which was £685,843 or 40s. 5d. per ton. The mining and development cost was £147,694 or 8s. 8d. per ton and the cost of metallurgical treatment was £88,449 or 5s. 3d. per ton. In addition, administration cost £26,493 or 1s. 7d. per ton, bringing the total cost to £262,636 or 15s. 7d. per ton. The profit was £423,207, and the balance brought forward from the previous year was £357,203. For the year 1909 a dividend of £570,000 has been declared, being at the rate of 600% on the nominal capital. As regards the future the ore reserve on December 31 last was 937,619 tons with an average assay-value of 8.65 pennyweights.

The Frontenac Consolidated company has been formed for the purpose of amalgamating the properties of the Frontenac Mining Co. and the Adduddel Mines Co. and extending operations. The properties consist of mines on the same vein three miles south of Central City, Gilpin county, Colorado. Henry P. Lowe is the manager. The ore consists of auriferous sulphides, some of the gold being caught by amalgamation in the battery and the remainder recovered by concentration. The vein has been intersected at a vertical depth of 1800 ft. by the Newhouse tunnel. The Frontenac company has been working since 1906 and has sunk a shaft 720 ft. and driven eight levels totaling 5500 ft. A stamp-mill and concentrating plant with a capacity of 60 tons per day has been erected, and the producing stage was reached in the middle of 1909. The Adduddel company is

not so far forward as regards production, but 6000 ft. of development has been done. The actual ore exposed amounts to 30,718 tons with an assay value of $9.75, and the profit is estimated at $100,929. It is estimated that the output above the level of the Newhouse tunnel will be 344,216 tons, giving a profit of $1,256,484. By means of the present flotation additional capital will be obtained whereby the treatment plant will be extended to 300 tons per day.

Mining in the Newhouse Tunnel.

The capital of the company is £300,000, of which 70,000 shares of £1 each are now being issued for the purpose of raising the necessary funds. The properties have been examined by S. W. Tyler, Forbes Rickard, and by a representative of Alexander Hill & Stewart.

KALGOORLIE, WESTERN AUSTRALIA

Presidential Address at Chamber of Mines. — Water Pipe Troubles. — Patent Litigation.—Associated Head-Frame. — Institute Meeting.—Filter-Presses.—Monthly Output.

During the month of March there were good developments in the Hainault, Ivanhoe, and Perseverance mines, at depths ranging from 500 to 2100 ft., and mining generally on the belt is in a sound condition. The gold yield from the State was valued at $2,500,000. From the President's address at the annual meeting of the Chamber of Mines, the following may be of interest: "The results of the past year have not been altogether commensurate with our wishes, which are always in the direction of growth and improvement, but we have very fair reason to be satisfied with the work and the results obtained. The general rule of the past five years was maintained as to increased tonnage treated, shrinkage in the gold output, and dwindling profits. In 1909 the total quantity of ore treated was 3,105,094 tons, yielding gold to the value of $33,480,000. The tonnage shows an increase of 23,180 tons over that of 1908, while the value of the gold produced is $415,000 less. The ore grade is still declining; it dropped from $10.56 in 1908 to $10.32 in 1909. On the other hand the working costs increased from $4.62 in 1908 to $4.84 in 1909, and $640,000 less was paid in dividends by gold mining companies. I would again emphasize, as I did last year, the urgent need of keeping down working costs to the lowest possible level, otherwise the mining industry must suffer, since no high-grade mines have been lately discovered to compensate for the falling grade of the existing mines in the State. To do this will, I know, be exceedingly difficult. In the Kalgoorlie field, which is still the backbone of the industry, we have to face the problem of dearer water, dearer fuel, and the higher costs incidental to deep mining. Speaking generally of the mines in the back country, their special difficulty is the practice pursued by the Arbitration Court of granting what appear to me to be unwarranted increases in wages. I would direct your attention to that part of the council's report which deals with this matter, and especially to the following sentence: 'For the future it will be the duty of the mining employers to take advantage of every reasonable and legitimate means to endeavor to bring down the rates of wages, and the cost of commodities to a standard more commensurate with the existing state of the industry'." Many other points were dealt with, such as ventilating the mines better in view of deeper workings, decline of capital invested in new mines; the Government's work in connection with explosives used in the mines, and miner's phthisis; and the gold stealing evil.

Mention has been made in these notes from time to time of the Water Scheme, and the corrosion that is taking place inside and outside of the main. Investigations have been carried out in England by Sir A. Bennie, Son & Deacon, Sir W. Ramsay, and Otto Hehner, who report that external corrosion of the water-pipes is due to (1) deterioration of the protective coating, (2) the pipe being buried in trenches when it should have been carried on trestles, so as not to be in contact with the surrounding soil, the soluble salts contained in which give rise to corrosion when moisture is present. For external corrosion, the best protection is held to be scraping the affected part, painting with bitumen and tar, and wrapping with tarred hessian. If laid in trenches, the pipe should be laid in a bed of lime concrete, a half-inch layer of CaO on top. The CaO would entirely prevent corrosion should the coating be damaged and moisture obtain access to the pipe. Internal corrosion is due to the failure of the coating. To scrape and re-coat is out of the question. Oxygen is the cause of the nodular incrustation. It is proposed (1) to prevent air entering the main at any point; and (2) that three grains of CaO per gallon be added to the water as it is pumped from the reservoir. The cost of the improvements suggested would be $935,000, and annual working cost $11,500. These experiments are of great value, as 443 miles of pipes are affected internally and externally. The water itself is very pure indeed; but the country the main passes through is very salty. We have had five hot and dry months, and the water consumption keeps high. In February, 102,347,000 gal. were used, returning $83,000; and for eight months of the financial year, 716,434,000 gal. for $755,000.

A big case of much interest in metallurgical circles is to be tried in Perth next month, as the London & Hamburg Gold Recovery Co., Ltd., which controls the patents out here for the use of bromo-cyanide, is sueing the Golden Horseshoe for some $300,000 for royalty not paid. The case is sure to be highly technical, and an abstract will be written for the readers of the Journal when the matter is decided. The Associated company has just erected a fine head-frame on the main shaft. This is made out of 18 by 20-in. Oregon timber, and is 102 ft. high. It was built over the old head-frame, which will be left in position, as a part will serve for the new 7½ Gates breaker and ore-bin to be erected in connection with self-dumping skips in the shaft. This work was carried out without delaying the usual hoisting. The Lake View Consols has started its No. 5 Krupp ball-mill wet crushing along with its 75 stamps. The screens used are about 28-mesh, against the 15-mesh on the battery. So far the mill is crushing 30 tons per day, but a thorough test will be made before long. Lack of tube-mill capacity prevents the coarser screen being used on the ball-mill.

During the month the local branch of the Australasian Institute of Mining Engineers met at the Chamber of Mines for the quarterly meeting. There was the usual representative gathering of mine managers, metallurgists, and

others. There was further discussion on roasting practice generally; the advantage or otherwise of cooling the roasted ore before mixing with the weak KCN solution; why the ore in the furnace tends to 'ball'; depth of ore in the furnace; and so on. It appears that this discussion will run on for several meetings yet. At the meeting written about, a paper on 'Filter-pressing' was read by M. W. von Bernewitz. The paper dealt with analyses of the ore before and after roasting, grading tests, details of agitation, filling, washing, and discharging presses, full details as to the cloths, plates, solution values, and soluble gold left in the cakes, costs, extraction, re-treatment of residue as against the vacuum process, and some experiments on sluicing-out presses. Discussion on this paper will take place in June. Every meeting seems to go off with greater swing, and much information will be forthcoming as discussion continues. The representative of the Butters Filter company is here investigating processes in use. The press still holds the lead here, but for how long is uncertain. The new hoist on the Kalgurli has been erected and is at work. It is a Corliss type engine built by Fraser & Chalmers, with cylinders 20 by 60 in., and will hoist nine tons from a depth of 4000 ft. It is fitted with special over-winding safety gear. All the clutches, reversing gear, and brakes are operated by steam. The returns from the principal mines were as follows:

Name.	Tonnage.	Value.	Profit.
Associated	11,108	$75,800	$2,300*
Associated Northern	3,137	21,000	3,000
Chaffers	4,038	31,500	2,500
Golden Ridge	2,479	31,000	14,000
Golden Horseshoe	25,739	210,000	40,000
Great Boulder	18,459	248,000	127,000
Great Fingall	10,784	87,500	10,200
Hainault	5,927	39,500	7,500
Ivanhoe	19,474	208,000	100,000
Kalgurli	10,940	140,000	75,000
Lake View Consols	11,362	77,000	12,000
North Boulder	1,200	34,000	.....
Oroya-Brownhill	21,596†	26,000	13,500
Oroya-Black Range	4,550	45,500	10,000
Oroya-Links	11,495	80,000	20,900
Sons of Gwalia	13,512	118,000	49,000
Sons of Gwalia South	3,497	33,500	.....
South Kalgurli	9,212	60,000	11,000

*Loss. †Old residue only.

TORONTO, CANADA

Cobalt Development.—Porcupine District.—Metagama Coal and Petroleum Deposits.—Explosives Regulation.

The general use of electric power is having its effect in gradually increasing shipments from Cobalt, and improving the physical condition and prospects of the camp. The most encouraging signs are the more favorable reports from the leading mines, the Nipissing and La Rose, the annual statement of the former being particularly satisfactory, showing an actual production during 1909 of 4,727,231 oz. silver, and a decrease in the cost of production from 20.7 to 16.39c. per ounce. The profit on operations amounted to 68.53% of the gross. The most hopeful feature is the marked increase in the ore reserves, estimated by Mr. Watson, the manager, at 6,539,200 oz. silver, as against 2,156,000 at the beginning of 1909. There are 132 known veins on the property. At the La Rose some rich orebodies have been opened on the Lawson property, both on the 48 and 88-ft. levels, the latter being regarded as a highly important development. In the main workings of La Rose proper, several veins have been proved at greater depths, and three veins of the Princess are yielding good ore. There has been a renewal of the rumors of a contemplated merger of the Nipissing and La Rose, and possibly other companies, but no definite steps to that end have so far been taken. The stock market is steadier and a feeling of greater confidence has arisen, but speculation in Cobalt stocks is practically dead. The Temiskaming directors have issued a report for the quarter ended April 30, showing cash liabilities of $190,820, and cash assets of $180,188, with profits amounting to $96,486. The veins are holding out well in depth, No. 2 at the 400-ft. level averaging 8 in. and assaying 4000 oz. silver per ton, while No. 1 is in good ore at 350 ft., and No. 3 carries 6 in. of high-grade at 390 ft. The new mill of the Nova Scotia is in operation, but only 10 stamps are being used at present. It will shortly be running to its full capacity of 100 tons per day. A new lead has been struck on the 100-ft. level from which rich ore is being taken. At the Trethewey a 6-in. vein assaying 4000 oz. silver per ton has been struck on the 150-ft. level. Development on the 280-ft. level of the Cobalt Lake near the McKinley-Darragh boundary has disclosed good ore. There are 13 stringers of ore in the face of the drift, two of them 3 in. wide, containing smaltite which assays between 2000 and 3000 oz. silver per ton. A vein discovered a short time ago on the Nipissing property has been traced to the Little Nipissing and appears to cross it. Assays from ore at the surface run as high as 2000 oz. The new vein struck by the Little Nipissing at the 210-ft. level has been opened by a drift for 100 ft.; over 300 tons of ore have been extracted from it. On May 18 the camp was visited by the members of the Canadian Press Association, 130 of whom are making a trip through the mining districts of northern Ontario. Sir Mackenzie Bowell and Senator Jaffray were with the party.

Many prospectors and mining men are going into the Porcupine gold district. W. E. H. Carter, a mining engineer, and H. E. T. Haultain, professor at the Toronto University School of Mining, have gone to make an inspection of the district. Important discoveries have been made on the North Vipond property owned by the Porcupine Gold Mines, Ltd., where a vein 5 ft. wide has a high-grade streak in the centre 2 ft. wide, showing native gold which will yield several hundred dollars per ton. A shaft is being sunk on the vein. Willet G. Miller has gone to investigate the reported discoveries of coal along the Metagama river. Numerous prospecting parties have lately been busy in that region, and it is claimed that a good quality of cannel coal has been found underlying the lignite. R. Horschitz, of Pittsburg, has staked four claims for an American syndicate. The United States Steel Corporation is also in the field, represented by R. J. Flaherty, who is said to have found large deposits of coal, iron, and salt. Strong indications of petroleum are reported throughout this region. Hon. W. Templeman, Canadian Minister of Mines, has in preparation a measure dealing with the use and storage of explosives, as a means of preventing accidents. It is proposed to create an Explosives Division of the Department of Mines, to which will be entrusted the testing and regulation of all explosives. A Government testing station will be established and drastic regulations passed against the use of unauthorized explosives.

WASHINGTON

Oil Land Legislation.—Agricultural Entries on Coal Lands.—Geological Survey Appropriations.—Land Examinations.

The enterprise displayed by the oil men of California in their campaign against the bill authorizing the President to withdraw the public lands from entry is exciting much comment in conservative Washington. It was not long after the bill passed the House that the Californians learned their interests were at stake. The bill as passed, if finally enacted into a law, would have withdrawn all oil lands from entry that were located subsequent to September 27, 1909. Congress heard from the oil men as fast as the words could come over the wire. Members of the Senate were asked to delay the passage of the bill until a delegation could arrive from California. They were told that the proposed law would be a coast-wide calamity; that the effect of any retroactive law would be immediately to stop the production of fuel oil to such an extent on lands on which a discovery of oil has been made since September 27, 1909, as at once to raise fuel oil to prohibitive prices and to allow large concerns owning patented lands to charge such price as the traffic would bear, thus creating such a monopoly of oil among the large interests such as has never existed in the United States. Another delegation telegraphed, "You can't conserve oil like coal and other minerals. It flows to nearest pumping well." Another wired, "Patented land

owners continue operations, thus depleting pools at small operators and Government expense." When the telegrams were read in the Senate, Reed Smoot, Senator from Utah, said that he thought the good people of California were under a mistaken apprehension as to the withdrawal bill. He explained that the bill known as the Pickett bill had already been acted upon by the Senate Committee on Public Lands, and that the enacting clause which permitted the withdrawal of the oil lands had been stricken from the measure. As the bill now stands, he said, there is no provision for the withdrawal of oil lands. Nevertheless this did not satisfy the Californians who have now reached Washington and are in the midst of a series of hearings before the House Committee on Public Lands, of which Frank Mondell, of Wyoming, is chairman. The bill will undoubtedly pass the Senate in its amended form and the amendments will be accepted by the House.

The Mondell bill, permitting agricultural entries on coal lands, has passed the House and is now before the Senate with a number of amendments. Joseph M. Dixon, Senator from Montana, will ask for a speedy hearing. In his report he says, "About 15,000,000 acres of lands have already been classified as coal lands, and about 45,000,000 acres are now withdrawn for classification, of which probably half will be eventually classified as coal lands. This represents an area of country about as large as the States of New York, Massachusetts, and Vermont. A great portion of this vast territory is suitable for agricultural entry, but under the homestead law cannot be entered as homesteads for the reason that the land contains coal. The situation is most urgent, as thousands of homestead entrymen are ready and anxious and willing to enter these surface lands as soon as remedial legislation can be had." The Sundry Civil bill, the last of the great appropriation measures, contains the following items: California Débris Commission, $15,000; public lands service, salaries, and commissions of registers and receivers, not to exceed $570,000; contingent expenses of land offices, $295,000; protecting public lands from fraud, $750,000; for surveys and re-surveys of public lands under the supervision of the Commissioner of the General Land Office, $450,000; toward surveying public lands in Valley, Dawson, Custer, and Fergus counties, Montana, $100,000; for United States Geological Survey, salaries, office of director, $34,860; scientific assistants, $29,900; for skilled laborers, $20,000; for topographic surveys, $350,000; for geologic surveys, $225,000; for chemical and physical research relating to the geology of the United States, $20,000; for preparation of report on mineral resources, $75,000; for gauging streams and determining the water supply of the United States, $100,000; for engraving and printing geologic maps, $100,000; for the investigation of fuels, $100,000; for the continuation of the topographic surveys of the public lands that have been or may hereafter be designated as national forests, $75,000; for subdivisional surveys of the public lands in Alaska and the preparation of the necessary maps and field notes, $40,000; for the investigation of mine explosions, $150,000; a total of $1,347,390 for the Geological Survey. An amendment is added to the bill authorizing the mine inspectors in the territories to inspect coal and other mines in the District of Alaska, to which district the provisions of this act are to be made applicable. The appropriation for testing structural materials has been cut from $100,000 to $50,000 and the work transferred from the Geological Survey to the Bureau of Standards in the Department of Commerce and Labor. It is thought that the passage of the Bureau of Mines bill nullifies this.

BUTTE, MONTANA

Parrot Opposition to Anaconda Consolidation. — Unwatering Ophir Mine.—North Butte.—Corbin and Radersburg Districts.

The dissenting stockholders of the Parrot Copper & Silver Mining Co. have instituted proceedings in the district court in Butte to have their stock appraised, as provided by the laws of Montana in cases where minority shareholders oppose the sale of property but can not prevent it. At the recent special meeting of the Parrot company, held in Butte, a small number of shareholders, represented by W. D. Kyle, as attorney, voted against the acceptance of the offer of the Anaconda Copper Mining Co. to purchase all of the Parrot assets for 90,000 shares of the new Anaconda stock. Under the State law action toward getting an independent appraisement of the value of their shares had to be taken within 20 days after the meeting. As no proceeding had been instituted in court within the 20 days it was generally assumed that the objectors had decided to make no further fight, but it appears from the pleadings filed in court that legal notice of a demand for an appraisment and payment under the award was served on both the Parrot and Anaconda companies by the protesting stockholders on May 18. The circular recently issued by the Western Development company through its vice-president, Calvin O. Geer, is attracting some attention, but among mining men there is a belief that the offer to exchange one share of United Copper company preferred for one of Anaconda, has been made solely in the interests of the United Copper company. The Anaconda company denies any connection with the deal and in order for the Western Development to carry out its part of the offer it must go into the open market and purchase Anaconda stock. The offer of the Western Development is not regarded seriously, but is considered an effort to boost the stock of the United Copper company which was organized to take over the assets of the bankrupt firm of Otto Heinze & Company.

Veiw of Part of Butte, Montana.

The work of unwatering the Ophir mine of the Butte Central Copper Co.'s property has been commenced with all the machinery in good working order. It is now estimated that it will take fully two months to get out all the water and this will mean that it will be about the first of August before the Ophir will be ready for active mining. Some good orebodies have been cut in the Raven mine and it is stated that it will not be long before regular shipments are commenced. Development is going along steadily and the company is reported strong financially. The energetic development which was promised at the annual meeting of the North Butte company is to be carried out. It is intended to sink the main shaft another 200 ft. and possibly 400, and cross-cut at these points as well as advance the development on the Croesus and adjoining veins. The work of constructing the new concentrator of the Butte & Superior mine is proceeding, and while there has been some

delay there is now a complete force of men at work, and unless some unforseen trouble arises the management expects to have the mill running in about three months.

The Corbin-Pennsylvania Mining Co. is the name of a company recently organized in the Corbin district with a capitalization of 500,000 shares of the par value of $1 each. The property acquired consists of six claims and is situated within half a mile of the Great Northern railway. On the east it adjoins the Boston & Alta property and on the northwest is the Boston & Alta and the Chicago & Alta extension, while on the south it is bounded by the Montana-Corbin. H. E. Emmerson, manager for the Boston & Corbin, is president of the new company, W. D. Gibson, superintendent of the Montana-Corbin, vice-president, and H. M. Brooks, secretary and treasurer. The Corbin Copper Co. will have its 200-ton concentrator in operation in about two weeks. When the mill is in working order the company will treat about 150 tons of ore per day which will come from the Dewey and Bonanza adits. The new electrical machinery for the Keating Gold mine, in the Radersburg district, will be in operation inside of two weeks and the company is expecting to increase its shipments of ore as soon as it is in working order.

BRITISH COLUMBIA

North Star Sold.—Rossland Shipments.—Slocan Star to Resume.—Greenwood Smelter to Blow in.— Fife Working. — Sheep Creek Items.

The North Star mine, at East Kootenay, is reported to have been sold to the Consolidated M. & S. Co., of Canada, Ltd. It is near Kimberley, Fort Steele mining division. Years ago this was the chief producing silver-lead mine in British Columbia. Its aggregate production to 1906, inclusive, was 69,500 tons of ore averaging, approximately, 30 oz. silver per ton and 40% lead. Production during recent years has been small; in 1909, it was only about 3000 tons of ore containing 39,000 oz. silver, and 711,000 lb. lead. The ore contains an excess of iron in oxidized form, and very little sulphur, consequently the smelting rate on it is low. Mining costs have been $2.33 per ton of ore. Tonnage of ore produced at Rossland during five expired months of current year aggregates 92,000, of which nearly 80,000 tons is from the Consolidated Co.'s Centre Star group. The Nickel Plate mine, long idle, is now leased and shipment of ore has been commenced. At Slocan, Byron N. White, of Spokane, president of the company owning the Slocan Star group, is arranging for mining and milling operations. The main workings of the Slocan Star mine have been closed for several years pending settlement of the lateral rights case of Star Mining & Milling Co. *v.* White, which was disposed of last fall. The company's concentrating mill, which makes both zinc and silver-lead products, will again be operated, after having been idle for years. The railway between Kaslo, on Kootenay lake, and Sandon, in the heart of Slocan district, is again being operated. Several years ago snowslides took out some big trestle bridges and these were not replaced. The road has lately been again placed in running order over the final eight miles which had been idle three or four years. An incline raise is being made from near the breast of the 2000-ft. adit driven last year by the Deep Mine, Ltd. The old workings of the Whitewater Deep mine are a total distance of 500 ft. up from the low-level adit, and connection is to be made with these. The present contract is for 150 ft. of raise and for exploratory drifts when that distance shall be reached.

The shipment of ore has not been resumed by the B. C. Copper Co. from its various mines to the Greenwood smelter, although all trouble between the company and its men has been settled. It is expected that work will be resumed with a good force of men in a few days, when the large furnace at the smelter will be blown in. The two other furnaces, which are being enlarged, will not be ready for work until about the first of June, when heavy shipments of ore will be made by the company to its smelter. Much new track is being laid and more electric motors added to the Mother Lode mine equipment. The company has only about half of its regular crew at work yet. There are about 40 men at work on the No. 7 property of the Consolidated company. Most of the work now being done is surface work. A deal is pending for the Highland Queen mine, near Greenwood.

The complete plant is now working well at the Fife mines, Rossland, and about 20 men are at work on development. It is not the intention to make steady shipments until considerable ore is blocked out, it is stated. A good strike of ore has been made in the main tunnel 500 ft. from the portal. The ore here carries over 5% copper and $4 to $6 in gold.

The Sheep Creek district seems to be the centre of attention hereabouts these days. The Queen is being examined by Richard A. Parker, of Denver, for Eastern capitalists. Mr. Erlund, of New York, is also at the property. Rumor has it that the Guggenheim interests have a bond on the Queen for $500,000. This property is now owned by Wisconsin people. It is equipped with air-compressing plant and 20-stamp mill, and has paid good dividends for several years past. There is considerable activity on Deer and Wolf creeks, and several of the properties have been examined by mining men in the last few days, including Haggen & Oliver, of Vancouver, and Shallenberger, Seelye & Mayer, of Spokane. The mill-run (of 568 hours) for the month of April at the Van-Roi mine, is summed up in the following figures: ore crushed, 4269 tons, yielding 140 tons lead concentrate, assaying 210.7 oz. silver, 62.6% lead, 10.8% zinc, and 100 tons zinc concentrate assaying 74.2 oz. silver, 3.4% lead, and 43.9% zinc; approximate value, $19,834. The shipment of ore from the Society Girl mine, Moyie, will soon be made possible by the new wagon-road being built to the property. An electrical lead-zinc experimental plant has been erected at Cranbrook and some tests on local ore will be made.

NEW YORK

Market Conditions.—J. Parke Channing on Porphyry Coppers.—Ray Con.—Utah Copper and Nevada Con. Listed.— Guggenheim in Alaska.—Cobalt.—British Columbia.

Wall Street has become a Sargasso sea. An unbroken calm broods over the market. Interest in mining matters is at its lowest ebb. The copper situation is much confused. About the only figures, apparently, upon which reliance can be placed, are those of the producers. The statisticians are evidently uneasy over the possibility of hidden supplies which might suddenly be added to the 'visible', while on the other hand it is admitted that all of the existing accumulation could be immediately absorbed if buyers would carry the usual stock. It is generally understood that there is to be something of a war between the smelter crowds, and that in this the copper mines will figure as important factors. In some quarters there is talk of a combination, or, at least, of an understanding which will save open warfare, but nothing definite has yet appeared. Copper authorities are pointing to the fact that known consumption, that is, deliveries known to be going to genuine users of the metal, is breaking all records and that the present surplus is not proportionately larger than at many times past. It is true that production is running about 10% ahead of consumption and that some of the low-cost producers, whose only possible profit lies in an enormous output, are now on a basis where curtailment is impossible. There is also the further fact that some of the low-cost coppers now in the making have already cost so much that developments cannot be sidetracked and their production must be thrown on a glutted market. It is this state of affairs that causes buyers to stay out of the market. The law of inertia holds good in regard to the steam-shovel coppers. It takes a mint of money, years of time and labor to get one of these properties started, but when started, it cannot be stopped but must be kept going. Recent discussion of the possibilities of the porphyries has called from J. Parke Channing a very pertinent interview, in which he says: "It is ridiculous to put down the costs of most of the new copper properties, which have never yet turned a wheel, to 7½c. per pound. Yet this very thing

is being done on all sides, and it looks to me as if the indiscriminate use of such low cost figures is mostly responsible for the present lack of buying in our copper market. Large consumers take the view that if so many properties are going to produce copper for 7½c a pound, they might just as well hold themselves aloof from the market until such a time as the metal sells lower. I have never claimed better than costs of 9c per pound for ores of the Miami Copper Co., yet in a number of tables that I have seen, in which the figure of cost was given, I have invariably found the latter placed below 8c. In addition, operators who are taking every step they know of to show what a tremendous amount of copper their properties will be able to produce within 12 or 18 months' time are not helping the copper situation in any light, whatsoever. These statements of tremendous output which are made also have an influence tending to keep buyers out of the markets. The worst of it is, that, when these predictions are sifted to rock bottom, one finds that they are usually 50% greater than the most flourishing of possibilities. It is a form of exaggeration which in my opinion is largely responsible for the present low price of the copper metal."

While the predominance of the porphyries may for the moment aggravate the untoward conditions of the copper metal market, they have exerted a widespread influence upon the mining share market which has been wholly beneficial and which is extending, and has already extended far beyond the limits of copper mining shares. This is the lesson taught, largely through these issues, of regarding and studying mining from an investment point of view. It is true that the public, carried away by the realization that this type of mine eliminated the element of uncertainty, became over-enthusiastic and forced these issues to higher

Red Rock Shaft, and Experimental Mill at the Miami.

levels than can be justified. Perhaps nothing demonstrates more fully this temporary reversal of sentiment toward the copper list than the complete lack of interest in the preliminary merger of the developing properties in the Utah Copper group. The recent announcement of the consolidation of Ray Consolidated and Gila was received without comment, and while the combined property is claimed to be potentially equal to Utah Copper, there has been no market response. In fact, both issues have sagged materially. The stockholders' meeting called for the ratification of the proposed consolidation was held this week and the necessary increase in the capital stock of the Ray Consolidated from $10,000,000 to $12,000,000 was authorized by unanimous vote. Notwithstanding the inevitable reaction and the present decline in enthusiasm and some drastic shrinkage and heavy losses incurred, the lesson will remain and mining investors will not forget what they have learned in regard to ore reserves, average values, extraction costs, depreciation charges, and many other vital features, which hitherto were never considered by the general public in mining matters. The more the general public becomes educated in regard to mining, the better for the industry, as well as the public. The progress made along this line is illustrated by the admission of Utah Copper, and Nevada Con. to trading privileges on the New York Stock Exchange. Goldfield Con. is preparing to ask for trading privileges and it may be expected that others will strive to follow their example. In fact, it is the step in market progress that is one of the underlying causes of the present stagnation in mining issues. Some of the larger California oil companies as well as some of the industrial 'trust' shares are being removed from the speculative field and placed in the investment class, that there should be a momentary halt and a readjustment as this step is made is to be expected. The Guggenheims, who seem to have been the disturbing factor in the projected merger last winter, are in the spot light again owing to a bitter attack upon their actions in Alaska in connection with the J. P. Morgan interests. The Senate Judiciary Committee at Washington is holding meetings behind closed doors. James Wickersham, delegate from Alaska, is known, however, to have made startling charges, in connection with the accusation that the Morgan Guggenheim syndicate tried by fair means and foul to completely dominate Alaska and secure control of all of its natural resources. Members of the committee are moving to force public hearings, and sensations are expected.

The long lethargy of the Cobalts has been broken. Nipissing and La Rose moved up sharply on the rumor of an interim distribution of 5% by the former and a re-establishment of the latter on its old dividend basis of 16% as against its present rate of 8%. The talk of merger was immediately revived upon the show of some activity in the stocks; both companies concede the desirability of consolidation but evidently think the time is not yet arrived to make the move. The smelter of the British Columbia Copper Co. is to be blown in after a shut-down of more than six weeks. The labor difficulties have been adjusted and there are enough men now on the payroll to operate mine and mill and everything is expected to be in full blast by the middle of June. Shipments from the claims recently acquired in the Wellington district are to be received immediately, as the Canadian Pacific railway is just completing its spur track connecting Wellington with the smelter, so that the furnaces will have the benefit of this additional tonnage.

SALT LAKE, UTAH

Bingham District Active.—Utah Con. Tramway Tested. — Ohio Copper Preparing for Extensions.— Changes at Silver King. —Tintic News.

The annual report of the United States S. R. & M. Co. in referring to the company's property at Bingham states that the tonnage of ore already developed is sufficient to keep the plant running at present capacity for some years. The profits for the year were materially increased by the installation of a Huff electrostatic mill by means of which the zinc in the ore is made a source of revenue. The bag-house has been in successful operation during the past year or more and the capacity of the concentrating plant has been increased. The International smelter at Tooele will be ready for operation some time in August, probably near the first of the month. The plant will commence to receive ore some time in July as a reserve of 40,000 to 50,000 tons is desired, once the plant is started. The tramway of the Utah Consolidated from the mine at Bingham has been completed and is being tried out, but the company is not yet at liberty to ship to the Tooele plant as it is held by a tonnage contract with the Garfield smelter which it will not complete until about the time that the International plant is ready to receive ore. The new contract should work well for the Utah Con. Not only will it be relieved of the toll that it is now obliged to pay the Garfield plant, but it will be enabled to ship a larger tonnage than at any time since its own plant was closed and the transportation by aerial tram will be a decided advantage over the present method of shipment which is by tram to the lower part of town and thence by rail to the smelter. During the last year a new orebody has been opened up below and north of the fault that two years ago was said to have cut off the vein entirely. This orebody is somewhat better in grade, in fact it is estimated that it is sufficiently better to more than offset the added expense of mining at the lower level. The Utah Metals Co. is pushing work on the tunnel which is to connect Bingham with the International smelter. That portion which has already been driven has been straightened out and enlarged so as to be uniform

with the rest of the work, namely, 8 by 10 ft. in size with accommodations for two 24-in. tracks which will be laid with 35-lb. rails. A new pipe-line has been built to the source of supply up Middle canyon that gives ample electric power for the work, and a new generator unit has been installed. Each generator has individual connection to a Pelton wheel. W. J. Allison, a prominent banker from the East, has been going over the Ohio Copper Co. with Colin MacIntosh, the manager. No definite announcement has been made at this time, but the supposition is that now that Heinze's troubles are over the completion of the mill will be undertaken. The mill was designed for 3000 tons and a corresponding building erected, but only one-half the machinery has been installed. The North Utah has bought into the Bingham Copper Co., presumably to a considerable extent as W. D. Bohm, manager of the North Utah, has assumed the management of the Bingham. Clearing out the old workings has been commenced. It is expected that after the stockholders' meeting which is to be held at Cheyenne, Wyoming, on June 20, operation will commence.

In the Park City district the operating staff of the Silver King Coalition is to undergo a pretty general shaking up. George D. Blood, consulting engineer for the company, will become assistant general manager in active charge of all mining operations in place of M. J. Daly. M. F. Sammon, formerly mine superintendent for the Bingham Mines Co., will become mine foreman, in place of Frank Daly. The reason given for the change is ill health on the part of the Daly brothers, but it is generally believed that the company desires a higher standard of efficiency than in the past. Whether the embarrassing disclosures made in the suit of the Silver King Consolidated against the Coalition had anything to do with the change can not be learned. The annual meeting of the company was held recently and the old officers and directors re-elected. The Daly-Judge has also re-elected its old board and officers. Work on the Snake Creek tunnel in which the Daly-Judge is largely interested is progressing at the rate of 15 ft. per day. The tunnel is now about 200 ft. under cover. It is the largest undertaking of the kind in Utah. It will be 14,000 ft. long and 6½ by 9 ft. above the tracks, with a concave drain 3½ by 4 ft. below. Power is furnished by the company's own electric plant on Snake creek. A lateral may be driven through the divide into Alta. The Little Bell is making plans for a concentrating mill to treat a large tonnage of low-grade ore. The company has a considerable amount of high-grade ore and has been paying dividends since last December, but desires to increase its earnings.

In the Tintic district the work of sinking the McChrystal shaft of the Eagle and Blue Bell is progressing, although the new equipment is not expected until July. The McChrystal is to be carried to the 1000-ft. level, and made the main working entry of the mine. This level is being extended under the shaft and as soon as the point is reached work will be carried on by raising and sinking at the same time. The present hoist is good for only 800 ft., but as the shaft is only down 200, will be made to do until the new hoist, which has a capacity of 2000 ft., is installed. The activity here is another indication of the intentions of the Bingham Mines Co. At a recent meeting of the directors of the Lower Mammoth the levying of another assessment was voted down by a large majority. The mine probably can now take out sufficient ore to at least pay expenses. A winze from the 1800-ft. level is in good shipping sulphide ore. The Mammoth shipped seven carloads of ore running $60 to $80 per ton last week, and the lower levels look so well that there is some talk of increasing the output. A few months ago this mine shipped one carload of ore that netted the company $100,000. Those interested in the geology of the Tintic district have a new cause for speculation in the strike in the Carisa of ore identical with that in Colorado, Sioux Con., and other mines on the Colorado fissure. The strike was made on the 500-ft. level and developed into a 3-ft. vein of characteristic Colorado ore. Several theories have been advanced as to the Colorado vein, one being that it bends out of Iron Blossom into the Carisa and another that it has a feeder running in that direction.

FAIRBANKS, ALASKA

Silver-Bearing Galena on Cleary Summit. — Test Runs on Gold Quartz.—Talk of a Dredge. — Redwing Leases Jupiter Mars.

Although the high-grade ores in this district so far have been those containing a large percentage of free gold, late discoveries show that other classes exist. Near the Cleary Summit, and in the same mineral belt with the free-gold ores, a deposit of silver-bearing galena has been lately uncovered. This assays 115 oz. silver and $2 gold per ton. Not enough work has been done to show the extent of the find. Masses of galena weighing several hundred pounds were found on the outcrop. Another base ore recently assayed for the first time, although discovered by a woodchopper a year ago, proves to be antimony, assaying 51 oz. silver and $18.75 gold. Although the exact location of this find is as yet pledged to secrecy, the district is one not far from Fairbanks and on the Chatanika river. The recent mill-run on 10 tons of ore from the Crawford lease on the Rhodes-Hall property yielded a 95-oz. retort. This shows the ore to run between $175 and $200 per ton in free gold. It is probable that at least $50 per ton was lost in the tailing, as there is no provision in the test-mill for saving concentrate. Mr. Crawford is now building an arrastre on Bedrock creek to run by water-power. In this he intends to grind his richest rock. Preparations are being made to timber the 60-ft. shaft in the Spaulding-Clough property before the thaw causes the shaft to slough. In this shaft the vein shows at least 3 ft. at the bottom and free gold can be seen in the rock. By lining up the strike of the vein with a small transit, Mr. Spaulding was able to find the vein 700 ft. farther down the creek and again at 1500 ft. from the Discovery shaft. The remarkably straight walls of the lode, together with the fact that after lining up the vein was found in the first hole sunk 1500 ft. distant, speaks well for the permanence of the orebody. The extension of the Spaulding vein has been staked by Mrs. W. L. Spaulding, Mrs. R. R. Meyers, Mrs. D. J. Fairburn, and Mrs. Raymond Brumbaugh. They have a valuable claim and have named it the 'Wild Rose'. Herschberger, Buell & Phipps are still sinking on their lode on the saddle between Eldorado and Cleary creeks. The shaft is down over 40 ft. and shows high values in free gold. The gold is fine and can be seen with difficulty except with a glass. Under a glass it appears in clusters of bright colors. The main adit of the Rhodes-Hall claim has now been driven in 500 ft. The ore is still good, the vein varying greatly in width, but showing a flattering average in width and value. Mr. Rhodes will soon send in a shipment of ore. On Chatham cheek, the Pioneer Quartz Mining Co. has run into rich stringers while cross-cutting for the main vein. The rock is being sacked for future treatment. The partners, Ringseth, Giske, and Larson, are thinking of building an arrastre to handle the richest of the rock. Lawson, Sommersett & McCarty have struck the vein in their cross-cut farther down the hill. The opening between the walls averages about 30 inches, with 20 of quartz that is worth $100 per ton. There is talk of installing a dredge on a group of claims owned by the Blaker Bros. on Goldstream. The ground is 35 to 50 ft. deep and averages $1 per square foot of bedrock. As most of the overburden is muck with a large percentage of water, no trouble is anticipated in working the ground, once the pit is started and a face exposed.

The Tolovana Mining Co. has just shipped in 9 tons of rich quartz to be put through the Fairbanks test-mill. Returns should show at least $150 per ton in free gold, as hand specimens show a plentiful supply of coarse gold. The Redwing Mining & Leasing Co., Inc., of Nevada, has taken a two years' lease on 400 ft. of the Jupiter-Mars Con. Mining Co.'s ground on Chatham creek. The lease was taken after a thorough sampling by S. R. Calvin. The Redwing company is a close corporation controlled by Emil Furstenau and S. R. Calvin. The terms of the lease call for an immediate commencement of work, the development to be carried on continuously. A working shaft that will open up two levels at 100 and 200 ft. is called for, with a certain amount of driving on each level.

General Mining News

ALASKA

(Special Correspondence) —The Mount Andrew mine shipped 400 tons of ore during May on the *Jeanie*, and will have 1200 tons ready to forward the early part of June. The development is being carried ahead rapidly and a large amount of ore is blocked out in the mine.— The Chicago Exploration Co has taken a lease on the Unuk river placers, which contain 6000 acres of gold bearing gravel, and will start work at once —— R. G. Mellen, representing the Tyee Copper Co., is examining properties in this district and recently completed the examination of the Poor Man mine on Kasaan bay.— Development at the It mine is proceeding favorably, the gold content in the ore showing a fair increase as depth is attained ——On the Veta, near McLean's arm, Ickis & Polson have intersected the vein in a crosscut run from the shaft at a depth of 30 feet.

Ketchikan, May 18.

The report of the Alaska Mexican Mining Co. for the month ended April 15 states that the 120-stamp mill ran 30 days 14 hours during the month, crushing 19,315 tons of ore. The estimated value of the free milling gold amounted to $30,938, and of the concentrate $27,244, the realizable

Alaska.

total value being $55,713. The operating expenses amounted to $19,818. The report of the Alaska United Gold Mining Co. for the same period gave the running time of the Ready Bullion mill as 28 days 14 hours. It crushed 18,820 tons of ore, producing 405 tons of concentrate which, with the bullion, was worth $42,582. The 700-Ft. Claim mill ran 30 days 15 hours, crushing 16,616 tons. The operating expenses amounted to $24,495, and the total value realizable from the ore was $31,362.

ARIZONA

COCHISE COUNTY

The ore-pocket at the 1600-ft. station of the Sacramento shaft of the Copper Queen mine at Bisbee, has been completed after considerable trouble with loose ground. The drifts on the 200 and 300-ft. levels between the Czar and Holbrook shafts are being put in working order and supplies will be handled through these while the Holbrook is being retimbered.——Drift No. 15, at Denn-Arizona, opened a body of oxide ore. There are about 40 tons of ore on the dump that will average between 8 and 9% copper.——Regular shipments of wolframite ore are being made from the claims of P. Climmons at Dragoon. Some vanadium ore has also been opened on one of the claims of this group.—— The Arizona Mining & Milling Co., operating at Patagonia, has ordered 10 additional stamps for the mill which will double the capacity of the plant.——The shaft at the Scott & Crawford, at Paradise, is now down 45 ft., and a small amount of copper ore has been taken out.

GILA COUNTY

(Special Correspondence).—A third shift of 10 men has just been added to the working force at the Old Dominion concentrator ——The Williams shaft, on the National Mining Exploration property, has been sunk to a depth of 798 ft. A new level will be established 778 ft from the surface ——Churn drill hole No. 3 at the Live Oak mine cut chalcocite at a depth of 500 ft a few days ago and has since passed through 55 ft of ore averaging 2.5% copper This hole is 700 ft west of the vertical shaft, and shows the Live Oak orebody to have an east and west extent of fully 861 ft —— On the property of the Kasser Gold Mining Co., in the Lost Gulch region nine miles from Globe, a combination churn and core drill is being set up preparatory to prospecting the property. The Kasser holdings embrace 27 claims Ballard Day is in charge of operations —— The Final Mountain Mining Co. has recently found ore containing copper and gold in the adit by means of which the property is being developed. The ore runs from 3 to 14% in copper and assays from $5 to $12 gold per ton. H. H Harvey is in charge of the work.

Globe, May 27.

PIMA COUNTY

The new 25 hp. engine has been installed at the Chesterfield Copper Co.'s property and hoisting started from the 400-ft. level. In the south drift from the west cross-cut a shoot of silver-bearing galena has been opened that will assay 20 oz. silver per ton, and the ore is being hauled to the railroad at Twin Buttes and shipped from there to the El Paso smelter.——A contract has been let to sink the shaft of the Gold Bullion in the Baboquivari mountains 100 ft. which will take it to the 275-ft. level where cross cuts will be run to the vein.

YAVAPAI COUNTY

Grading for a new hoist at the Tomboy mine in the Castle Rock district has been started and a road to haul the machinery over is under construction. As soon as the hoist is in position a two-compartment shaft will be sunk from which the company plans extensive development work.——The Alvarado company has completed the connection between its two deep shafts on the 1000-ft. level a distance of over 1000 ft. The work has been entirely on the vein and has opened a body of commerical ore.——The adit at the Gold Ridge is in 725 ft.——At the Yarnell a large body of ore assaying from $7 to $10 per ton has been opened and a winze has been started in the ore from the main adit-level.——The Mountainside Mining Co., organized to operate the Stanton-Rich Hill mine, has commenced work on the property and is overhauling the mill to test the value of the ore.——A 10-stamp mill is being erected at the Mildred.——Davis & Hurley, who are operating the Octave mine under lease, started the mill a few weeks ago and are reported to have made a fair clean-up.——The United Mines Co., of Congress, is operating the 30-ton plant and shipping a good grade of concentrate.

YUMA COUNTY

The New La Paz Gold Dredging Co. is preparing to commence work on its placer ground on the Colorado river near La Paz where a number of rich placer properties were worked in the early days of the State.

CALIFORNIA

EL DORADO COUNTY

A 7-ft. vein of free-milling ore was opened recently by the drift on the 500-ft. level of the old Pacific mine which is within the city limits of Placerville. The mine is being re-opened after an idleness of twenty years, and while the extent of the shoot has not been determined the ore is well sprinkled with gold and has the appearance of permanance.

NEVADA COUNTY

The new shaft at the Cassidy property opened a shoot of $39 ore when down 20 ft. C. M. Wilson is in charge of the work.——The Ethel mine has been unwatered below the main level and the mill overhauled. The force has been increased and development work will be started at once.—— The lower drift at the Republic mine, operated by William McLean & Co., at Graniteville, opened a shoot of free-milling ore. The mine was under bond to an Eastern company some time ago, but as no amount of ore was found the bond was relinquished and the McLean interests again took up the work.

PLACER COUNTY

An examination of the Imperial gravel mine at Michigan Bluff is being made by H. S. Detwiler and George Denny, and if found satisfactory the outstanding stock will be purchased by Eastern stockholders and the mine re-opened.

SIERRA COUNTY

(Special Correspondence).—Fifteen men are sinking the winze at the Sixteen-to-One. Until this has been completed production will be suspended.——The Croesus Mining Co., operating the Plumbago mine, has its mill in steady operation and is treating the usual grade of ore.——The owners of the Federal claim have been enjoined from driving their tunnel into ground claimed by the South Fork Mining Co. ——The first payment on the Ramshorn group has been made by S. Arnold and associates of Goldfield.——Plumas county capitalists are examining the Young America quartz mine near Sierra City and are planning to resume operations if examinations prove satisfactory.

Alleghany, May 28.

An adit has been started on the serpentine contact on the Higbee claim near Alleghany that is claimed by its owners to be the extension of the Tightner.——A contract has been let to drive the adit at the Monte Cristo property 400 ft.—— The drift from the Mott shaft on Rock creek is being extended to the west, and it is thought by the owners that they will have to sink deeper to open the channel.——W. W. Old has secured a bond on the American Flag group of claims in the western part of the county and work will probably be started in a short time. The Gibraltar gravel mine is to be started some time this month. Last fall the hoist broke just as the ground was being well opened, and operations were suspended for the season.——The upper adit at the Sargent claims in Slate Castle ravine has opened the shoot a distance of 60 ft., showing the vein to be 5 ft. wide and to average $30 per ton.

SISKIYOU COUNTY

The clean-up for the first month's run of the mill on the Oom Paul mine near Greenville amounted to $2400, which is considered satisfactory by Pickard & Nagle, who are operating the property. A lower adit has been started that will tap the vein 75 ft. lower than the present workings and a drift is being run that will open another shoot 400 ft. distant.

TUOLUMNE COUNTY

(Special Correspondence).—The Wickham mine, situated near Jeffersonville, has been bonded to Carlow & Hensley, of Sacramento, who will at once commence the further development of the property and install a 5-stamp mill.——At the Ida Klein mine, near Stent, work is confined to driving on the vein and stoping. The 3-stamp mill is in steady operation on high-grade ore from the north drift, where a shoot estimated to be 300 ft. long has been opened.——Sinking is progressing satisfactorily at the Mariana copper claim, situated near Chinese Camp, with indications steadily growing more favorable.——The Gold Crater Mining Co. is erecting a 10-stamp mill at its property on Knight's creek.

Tuolumne, May 28.

COLORADO

GUNNISON COUNTY

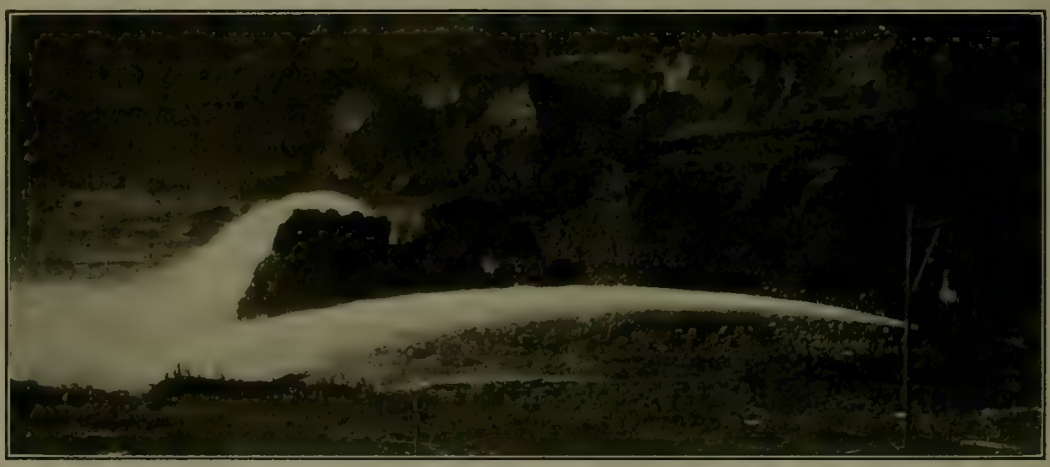
The melting of the snow in the Dorchester district the past month has made the roads almost impassable and greatly retarded mining operations in this vicinity. The water-power plant at the Enterprise mine has been completed and is now driving the compressor that furnishes the air for drilling, dynamos, and mill.——Work is to be resumed early this month in the North Star and Extension groups of Charles Hubbard.——A force of men has been started on the Mahlgren group and the high-grade lead ore will be shipped this summer.——The contract in the Pie Plant adit has been completed and a new one let that is thought will complete the work.——The Bonanza lead mine that was opened last season at the foot of Italian mountain has found a good grade of ore and will soon commence shipping.

LAKE COUNTY

The northern extension of the Cleveland fissure at Leadville has been opened in the Valley property and a 30-ft. shoot of gold ore found.——The Ibex mine is shipping about 7500 tons of ore per month which is being drawn from the four shafts on Breece hill.——The shoot has been opened on the third level of the St. Louis, showing the vein to be 5 ft. wide and to assay 1 oz. gold, 18 oz. silver, 24% zinc, and 16% lead.——Since starting operations on the Sliver property last fall the lessees have taken out over $35,000 worth of ore and have now opened a large body which will be worked through the Little Emma shaft as soon as connections can be made.——Work has been started on the Kennebec property and about 15 tons of ore per day is being hoisted.—— The new electric hoist at the Silent Friend is in good working order and active mining will be started on the lower levels as soon as they are drained by the bore-hole from the Yak tunnel.——Work has been started replacing the plant at the A. Y. and Minnie mine which was destroyed by fire a short time ago. For the present operations will be conducted through the pump-shaft at the foot of Iron hill in California gulch.——Frank Zaitz and associates have commenced work on the New Emmet property and are shipping about 25 tons of lead ore per day.——The Birdella adit which the Gleason Gulch Mining Co. is driving is now in over 700 ft., and is expected to open the President and Amity veins within the next 100 ft.——The Yankee Doodle mine on Carbonate hill is shipping from 25 to 30 tons of ore per day.

OURAY COUNTY

A long drill-hole has been run from the face of the deep adit that has been driven to tap the lower levels of the



Davis Hydraulic Mine, Siskiyou County.

Calliope mine near Ouray, and the old workings are being unwatered. Considerable ore has been taken from the mine and it is expected again to become a regular producer.——Fred Herzinger, who is operating the Black Girl mine, has blocked out a large amount of stoping ground and is shipping regularly.——Two cars of ore were shipped recently from the Wedge mine, which is under lease to F. M. Jackson.——A contract has been let to sink the shaft at the Brazilian Monitor 125 ft. and work resumed at that property.

SAN JUAN COUNTY

John Paul and John Rohave secured a lease on the tailing from the Gold King mill at Silverton and are erecting a small plant to treat the material, which assays from $6 to $8 per ton.——There is a large amount of ore in the bins at the Vermillion mine near Animas Forks and the mill that was erected last year will soon be started.

SUMMIT COUNTY

The St. Johns Mining Co. is regrading the road from the mine to Montezuma and will soon commence shipping ore. The old property is developed by several miles of workings and it is taking considerable labor to get the mine in good condition.——The Moctezuma Mines Development Co. has started the mill and is hauling the ore from the mine to the plant.——F. and J. W. Burke are working in the adit on the Deer creek side of Glacier mountain that will open their property 1000 ft. below the present workings of the mine.——The owners of the Ohio-Toledo have completed the mill building and are installing the new machinery. The main adit is being driven ahead and development carried forward on the veins already opened.

TELLER COUNTY

Stoping by the lessees of the Jennie Sample mine in the Cripple Creek district has been stopped temporarily to allow the company to re-timber the shaft which has been declared unsafe by the mine inspector of the district.——Schaeffer & Co., operating a lease on the second level of the Anchoria-Leland, have opened a shoot that assays between $25 and $30 per ton and are preparing to make a 35-ton shipment.——The lessees of the Eclipse group of Battle mountain have installed an electric hoist at the main shaft of the property and are unwatering the lower workings which have been filed to the 200-ft. station.——The Success Leasing Co. has purchased the sub-lease of the Union Leasing Co. on the Beacon claim for $500, and will install a hoist and compressor.——Buckmaster, Price & McIntyre, leasing the Home and J. J. L. claims of the Commonwealth Mining & Milling Co., opened a shoot of high-grade ore on the 300-ft. level and have commenced shipping.——The Blue Bird Mining Co. has resumed operations and will further develop the lower levels, opening them for lessees.——The Copper Mountain mill is reported running steadily and saving a higher percentage than has previously obtained. At present about 25 tons per day is treated, but this will shortly be increased to the full capacity of the plant. The ore treated is mined from both the surface deposit and the adit workings on the Fluorine mine and is estimated at about $4 per ton.

IDAHO

IDAHO COUNTY

Washington B. Van Delip, of New York, has secured a bond on the Mammonite group of W. F. Newton, and the Illinois of Smith Brothers in the Ten-Mile district. The claims are among those staked this spring between Big Leggett and Little Leggett creeks. The whole district is active and a train of 60 mules is kept busy packing in supplies from Grangeville.——The repairs to the dredge on Little Elk creek in the Elk City district have been completed and the machinery is running again.——New machinery has been ordered for the Crackerjack mine in the Hump district operated by the Mines Co., Ltd., and will be hauled to Stites as soon as the roads will permit of lower freight rates.

SHOSHONE COUNTY

The Caledonia Mining Co., operating in the Coeur d'Alene district, which paid its second monthly dividend, disbursing $13,000 at the rate of 1c. per share, on May 25, announces that 40 tons per day of crude ore is being sent to the smelters. The company paid a dividend of 2c. per share in April.

The Monarch mine has just shipped its first car of concentrate to the smelter at Bingham. The renovation of the mill on the property was completed a short time ago, and the machinery is running smoothly. The mill is to be enlarged, but for the present 10 cars of ore per month will be shipped. The mill's capacity is from 75 to 100 tons per day and this will be increased to 250 tons.——Stringers of rich galena have been cut in the lower adit of the Interstate mine, adjoining the Rex and Callahan properties in the Nine Mile canyon, six miles from Wallace.——Operations at the Paragon property in the Murray district will soon be resumed and the plant restored. The shaft house was demolished and its equipment scattered by a snowslide last winter. The house will be rebuilt and the machinery reinstalled. When the work is completed the property will be prospected with a diamond-drill from a point near the bottom of the shaft.

MONTANA

LINCOLN COUNTY

The Comet Placer Mining Co. has a force of men at work on the property on Cherry creek south of Libby preparing the mine for the season's run and sluicing will be started in a few days.——The board of directors of the Lincoln Gold Mining Co. at a recent meeting held in Spokane voted to add 15 stamps to the mill, making a total of 45 in the plant.

SILVERBOW COUNTY

From the statements for the year ended December 31, 1909, of the companies which will be included in the merger in the Butte camp under the ownership of the Anaconda Copper Mining Co., submitted in an application for the listing of the increased stock at New York, an approximate idea of the earning power of the stock may be gained. The following table shows the net profits and copper produced:

	Net profits.	Pounds copper produced.
Boston & Montana	$3,029,120	101,951,530
Anaconda	2,134,773	75,860,194
Washoe	1,732,673	80,559,625
Butte & Boston	751,712	20,955,910
Red Metal	566,988	34,654,971
Trenton Mining & Development	165,112	7,168,318
Big Blackfoot Milling Co.	191,724	.....
Diamond Coal & Coke	86,421	.....
Total	$8,658,523	301,150,368
Parrot Silver & Copper (loss)	132,965	5,407,255
Alice Gold & Silver (loss)	6,411	.....
Total loss	139,376	5,407,255
Net results	$8,519,147	306,557,623

The outstanding capital stock of the Anaconda Copper Mining Co., after all the merger exchanges shall have been made, will amount to 4,220,000 shares, of a par value of $25 per share, making a total par value of $105,500,000.

NEVADA

CLARK COUNTY

The orebody on the 400-ft. level of the Nevada Eagle mine in the Eldorado district has been cut for 22 ft., showing it to have an average value of $12 per ton. Arrangements have been completed for the installation of a mill, and the plant will probably be in full operation this fall.——At the Rich Hill property the company has started grading for a 10-stamp mill and concentrating plant. This will be operated in connection with the Nelson smelter, which is owned by this company and will treat custom ore.——The Capital Mines Co. has cross-cut to the vein on the 200-ft. level and opened a large body of sulphide ore. A 50-hp. hoist is to be installed at once and plans drawn for a 10-stamp mill. The company is now shipping ore in 10-ton lots to the Needle smelter.——The Success Mining Co. has purchased the Doly mill, installed in the Eldorado camp

near the Colorado river 25 years ago, and will place it on the June Bug claim.——On the Truax & Martin both shafts are in ore, samples from which assay from $30 to $70 per ton.——It is reported that the Occidental mine, which is equipped with a 35-ton Bryan mill, is to be worked in the near future.——The Sphinx, which has been idle for the past two months, has again resumed operations and the shaft will be sunk from the 200 to the 500-ft. level.——Work has been resumed on the Little Black Hawk property, which has been idle for over two years.

ELKO COUNTY

The adit of the Jarbidge-Pavlak company, operating at Jarbidge, cut the Taft vein at a depth of 150 ft., opening stringers of high-grade ore. The adit will be driven 400 ft. additional to tap the Pavlak vein.——The shaft of the Pick & Shovel is now 50 ft. on the hanging wall of the vein. W. W. Scott is superintendent.——Frank C. Williams, manager for the St. Lawrence Mining Co. at Shoshone, and J. L. Simpson, of Ely, have secured a five-year lease and bond on the claims of Mrs. D. A. Algens in the Lucin district. The mine has a production record of over $500,000, though it has been idle for the past 25 years. The old workings are being cleaned out and new machinery will be installed, when shipments will be started to the smelters.

ESMERALDA COUNTY

There is considerable work going on in the Cuprite district 14 miles south of Goldfield after an idle period of about two years. The owners of the Kerigan-Smith-Evans property have purchased an 18-hp. hoist and will sink the shaft from the 110-ft. point to the 400. W. S. Evans is manager. The sulphur deposits at Cuprite will soon be extensively developed. Ellsworth Oldt and associates, who have large holdings in the sulphur belt, are now completing negotiations for the erection of a refinery, and it is likely that within a few weeks work of construction of the first unit of the refinery will be started.——The directors of the Goldfield Consolidated Mines Co. held their regular quarterly meeting at Goldfield May 26 and declared the regular quarterly dividend of 30c. per share with an extra dividend of 20c. per share payable July 31 to stockholders of record June 30. The total disbursement of 50c. per share will amount to $1,779,549 and is the third consecutive dividend that has been declared in like amount. The underground work of the company is in excellent shape and the entire mill is expected to be in operation early this month.——The old Victor shaft on the C. O. D. Consolidated property is being put in shape for active work, and operations will soon be started under the direction of L. D. Koontz. Steady development is in progress on the Gray lease on the Gold Bar claim of the C. O. D., and although no shipments are being made at present it is expected that the increased work will open some good shipping ore.——The west drift on the 700-ft. level of the Yellow Tiger is now out 300 ft., the face being in a hard silicified dacite. It is expected to open the shoot on which a winze was sunk from the 600-ft. level in a short distance.

LYON COUNTY

Extensive changes are planned for the Nevada-Douglas by the officials of that company. A new compressor plant will be installed, a new transformer house built, and an electric-power line run to the Ludwig mine. A new ore-bin will be added to the one now in use, doubling the present capacity. The two bins will hold 700 tons of ore. A tramway 1600 ft. in length will be put in, running from the top of Douglas Hill to the railroad, the difference in elevation between the top of the hill and the end of the tramway at the railroad being 600 ft. In addition to the surface improvements the company contemplates extensive changes underground, and before fall at least 40 men will be put on development work. At the present time the company has 625,000 tons of ore, which will average 5½% copper, blocked out ready for extraction, and it is expected that this tonnage will be doubled before the smelter is blown in. The company also will begin at once the development of its gypsum beds, so as to start shipments as soon as the railroad reaches the mine.——A hoist is to be installed on the Bluestone Extension and active work resumed on the claims.

NYE COUNTY

(Special Correspondence).—The new vein in the Belmont is 12 ft. wide and has been followed about 16 ft. by the shaft, showing the ore to be of good milling grade. The Belmont 60-stamp mill at Millers has been started and 220 tons per day will be milled, while small shipments of high-grade quartz will be made to the smelters.——Herman Zadig and associates of San Francisco have re-incorporated the Tonopah Rescue Co. and are arranging to resume work.——The long delayed machinery for the 100-ton mill of the Bonnie Clare Mining Co. has arrived and will be installed immediately.——The Bullfrog-Mohawk is installing a plunger pump with a capacity of 2500 gal. per hour and will sink the shaft to the 500-ft. level. The pump will be operated by a 20-hp. gasoline engine.——The management of the Johnnie Consolidated reports a profit of $7340 for the three months of February, March, and April. During this time 6114 tons of ore were treated. Total costs of mining and milling are from $3.85 to $4.35 per ton, while the average recovery from ore milled is $6.09. The output for May has been slightly increased, while the installation of the new Lane mill will result in a further gain in June. The shaft is being sunk to the 800-ft. level.

Tonopah, May 28.

The Round Mountain Mining Co., at its office in Goldfield, declared its ninth consecutive dividend of 4c. per share, amounting to $34,650, on May 25, making the total dividends $293,733. This is payable on June 25 to stockholders of record on the books of the corporation June 20. The new vertical shaft going down 900 ft. east of the main works is said to be in pay-ore to its present depth of 130 ft., and it is expected that this condition will continue to at least 200 ft. This new work will open up an entirely new country, and will furnish a large tonnage to the mill. The present capacity is steadily maintained at about 130 tons per day, but this is to be increased to 150, which will for the immediate present be the limit.——There are 1000 tons of ore on the dump of the Swanson-Ross-Lyon lease on the Earl mine at Manhattan which will be treated in one of the local mills at an early date. The shaft is now down 200 ft. on the vein and it is the intention of the lessees to continue sinking several hundred feet farther.

STOREY COUNTY

The lowering of the water at the C. & C. shaft is the chief point of interest in the work on the Comstock Lode, and excellent progress is being made, several sections of the column and rods of the old Cornish pumping system having been taken out. The shaft has now been practically cleaned out to the present water-level, which is approximately 175 ft. below the 2350-ft. station. The timbers in the shaft below the 2450 to this point are in a fine state of preservation.——In the Ophir and Consolidated Virginia mines there are no important new developments this week. In Consolidated Virginia the taking up of the water will allow prospecting work in the deep levels, but no new work has yet been started. Stoping of ore from the 1750 and 1800-ft. levels continues, and Ophir is shipping ore to Kinkead's mill. In the latter mine no changes are reported from the 2300 or 2400-ft. levels.——At the Mexican mine the operations for the past few weeks have been dead work, it being necessary to do considerable timbering in the workings on the west vein on the 2300-ft. level. On the 2400-ft. level the west cross-cut from the winze-station is being continued and is in vein material. In the winze the additional pump has been installed on the 2200-ft. level, which is easily taking care of the small flow of water above this.——At the Ward shaft work has been started setting up one of the three new pumps to be installed on the 2100-ft. pump-station, the first one being placed at the west end of the station.——The pumping plant at the Monte Cristo is doing excellent work and has lowered the water in the shaft from 15 to 20 ft. There is a big territory to drain and progress is slow.

WHITE PINE COUNTY

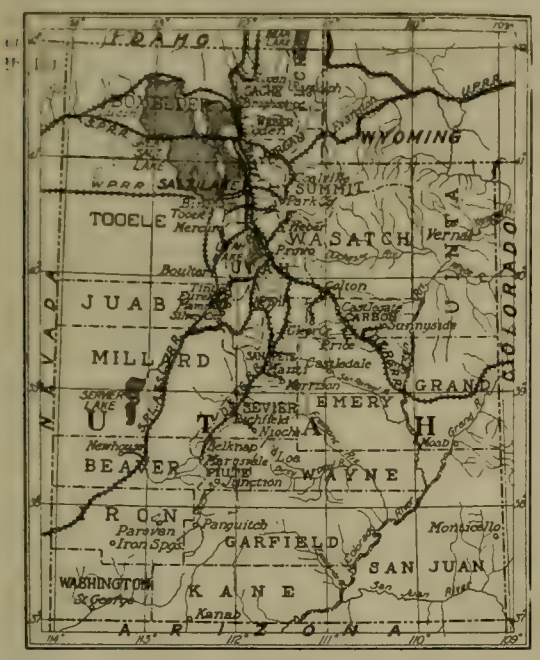
The work of grading for the new 10-stamp mill which will be erected at the Willow Patch near Osceola for the Amalgamated Nevada Mines & Power Co., has been started

by the Traylor Engineering Co., which has a contract for the work. Most of the machinery has been delivered at the mine and the rest is at the East Ely depot and will be hauled to the property at once. A small force of men has been started in the San Pedro mine, and if the supply from this property is not found sufficient to keep the mill busy, operations will be started at the Mable and other holdings of the company. - - A cross-cut from the main adit at the old Cornell mine near Hamilton, operated by A. B. Witcher and Charles Minnoletti, of Ely, opened a body of lead silver ore that assayed over 25 oz. silver per ton. A drift has been started along the orebody and shipments will be started as soon as a stope can be opened. - - O. E. Turner, president of the Ely Central Copper Co., is the moving spirit in the organization of the Huebnerite Tungsten Co., which was recently incorporated. The new corporation, which will develop a group of tungsten properties about 12 miles southeast of Osceola, is capitalized for $100,000, divided in shares of the par value of $1 each.

UTAH

BEAVER COUNTY

After several weeks of preparatory work two diamond drills have been installed in the Black Bird mine and the ground will be thoroughly prospected.——Two cars of silver-lead ore were shipped a few days ago from the Cedar-Talisman and a shipment of zinc is soon to be forwarded. The new orebody has been proved from the 125 to the 500-ft. level, and on the 500 the drift has been driven 500 ft. showing the vein to contain five feet of shipping ore and two of milling.——The drifts on the 300-ft. level of the Rob Roy are opening a 30-ft. vein in which some excellent ore has been found. There is a mill on the property but no ore has been treated recently as the company has not been able to develop a shoot of any length, the ore being rich but patchy.



Map of Utah.

IRON COUNTY

At Gold Springs the differences between the Western Electric Co. and the Gold Springs M. & P. Co., which resulted in the application for a receiver for the latter, have been adjusted out of court, and the power-plant of the Gold Springs company will be ready to go into commission before long. The motors and compressor at the mine are being installed.

WASHINGTON

FERRY COUNTY

The Pacific Ore Reduction Co., of which E. R. Davidson is president and general manager, has broken ground for a 100 ton cyanide mill at Republic, where custom ore from the district will be treated. The schedule of charges ranges from $3 to $4.50 per ton, according to the grade of ore, and settlements will be made on delivery, on the assay value of each lot. Contracts for tonnage already have been signed by a dozen producers. The equipment will consist of rock crushers, Chilean mills, four 25 ton cyanide tanks, and an air compressor. Tests show that the best extraction is obtained by crushing to a fineness of 80 mesh and subjecting the pulp to treatment by a mild solution of cyanide from 8 to 24 hours.

MEXICO

OAXACA

(Special Correspondence).- The passenger and freight trains are now running regularly in the Taviche camp. With the advent of the train, and the re-opening of the San Juan mine under American management, there is a general improvement with various other properties in this district. Some properties which have been closed down for two years are now getting ready to resume development work.——Malcolm McLeish, of Denver, has during the past week, made a contract to treat the tailing of the Los Reyes mill, by cyanide process. J. G. Gray, receiver of the Los Reyes properties, has been making an examination of the company's interests, with a view to resuming work.——Frank W. Leonard has sold a one-fifth interest in the San Martin mine for $100,000. The purchasers are Canadian capitalists, and in connection with Mr. Leonard expect to operate the property along modern lines.——A railroad concession has been granted by the Government to the Oaxaca Coal & Iron Co., for a road from Puebla, through the Oaxaca coalfields in the Tlaxiaco district, to the west coast near Salina Cruz. The road will open territory, both mineral and agricultural, heretofore practically unexplored.

Within the past month there has been organized in Wichita Falls, Texas, the Wichita Falls Mexico Mining Co., with a capital of $750,000 United States currency. The company is composed of leading business men of Wichita Falls, who have already bought the Santa Rosa and Nevada claims in the Nochistlan district. J. A. Morris, who is also manager for the Georgia Mexico Mining Co., operating a mill in the same district, will have charge of the initial work.——N. O. S. Ford is making an examination of the Taviche camp, for a proposed custom mill to be installed at Santa Inez.——The first payment has been made on the proposed hydro-electric plant, which will utilize the waters of the Tomellin canyon, for supplying Oaxaca and neighboring camps with electric power. The plan includes the acquiring of the local lighting and power-plant and the electrification of the local street car lines.

Oaxaca, May 25.

SONORA

(Special Correspondence).—Frank J. Nichols, of Douglas and Clifford Robertson, of El Paso, who have an option on the Agua Buena mine, are dewatering it preparatory to examination by Kansas City and Chicago capitalists. The mine is situated 18 miles south of Nacozari.——Two hundred sacks of ore have been shipped this week from the gold property of Herbert Walters in the Barigon goldfield near Nacozari. This is a new district where rich gold quartz was discovered only three months ago. Another mine in this district is that owned by the Montenegro Mining Co., the Mexican holding company of the Barigon Mining Co. This property is about five and a half miles northwest of Nacozari, and has been opened by 4000 ft. of development work.——The Transvaal Mining Co., operating west of Cumpas, will not smelt any ore at its little smelter till the Southern Pacific railroad is extended from Nacozari to Cumpas. Most of the grading and cut work is now completed on this extension.——A. J. King and associates have now completed repairing the wagon-road from the El Tigre road to the Cinco de Mayo and Roy mines in the El Tigre district. The old mill at the Roy mine has been repaired and put into operation, and about 1400 oz. of silver concentrate is now ready for shipment to El Paso.

Nacozari, May 28.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

GAS AND OIL LEASE—CONSTRUCTION

A lease granted to the lessee the right to produce oil and gas from certain lands for ten years with the exclusive right to drill and operate oil and gas wells, to lay and operate pipe-lines, with the necessary right of way over the premises, and a sufficient quantity of lands to preserve the products, and that when oil or gas should be found in paying products the lessor would extend the lease from year to year so long as such production continued and limited the lessee's use to so much of the land as might be necessary for the purposes named. In a controversy over the lease as to the exclusive use of the land, the lease was construed to give no general or exclusive right to lay and operate pipe-lines, but only sufficient rights in that respect to enable the lessee to carry out the main object of producing and removing oil and gas, and that a subsequent permission by the lessor to a third person to construct a pipe-line across such leased land to conduct oil from other lands to market was not adverse to the rights of the lessee in the land, until the lessee began to use the part of the land through which the leased pipe-line ran and until his use of that part of the land became incompatible with the maintenance of the other pipe-line.

Brookshire Oil Co. *v.* Casmalia Ranch Oil & Dev. Co., (Cal.) 103 Pac. 927, Aug. '09.

LOCATION OF PLACER MINING CLAIM

Mining claims are not opened to re-location until the rights of a former locator have come to an end, and two locations cannot legally occupy the same space at the same time. In the location of placer mines, the surface is the thing located, and the position of the surface is absolutely essential to the mining operation. A valid mining location although unpatented is a grant and the estate enjoyed is in the nature of an estate in fee, and it is an appropriation of land by the locator to the exclusion of all others. There is no reason why a junior locator of a placer claim cannot lay his lines across a claim already located. But the rule is that an association placer mining claim cannot be located over other prior claims so as to include within its boundaries and to appropriate a number of unlocated and noncontiguous fractions lying between such prior claim.

Stengfeld *v.* Espe, 171 Fed. 825, May '09.

INJUNCTION TO PREVENT REMOVAL OF MINERALS

A court of equity enjoined the removal of iron ore by a person who had no right thereto, in order to prevent irreparable injury, though the owner himself was not in actual possession of the ore when the suit was commenced. And in such an action where the court had jurisdiction, and in order to do complete justice and prevent irreparable injury, it could settle the title to the ore.

Morrison *v.* American Assn. (Va.) 65 S. E. 469 Sept. '09.

CONVEYANCE OF MINERALS

A deed conveying without reserve all the iron ore under the land described to the grantee and his heirs and assigns forever, without any suggestion that the title should in any event revert to the grantor, was sufficient to pass a fee simple to the ore and not merely a license to operate the mine.

Morrison *v.* American Assn. (Va.) 65 S. E. 469, Sept. '09.

RE-LOCATION OF MINING CLAIM—EFFECT

Persons who asserted rights to a mining claim as re-locators on the theory that the claim had been forfeited for failure to perform the required assessment work, were held to have recognized as re-locators the prior location, which became forfeited by the re-location.

Golden *v.* Murphy (Nev.) 103 Pac. 394, July '09.

Company Reports

UNITED STATES SMELTING, REFINING & MINING

The fourth annual report of the United States, Smelting, Refining & Mining Co. shows a profit for 1909 of $3,136,360, compared with $3,017,947 in the previous year. Out of the earnings has been paid a U. S. Smelting preferred dividend of $1,700,693 and a dividend on common stock of $701,961. The output of metals was as follows:

	1909.	1908.	1907.
Copper, lb.	36,672,606	32,803,603	38,518,378
Lead, lb.	41,627,995	27,304,347	53,617,324
Silver, oz.	9,637,119	8,340,566	6,739,269
Gold, oz.	128,393	128,208	235,822

The percentage of value of each metal and the average price received in 1909 and 1908 were:

	1909		1908	
	Per cent value.	Price received.	Per cent value.	Price received.
Copper	33.81	13.006c. lb.	34.5	13.27c. lb.
Lead	12.58	4.297c. lb.	10.0	4.23c. lb.
Silver	35.06	51.969c. oz.	34.5	52.97c. oz.
Gold	18.55	.....	21.0	....

The total ore product from the Centennial-Eureka, Mammoth, and the United States mines at Bingham, and the Mexican mines, was 69,771 tons, yielding money values in the proportion of 42% copper, 5 lead, 35 silver, and 18 gold. The financial position of the company is shown in the appended balance sheet struck on December 31, 1909:

ASSETS

	1909.	1908.
Cost of properties	$40,518,486	$39,879,357
Deferred charges and operation	139,106	50,546
Ores and matte	781,863	666,321
Supplies, fuel, and timber	981,510	981,329
Metals in process and in transit	6,279,822	5,315,433
Notes receivable	865,360	628,489
Accounts receivable	703,418	970,795
Cash	1,807,238	1,329,724
Total	$52,076,807	$49,821,997

LIABILITIES

Common stock	$17,549,350	$17,549,125
Preferred stock	24,300,012	24,299,175
Capital of subsidiary companies not held by company	1,055,574	1,056,228
Debentures of sub-companies	.....	500,000
Bills payable	3,428,781	2,267,175
Current accounts payable	1,160,202	1,092,801
Drafts in transit	127,805	80,000
Reserves for freight, ref'g, etc.	463,608	371,697
Dividends declared not yet paid	600,793	600,717
Depreciation funds	1,599,389	973,450
Undivided surplus for stock sub-companies not owned	76,058	43,925
Profit and loss surplus	1,715,230	987,704
Total	$52,076,807	$49,821,997

The $500,000 6% debentures of the United States Mining Co. which matured May 1909 were paid at maturity. At the Midvale smelter in Utah the construction of the bag-house for filtering the smelter fume was completed during the year and the cost charged to capital account. At the Chrome refinery, New Jersey, a valuable tract of real estate adjoining the refinery lands was purchased. An adequate provision has been made out of earnings for the examination and exploration of new property. During the past year a smelter at Needles, California, and some promising mining territory near Kingman, Arizona, tributary to this plant, were purchased, as well as some other properties at present of minor importance. On December 1, 1909, Sidney J. Jennings was elected vice-president in charge of exploration and mining investment, and he is now actively in charge of this department.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends

Lewis Hind has gone to Sonora.

E. A. Sperry was in San Francisco.

A. D. Geiger has returned to Boston.

Courtenay De Kalb is at Grass Valley

H. D. McCaskey is expected at San Francisco.

W. M. Knox has gone to Minas Geraes, Brazil.

C. H. Munro has gone to Nome for the season.

C. W. Purington sailed for Yokahama on the *Tenyo Maru* May 31.

A. H. Eeftman was in San Francisco but left for Chicago and the East.

Clarence C. Semple has returned from Nicaragua, and is in San Francisco.

S. F. Emmons has gone to Dinard, France. He will remain abroad until October.

H. G. Hahn, recently with the Camp Bird, Ltd., has gone to Siberia with C. W. Purington.

C. T. Law, of Law & Wichman, Salt Lake, is on his way to Alaska on professional business.

W. J. Rickell has removed from Mina, Nevada, to Los Angeles, where he will open an assay office.

C. H. Clapp is making geological surveys on Vancouver Island for the Canadian Geological Survey.

Theodore Gross, resident manager for the Hirsch Syndicate, Ltd., has returned to New York from London.

Earl R. Pembroke, of Salt Lake, is superintendent of the Mt. Gaines mine at Hornitos, Mariposa county, California.

F. M. Wiehman has been appointed general superintendent for the Bingham-New Haven mine at Bingham, Utah.

Jacob Hasslacher, president of the Roessler & Hasslacher Chemical Co., of New York, is in San Francisco.

James W. Neill was in San Francisco. He has become managing director of the Mt. Gaines mine, Hornitos, California.

R. H. Chapman is in charge of topographic surveys in British Columbia this season. His address is Vancouver, British Columbia.

William R. Jewell has become consulting geologist to the Globe Exploration Co., operating in the Sunset, Midway, and Coalinga oilfields.

R. A. F. Penrose, Jr., has been appointed as delegate from the Philadelphia Academy of Natural Science to the International Geological Congress at Stockholm.

George F. Powell, manager for the El Tajo Mining Co., of Poza, Sonora, Mexico, has been in San Francisco and Denver investigating machinery for a new mill to be built at its mines.

Commencement at the School of Mines and Metallurgy of the University of Missouri, was held at Rolla, June 1.

OBITUARY

James Arthur Diggles, who died recently in New South Wales, was a graduate of Stanford University in 1895. After considerable experience in California he joined the staff of Bewick, Moreing & Co., and has for some years, been managing silver mines at Broken Hill. His death was due to heart failure following typhoid from which he had seemed to be recovering.

S. Pearson & Son, Ltd., the firm which has been in a bitter warfare in Mexico with the Waters-Pierce Oil Co., which is stated to have cost the Pearson interests $10,000,000, is soliciting subscriptions in London to the Mexican Eagle Oil Co., capitalized for ₱30,000,000. This company, although only two years old, has established over 150 distributing depots and agencies throughout Mexico, and at present is constructing a pipe-line 60 miles long to connect its oilfields with shipping points.

Metal Prices

LOCAL METAL PRICES

San Francisco, June 2.

Antimony	12—13½c	Quicksilver (flask)	47½—48½
Electrolytic Copper	13½—13¾c	Spelter	7 7¼c
Pig Lead	4.70—5.05c	Tin	39¼—39¾c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
May 26	12.63	4.33	5.14	53⅝
" 27	12.63	4.33	5.11	53⅝
" 28	12.63	4.33	5.11	53⅝
" 29	Sunday.	No market.		
" 30	Holiday.	No market.		
" 31	12.69	4.33	5.09	53⅜
June 1	12.69	4.33	5.10	53⅜

Joplin Lead and Zinc Prices

The *News-Herald* figures for the week ending May 28, 1910, are as follows:

Zinc blende sold for as high as $43.50, basis of 60%, but the prevailing sales were made on prices ranging from $40 to $43. The top price for choice lots was $46 a ton, while the average price was $40.95, compared to $41.39 of the previous week.

Spelter was weaker than for the previous week, the close being quoted Saturday at $5.17½, compared to $5.20 of the previous week.

Calamine was unchanged at $20 to $24 basis of 40% grades, with a top price of $26, and an average price of $25.51, compared to $22.52 of the previous week.

Lead prices, both for ore and metal, were little changed. The prevailing offerings for ore were $48 a ton, the average paid being $47.82, compared to $48.68 of the previous week. Pig lead was stronger at $4.25, compared to $4.20 of the previous week.

Below are given the value of shipments from each district with a summary for the district, in pounds and total values:

Joplin: Blende, $32,760; calamine, $195; lead, $2600. Total, $36,555.

Webb City-Cartersville: Blende, $58,548; lead, $16,224. Total, $74,772.

Galena: Blende, $24,805; lead, $1488. Total, $26,293.

Granby: Blende, $5645; calamine, $4675; lead, $325. Total, $10,645.

Duenweg: Blende, $23,856; calamine, $806; lead, $528. Total, $25,190.

Miami: Blende, $20,615; lead, $3120. Total, $23,735.

Aurora: Blende, $832; calamine, $819; lead, $96. Total, $1747.

Alba-Neck City: Blende, $17,114.

Zincite: Blende, $1302.

Badger-Peacock: Blende, $10,619; lead, $47. Total, $10,666.

Oronogo: Blende, $23,555; lead, $58. Total, $23,613.

Carthage: Blende, $3990; calamine, $585. Total, $4575.

Stotts City: Blende, $2400.

Carl Junction: Blende, $4171.

Quapaw: Blende, $1680.

Sarcoxie: Blende, $4480.

Spring City: Blende, $1453; calamine, $598; lead, $240. Total, $2291.

Cave Springs: Blende, $288.

Summary for the district: Blende, 11,614,845 lb.; calamine, 594,970 lb.; lead, 1,087,790 lb. Values: Blende, $237,825; calamine, $7678; lead, $26,014. Total, $271,517.

Total for 22 weeks: Blende, 224,242,200 lb.; calamine, 18,361,230 lb.; lead, 35,869,445 lb. Values: Blende, $4,739,825; calamine, $231,203; lead, $944,849. Total, $5,915,877.

The Associated Oil Co. last year produced 7,114,796 bbl. a portion of which it consumed for its own use. Its gross income for the year, both from sales of oil and its interest in transportation, pipe-lines, and other companies was $15,000,000.

Market Reports

ANGLO-AMERICAN SHARES.
Cabled from London.

	May 26. £ s. d.	June 1. £ s. d.	
Camp Bird	1 9 6	1 8 6	ex div.
El Oro	1 7 3	1 6 9	
Esperanza	2 14 9	2 13 9	
Dolores	1 8 9	1 8 9	
Oroville Dredging	0 9 4½	0 9 4½	
Mexico Mines	8 11 3	8 8 9	
Tomboy	0 19 3	0 19 3	

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, June 2.		Closing prices, June 2.
Adventure	5¾	Mohawk	49
Allouez	43	North Butte	31¾
Atlantic	7	Old Dominion	35
Calumet & Arizona	63	Osceola	135
Calumet & Hecla	560	Parrot	15
Centennial	16	Santa Fe	1⅞
Copper Range	66¼	Shannon	10½
Daly West	8	Superior & Pittsburg	11⅜
Franklin	12¼	Tamarack	50
Granby	39	Trinity	57⅛
Greene-Cananea, ctf.	8¼	Utah Con	22
Isle Royale	20¾	Victoria	3
La Salle	11½	Winona	7¼
Mass Copper	6¾	Wolverine	116

(By courtesy of J. C. Wilson, Mills Building.)

MINING STOCK QUOTATIONS—NEW YORK.
(By wire from Catlin & Powell Co., New York.)

	Closing prices, June 1.		Closing prices, June 1.
Amalgamated Copper	67⅛	Miami Copper	21⅜
A. S. & R. Co.	76¾	Mines Co. of America	9/16
Boston Copper	18⅜	Montgomery-Shoshone	⅝
B. C. Copper Co.	5⅝	Nevada Con.	19⅝
Butte Coalition	19	Nevada Utah	1
Chino	11⅞	Nipissing	10⅞
Davis-Daly	1¾	Ohio Copper	2⅜
Dolores	6¼	Ray Central	2⅝
El Rayo	3½	Ray Con.	18
Ely Central	¾	South Utah	1¾
First National	3⅞	Superior & Pittsburg	11½
Giroux	6¾	Tenn. Copper	26
Guanajuato Con	1	Trinity	6
Inspiration	7	Tuolumne Copper	3¼
Kerr Lake	8⅜	United Copper	6
La Rose	4⅝	Utah Copper	44
Mason Valley	7¾	Yukon Gold	4¼

SOUTHERN NEVADA STOCKS.
San Francisco, June 2.

Atlanta	$ 13	Mayflower	$ 3
Belmont	3.75	Midway	29
Booth	13	Montana Tonopah	34
Columbia Mtn	6	Nevada Hills	85
Combination Fraction	52	Pittsburg Silver Peak	69
Daisy	6	Rawhide Coalition	27
Fairview Eagle	15	Rawhide Queen	32
Florence	2.30	Round Mountain	57
Goldfield Con	8.45	Sandstorm	4
Gold Kewenas	6	Silver Pick	6
Great Bend	8	St. Ives	12
Jim Butler	31	Tonopah Extension	99
Jumbo Extension	21	Tonopah of Nevada	8.60
MacNamara	27	West End	66

(By courtesy of San Francisco Stock Exchange.)

COMSTOCKS.
San Francisco, June 2.

Alpha	$ 6	Justice	$ 14
Alta	15	Kentuck	14
Andes	14	Mexican	1.07½
Belcher	70	New York Con.	7
Bullion	17	N. G. & Curry	25
Brunswick Cholla	4	Occidental	25
Brunswick Potosi	4	Ophir	1.00
Caledonia	47	Overman	85
Challenge Con.	30	Potosi	40
Chollar	14	Savage	23
Confidence	75	Scorpion	6
Con. Imperial	6	Seg. Belcher	19
Con. Virginia	98	Sierra Nevada	19
Crown Point	70	Silver Hill	13
Exchequer	22	St. Louis	5
Gould & Curry	19	Union	19
Hale & Norcross	32	Utah	6
Julia	13	Yellow Jacket	75

(By courtesy of San Francisco Stock Exchange.)

OIL SHARES.
San Francisco, June 2.

Alma	$ 1.00	Palmer	$ 1.45
Apollo	10	Paraffine	1.25
Associated Oil	53.75	Peerless	6.00
Bay City	2.40	Pinal	9 75
Blue Moon	30	Premier	1.20
Brookshire	1.77	Record	6.00
Claremont	1.80	Republic	50
Del Ray	16	S. F. & McK.	20.00
De Luxe	1.85	Sauer Dough	2.00
Enos	1.52	Section 25	26.00
Four	12	Seanon	8.00
Fulton	1.25	Silver Tip	2.80
Illinois Crude	50	S. W. & B.	51
Junction	75	Sterling	2.75
McKittrick	21	Turner	1.90
Monte Cristo	3.20	Wolverine	40
Nevada Midway	21	W. K. Oil	3.15

(By courtesy of San Francisco Stock Exchange.)

Current Prices for Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, 100 lb.	$0.90	$1.25
Acid, sulphuric, com'l, 66°, carboy, 100 lb.	1.00	1.50
Acid, sulphuric, C.P., 9-lb. bottle, bbl., lb.	0.13	0.18
Acid, sulphuric, C.P., bulk, carboy, lb.	0.09½	0.12
Acid, muriatic, com'l, carboy, 100 lb.	1.70	2.00
Acid, muriatic, C.P., 6-lb. bottle, bbl., lb.	0.15	0.20
Acid, muriatic, C.P., bulk, carboy, lb.	0.10½	0.15
Acid, nitric, com'l, carboy, 100 lb.	5.25	6.50
Acid, nitric, C.P., 7-lb. bottle, bbl., lb.	0.16	0.22
Acid, nitric, C.P., bulk, carboy, lb.	0.12½	0.15
Argols, ground, bbl, lb.	0.20	0.25
Borax, cryst. and conc., bags, 100 lb.	2.75	3.85
Borax, powdered, bbl., 100 lb.	3.00	4.00
Borax glass, ground, 30 mesh, kegs, 100 lb.	10.00	13.00
Bone ash, 60 to 80 mesh, bbl., 100 lb.	4.50	5.50
Bromine, 1-lb. bottle, lb.	0.55	0.65
Candles, adamantine, 12 oz., 40 sets to case.	3.50	4.15
Candles, adamantine, 14 oz., 40 sets to case.	4.00	4.55
Candles, Stearic, 12 oz, 40 sets to case.	4.95	5.50
Candles, Stearic, 14 oz., 40 sets to case.	4.65	5.20
Clay, fire, sack, 100 lb.	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, lb.	0.20¾	0.24¾
Cyanide, 98 to 100%, 200-lb. case, lb.	0.20	0.24
Cyanide, 125 to 127%, 100-lb. case, lb.	0.27½	0.28½
Cyanide, 125 to 127%, 200-lb. case, lb.	0.26¾	0.27½
Lead acetate, brown, broken casks, 100 lb.	9.00	9.25
Lead acetate, white, broken casks, 100 lb.	10.25	10.50
Lead acetate, white, crystals, 100 lb.	12.00	12.50
Lead, C. P., test., gran., 100 lb.	13.00	15.00
Lead, C.P., sheet, 100 lb.	15.00	18.00
Litharge, C.P., silver free, 100 lb.	11.50	13.00
Litharge, com'l, 100 lb.	6.50	7.50
Manganese ox., blk., dom. in bags, ton.	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ton. (85% MnO_2—¾% Fe)	45.00	50.00
Mercury, 75-lb. flask	48.00	49.00
Nitre, double ref'd, small cryst, bbl., 100 lb.	7.00	8.00
Nitre, double ref'd, granular, bbl., 100 lb.	6.50	7.50
Nitre, double ref'd, powdered, bbl., 100 lb.	7.25	8.25
Potassium bicarbonate, cryst., 100 lb.	12.00	15.00
Potassium carbonate, calcined, 100 lb.	15.00	18.00
Potassium permanganate, drum, lb.	0.11	0.12½
Silica, powdered, bags, lb.	0.03	0.05
Soda, carbonate (ash), bbl., 100 lb.	1.50	1.75
Soda, bicarbonate, bbl., 100 lb.	2.00	2.50
Soda, caustic, ground, 98%, bbl., 100 lb.	3.00	3.50
Soda, caustic, solid, 98%, bbl., 100 lb.	2.65	2.85
Zinc dust, 1400-lb. casks, 100 lb.	8.50	9.50
Zinc shavings, 800 fine, bbl., 100 lb.	10.50	11.50
Zinc sheet, No. 9—18 by 84, drum, 100 lb.	9.50	10.50

Publications Received

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

PRODUCER GAS FIRED FURNACES. By Oskar Nagel. Pp. 192, ill., 237, index. Published by the author, New York, 1910. Price $2.

A good popular exposition of the principles and practice of producer gas manufacture, and its applications, has been needed. Mr. Nagel has supplied the want. He has written a quite elaborate treatise, and his presentation of the subject is sound. All the leading producers, American and foreign, are illustrated and described. The details of construction of gas mains and accessory operations are given, after which comes an excellent chapter on conditions for the economic combustion of producer gas. The application in specific cases is taken up with thoroughness, accompanied by useful illustration. The list covers the chemical industries, metal industries, including the many applications to iron and steel manufacture; also lime and cement, glass, brick, and pottery. The present methods of purification of gas are described, but not as fully as might be desired. The chapter on refractory materials is also deficient in this regard, though containing much practical and suggestive comment. The book is one well worth careful perusal by anyone having to use producer gas.

THE MEXICAN POCKET LAWYER. Compiled by A. E. Ulloa. Pp. 209, index. A. Stein, Mexico, 1910. Price $1.25.

This little volume, small enough to be carried in the coat pocket, contains, in English, the recent fundamental laws of Mexico on patents, corporations, trade-marks, the new stamp law, mining law and regulations, and forms of documents, in Spanish, covering the following cases: applications for patent, registration of trade-mark, and for mining claims, power of attorney to obtain a patent, and the same for trade-mark. There are included the tariff of fees of mining agents, for collection of assay and melting dues, and conversion tables for weights and measures. It is an extremely convenient compendium, and should prove useful to all who require such information in English.

COPPER. By L. C. Graton, H. S. Gale, and G. W. Stose, U. S. Geol. Surv., Bull. 430-B. Pp. 65. Washington, 1910.

Advance pages from 'Contributions to Economic Geology', 1909, and including 'The Occurrence of Copper in Shasta County, California', by L. C. Graton; 'Geology of the Copper Deposits near Montpelier, Bear Lake county, Idaho', by H. S. Gale; 'The Copper Deposits of South Mountain in southern Pennsylvania', by G. W. Stose.

MINERAL PRODUCTION OF CANADA, 1907 and 1908. By John McLeish. Am. Rept. Div. Min. Res. & Statistics. Pp. 286. Dept. Mines, Mines Branch. Ottawa, 1910. Price 15 cents.

The usual review of mineral production with notes on production and consumption. An indispensable handbook for those interested in the Canadian mineral industry.

SURFACE WATER SUPPLY OF THE UNITED STATES. Part I. North Atlantic Coast. By H. K. Barrows and R. H. Bolster. U. S. Geol. Surv. Water Supply Paper, 241. Pp. 346, ill., index. Washington, 1910.

Methods and results of stream gauging.

REPORT OF THE BUREAU OF LABOR STATISTICS, ILLINOIS, 1908. By David Ross. Pp. 592. Springfield, 1910.

Containing full statistics regarding production of coal in the State.

DEPARTMENT OF GEOLOGY, PRINCETON UNIVERSITY. Announcement of Courses for 1910-1911. Pp. 25. Princeton, New Jersey.

The Prospector

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

J. H. J., Alberquerque, New Mexico: Rhyolite altering to chert.

S. E. M., Quartzsite, Arizona: Altered diabase containing veinlets of oxidized pyrite and gold.

G. R. D., Washoe, Nevada: No. 1, diorite; No. 2, fine-grained altered silicious rock with chalcopyrite.

C. M. C., Paradise, Arizona: No. 1, rhyolite breccia with small amount of limonite; No. 2, rhyolite; No. 3, rhyolite tuff; No. 4, quartzite; No. 5, rhyolite.

J. C. S., Danville, Washington: No. 9, rhyolite; No. 10, diorite; No. 11, diorite schist containing pyrite and pyrrhotite; No. 12, actinolite schist; No. 13, talc schist; No. 14, diorite; No. 15, diorite; No. 16, granodiorite.

J. M. L., Independence, California: No. 1, granodiorite altering to sericite; No. 2a, pegmatite; No. 2b, rhyolite; No. 2c, chert; No. 3, altered rhyolite; No. 4, altered gabbro; No. 5, altered igneous rock containing chalcopyrite.

The Rush to Iditarod, Alaska

Fear is expressed that the rush to the Iditarod will almost depopulate Fairbanks. Labor may be scarce, which will inconvenience operators who have large amounts of good ground blocked for summer work, although it is anticipated that many men will be back from the new diggings by August, as the unprecedented rush from all quarters will greatly over-populate the whole district. While this will encourage further prospecting, the small number of creeks showing pay, and the almost impossibility of getting heavy machinery into place before the next freeze-up, will mean an enormous overplus of labor all over the Iditarod. Numberless boats of all sizes, from 75-ft. steamers to power canoes, are at present building on the banks of the river, and, in fact, all over town, to join the rush down on the first water. All boats are designed to meet shallow water conditions, as hopes are entertained of making the mouth of Otter creek without transfer. Mining plants aggregating fully 1500 hp. will be shipped from Fairbanks and Chena, many of the boilers being used as motive power for steam barges. In fact, if the inspectors of hulls and machinery were to arrive here before the break-up, only a small fraction of the fleet would be able to sail. Only a portion of them are needed, according to the most reliable reports. There is no doubt but good ground has been found, but not enough to justify such a stampede.

Alaska Mexican Gold Mining Company

The Alaska Mexican milled 226,651 tons of ore during the year 1909, with an average assay value of $4.04 per ton. The ore reserves at the end of the year were 596,404 tons, including 201,350 tons broken and remaining in the stopes. The mill contains 120 stamps,, and the cost of milling during the period covered by the report was 24.31c. per ton. The ore yielded in free gold, including base bullion, $470,852 or $2.0774 per ton, and in concentrate $376,854, or $1.6627 per ton. The actual recovery was therefore $3.74 per ton, or 92.57%. The quicksilver lost was 28.44% of that used. Effective time for the mill during the year was 315 days, 17 hours. The stamp-duty was 5.37 tons. Renewals involved 482 shoes, 275 dies, 2 cams, 2 cam-shafts, 372 stems broken and replaced, 10 new stems, 37 tappets, 21 boss-heads, 1 mortar, and 9 vanner belts. The operating profit was $468,424, and total profit $499,488. Four dividends, representing 40% on the par value of the issued stock, were declared, the sum disbursed being $360,000.

Work of the Bear Creek Dredge

The following account of the work of the Bear Creek dredge is condensed from the Dawson *Daily News* of November 26 last, and has been furnished by the courtesy of the Marion Steam Shovel Co., builders of the dredge in question. It is based on a statement given for publication by Joseph W. Boyle, manager of the Canadian-Klondyke M. Co., Ltd.

Three points are made by Mr. Boyle in his statement. One is that the actual operation of the dredge and power-plant, including maintenance and repairs, and all items of labor, fuel, and everything of the kind, was less than 15c. per cu. yd. Another is that the percentage of time lost by the dredge was less than that of a number of similar boats operated in California. The third is that the length of season is far greater than ever supposed to be possible here. Mr. Boyle expects to be able to run the dredge 224 days in 1910. In his comparisons of operation made by dredges in California, he quotes of D'Arcy Weatherbe, writing in the MINING AND SCIENTIFIC PRESS.

In California it is customary, explains Mr. Boyle, for the mining companies to furnish such data to the scientific press, and it is said it is due largely to such data being given to the public that the dredge industry has reached its extensive proportions and efficiency. "The operation of the Bear Creek dredge," he continues, "this year compares most favorably with those of the best boats in California, both as to the yardage handled and the lost time during the operating season. The dredge started digging at 11 p. m. on May 9, and stopped at 7 a. m., November 20, a total of 194 days

Marion Steam Shovel.

and 8 hours elapsed time. During that period the boat dredged 681,616 cu. yd. of material, or on an average of 3558 cu. yd. per day throughout the season. The total lost time for the season was 368 hours, 43 minutes, or 7.9% of the total running time. The published statement available showing yardage and lost time on dredges in Oroville, California, are as follows: A dredge using 5 cu. ft. buckets dredged in 1905 a total of 589,082 cu. yd., and in 1906 a total of 557,084 cu. yd., digging the whole 12 months in the year. The published statements showing lost time on some of the well known dredges in California are as follows: The Butte, 18.5% for 32 months; the Eltoro, 33.41% for 20 months; the Yuba No. 1, 32.8 for 12 months; the Yuba No. 2, 30.4 for 12 months. The latter two boats are the property of the Yuba Consolidated Gold Fields, and the 12 months included in the statement ended January 1, 1906. The Canadian-Klondyke Mining Company's dredge is of the 7½-cu. ft. bucket capacity electrically driven."

The Bear Creek dredge has several appliances not installed on any of the other dredges operating at Dawson which assist materially in lengthening the period of yearly operations. The principle appliance is a heating plant, with steam pipes extending the entire length of the enclosed stacker-ladder. These are placed either side of the stacker-belt in such a manner as to entirely prevent any freezing. There are also steam coils under the lower belt rollers, under the sluicing tables, in the enclosed house constructed over the main drive, and at all other points necessary to be kept free from frost. On different occasions during November, 1909, the dredge was operating in a temperature of more than 20° below zero, without the slightest difficulty and with all the efficiency which it would have had in the warmest weather. A system of applying hot water to the sheaves through which the various shore lines operate, prevent any difficulty from this quarter. Mr. Boyle states that the difficulties through which the dredge has successfully worked this season has been greatly exaggerated and that in his opinion the miners of this country overcame in the simplest manner much greater difficulties in the placer mining carried on in winter in the early days. The dredge was expected to start digging on or about April 1, 1910, and to continue at least to November 20. This will give a season of at least 224 days. The only difficulty experienced here in operating in the fall of 1909, according to Mr. Boyle, was from the surface frost. This was so thin that it was impossible to thaw with existing methods, but successful means have been devised and spring operations will be started as planned.

CATALOGUES RECEIVED

THE LANE SLOW SPEED CHILIAN MILL CO., Los Angeles. 1910 Catalogue. 'Lane Mills'. Illustrated. 64 pages. 6 by 9 inches.

DENVER FIRE CLAY CO., Denver. 1910 Catalogue. 'Assayers' and Chemists' Supplies'. Illustrated. 424 pages, 6¾ by 9½ inches.

AMERICAN GRÖNDAL KJELLIN CO., New York. Bulletin. 'Concentration and Briquetting of Iron Ores'. Illustrated. 22 pages. 11 by 9 inches.

THE DORR CYANIDE MACHINERY CO., Denver. Catalogue No. 3. 'The Dorr Classifier and the Dorr Continuous Thickener'. Illustrated. 32 pages. 9 by 6 inches.

WORD BROS. San Francisco. 'The Drill Sharpener Book'. Showing the 1910 model Word Drill Maker and Sharpener for steel up to 50 ft. long. Illustrated. 20 pages. 7 by 5 inches.

SPRAGUE ELECTRIC CO., New York. Pamphlet 233. 'Electric Hoists'. Illustrated. 24 pages. 4 by 9 inches. Pamphlet 516. 'Flexible Steel Armored Hose'. Illustrated. 28 pages. 4 by 9 inches. Catalogue 321. 'Electric Fans'. Illustrated. 36 pages. 8 by 10½ inches.

COMMERCIAL PARAGRAPHS

T. H. PROSKE, Denver, recently shipped to the Isthmian Canal Commission the second 25-ft. D 24 Ajax drill sharpener for use on the Panama Canal.

The HAMMOND IRON WORKS, Warren, Pa., advises that John M. Nicol has been appointed as its Mexican representative. His office is at 1a Tacuba No. 6, Mexico City.

The REDWOOD MANUFACTURERS CO., Black Diamond, California, advises that it is furnishing the redwood cyanide tanks for the mill being erected by the Tonopah-Liberty Mining Co., at Millers, Nevada.

HAFF & COLWELL BROS., Ely, Nevada, have compiled a map of White Pine county, from Government surveys, showing the topographical features, mining districts, wagon-roads, railroads, streams, and postoffices.

ONE of the largest orders of its kind placed this year, comprising over 1000 cars, has recently been given to the ORENSTEIN-ARTHUR KOPPEL CO., whose works are at Koppel, Pa., with a branch office at San Francisco, by the JAMISON COAL & COKE CO., Greensburg, Pa. The cars are to be used in the new mines recently opened by this company in the Westmoreland fields. The coal company has been experimenting for several years with all makes of coal cars, with a view to securing actual data relative to the life, maintenance, and transportation costs of the several kinds, and the placing of this order is the result of these experiments. The cars to be furnished are of special design, of all steel construction, with cast steel wheels and roller bearings. Each is to be of 100-cu. ft. capacity.

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EDITORIAL.

COALINGA oil production has been threatened by encroachment of underground water. The leading companies have joined in the formation of a committee of eleven to undertake a joint survey and study. This sensible and farseeing co-operation will doubtless save the district from losses amounting to many times the cost of the work.

CONNELLSVILLE coke production, according to the Bureau of Statistics, in April amounted to 1,683,837 tons, a slight decrease from the records for the earlier months of the year. For the first four months of 1910 the production was 7,710,208 tons, almost 80 per cent above the figures for the corresponding portion of 1909. Pig iron production for April, 2,483,763 gross tons, was 43 per cent larger than in 1909 but none the less marked a slight check in industrial activity. The output for the first four months was 10,107,571 tons, 3,000,000 more than in 1909.

FIVE pipe-lines now furnish transportation from the Coalinga oilfield. Two belong to the Standard Oil Company and come to Richmond by way of Mendota; one, belonging to the Associated Transportation Company, leads to Monterey bay; another, that of the Associated Pipe Line Company, extends to Port Costa; and the fifth, the property of the Producers Transportation Company, connects the Coalinga, McKittrick, and Midway districts with Port Harford. Transportation is the secret of development of an oilfield, and in their nearness to the sea the California fields are very fortunate.

SOCIALISM is the next problem in politics. At least so says President Taft. No one can gainsay him, for socialism is an ever present problem. It has been the concern of men ever since they determined to limit their individual wills by becoming social creatures. The first socialist was the savage who gathered some of his fellows into a band knit by ties of common welfare. We will admit that President Taft had a more specific object in view than the inclusion of the general evolution of the social state among the dear concerns of the G. O. P. when he made his recent utterance in Chicago. He was thinking of votes, and of the organizations that pretend to be the exponents of socialism in its narrower and more deformed phases. He was thinking, probably, of a class which is associated in the public mind with the dream of a Utopia or the reaping of harvests which it has not sown. Words mean much. 'Socialism' has acquired an unpleasant flavor, so that men who believe in the practical possibility of a more highly economic and happier social state now describe themselves as collectivists. Under the name of

socialism many of the best things that could be devised for the betterment of human life are included, and this unfortunate association arouses opposition among a host of thinkers who would welcome the effort at improvement if freed from the contamination of an abused term. The thing that warns the healthy minded man away from the so-called socialism of some blatant propagandists is that they present schemes which involve the sacrifice of the individual initiative. A man must not be converted into a machine. He must find closer correlations of his life with those of others, to avoid waste of effort. Whatever will do that, is good, so long as it still leaves the individuals free agents, with opportunity to shape their own courses and utilize the special powers that lie in them. Mr. Taft did not say all this, but we incline to believe that he thought it, and we commend his suggestion, as we would commend that of any political leader who believes that the worthy proposals of the 'socialists' should be saved from hopeless association by being written into the platforms of the parties that have strength to make them effective. Luther objected to letting the devil have all the good tunes, and there is a chance here to rescue some excellent music to inspire the forward march of the race.

SOME TIME AGO 'Mr. Murphy' remarked that copper vacuum was the thing desired in seeking a copper property—'the lower the grade the better'. At the same time the copper-mine promoters have been claiming excessively low costs, present and prospective. It is bad policy. The whole matter was a mistake; the new word going round is that there is no copper vacuum; a tangible quantity of metal is really necessary: and it actually costs enough to mine and smelt it so that no expert accountant is needed to find the item in the published balance sheet of the corporations. In all seriousness, Mr. J. Parke Channing, consistently with previous utterances on the subject which unfortunately have not reached the public, has announced that the costs at Miami will be nearer 9 than 7½ cents per pound. Several copper companies are reported to have the elevation of costs under consideration. The argument is that the prospective buyer who waits in the hope of lower prices may cheer the producers by paying more in the end.

United South Africa

The United States of America must hereafter share with the United South Africa the long cherished initials U. S. A., and will gladly do so. The South Africans have paid us the compliment of adopting in their constitution many of the provisions of our own, and none will more heartily welcome them to the family of nations than do the Americans. In many particulars the formation of the new State is one of the most striking events of current political history. Less than eight years after the termination of a bitterly contested war which resulted in the loss of political independence by the people of two States, the contestants are found joining harmoniously in the launching of a new and larger political union based on the principles of local self-government. In nothing is the greatness of the English people and the sagacity of their political leadership shown more strikingly than in their wise treatment of the Boers since the war, and not less striking has been the far-sightedness of the Boer leaders. We are wont to think of our own as the country of generosity to the defeated, but when R. E. Lee, like Louis Botha, disdained to prolong by guerrilla warfare a contest where the end was certain, his people were met by the horrors and injustice of the long reconstruction period, and now after forty years we have not reached the point that the British have in eight: that of passing over to the defeated, responsibility for the government of the whole country.

The old Boer government was reactionary and corrupt. It laid a heavy hand on the mining industry, and gave little in return. It was inevitable that it should be swept away. The Government since the war has laid equally heavy burdens on the mines, but the money has gone to the Government rather than to favorites, and much has been given in exchange. The greatness of the Boer leaders developed during and since the war, is unchallenged. No one doubts that good and honest administration will obtain with them in charge, and the fine spirit shown by both English and Boers augurs well for the future. The appointment to the position of Governor-General of Lord Gladstone, son of the great prime minister of whose justice the Boers had such signal evidence, was a peculiarly graceful act. An empire of free commonwealths bound by such ties as hold Canada, Australia, and United South Africa together, is one which need have little fear of disunion.

Boosting California

Apology may be in order for the word 'boosting', but no explanation of its meaning is needed. That is the value of the term. It is plain old Anglo-Saxon. It is democratic and is understood. Moreover, it involves the principles of harmony and confidence. The California Development Board, which held its semi-annual meeting at Nevada City last Saturday, frankly called the gathering a convention of boosters. Believing in California as a good place for earnest workers to make money and to get ahead in the world, the members assembled to discuss plans for persistent advertising of the advantages of the Golden State. The California Development Board is a coalition of the former California Promotion Committee, the State Board of Trade, and the California Manufacturers' Association. Numerous local boards of trade and chambers of commerce throughout the State have become affiliated with the new organization, and the effort is being made to co-operate with all such bodies in California.

The place chosen for the meeting was well adapted to draw attention to the diverse opportunities offered by the State. Nevada county has been noted in the annals of mining since the great gold-rush in 1849. It has yielded more than $300,000,000 in the precious metals from placer and quartz mines, and it is still producing about two million dollars per annum. The North Star alone turns out bullion to the amount of a million dollars per year, and its neighbor, the Empire, yields more than half as much, and many other

mines are operating successfully. The great depth of these mines is remarkable. The Empire is hoisting ore from 3000 feet on the incline, while the North Star has explored its vein to a distance of more than a mile below the outcrop. The Champion mine has also reached a depth of 2400 feet. There are few places in the world where gold veins are so persistent, and where the industry is on so permanent a basis. Placer mines are also being worked to some extent although the anti-débris legislation has tied up the great gravel mines which formerly yielded so much treasure. The deposits of auriferous gravel in Nevada county are of enormous extent, and their gold content is so large that studies are now being made to determine economical means of operating them by modern methods of excavation with machinery. In a few cases it is hoped that dredging may be successfully applied. Opportunity exists for the application of engineering skill and ingenuity in solving the problem of working these great placers without floating the fine sand and silt down the streams to the detriment of agriculture, and of navigation in the Sacramento river.

While Nevada county has won distinction as the banner gold-producing district of California, its agricultural resources are enormous. The fertility of these foot-hill counties is remarkable, and the climate is most propitious. Fruits of every kind, from apples and pears and peaches to figs and oranges are successfully raised. Even the old tailing dumps from the placer mines have in many cases been leveled and converted into orchards. A striking contrast between conditions within a short distance, so often seen in California, is here presented, oranges and ice being harvested in the same month in the same county.

A number of important papers were read. Among these was an interesting account of the mining activity in Nevada county, by Mr. F. M. Miller, and a discussion of the oil industry in California, by Mr. Courtenay De Kalb. The latter is printed in this issue. The suggestion that the United States Geological Survey be given facilities for issuing monthly progress-bulletins presenting the latest observations of the geologists in the field was made the basis of a resolution to be laid before Congress. The value of early information is undoubted, and such bulletins would materially aid the economic development of the oilfields. The Department of Commerce and Labor has filled a need by issuing weekly Consular and Trade Reports, which prove of great advantage in promoting foreign trade. There is no good reason why those who are seeking to open up the natural resources of the country should not equally be facilitated in their efforts by the earliest possible information of geological conditions. We believe that the officers of the Survey would welcome the opportunity to serve the public in this manner if the present restrictions rendering speedy publication of data impossible were removed.

A strong appeal for united effort to secure the endorsement by the Government of the plan to hold the Panama exposition in 1915 at San Francisco was made by Mr. Frank L. Brown, and resolutions were passed pledging the aid of the California Development Board to that enterprise. California has asked merely for official sanction of the fair, and no financial support has been solicited. The sum of $5,000,000 has already been subscribed, a working organization has been effected, and no doubt exists that the people of the State would make it one of the greatest expositions ever held. It would attract capital and bring about a renewal of interest in mining that would prove of lasting benefit. The California 'boosters' do well to insist on the importance of the Panama exposition. It would be the most powerful engine that could be brought into action for promoting the growth of industry at a time when improved transportation facilities will open a new era for the State.

Making Railway Rates

The episode of David Crockett and the coon has been quite outdone by the recent encounter of Mr. Taft and Mr. Wickersham with the railroads. Whereas the famous Tennesseean is only credited with scaring one coon into surrender, the Attorney-General has twenty-five railroads to his credit. Not a bad bag for one day's shooting! Even a 'safe and sane' administration, one much 'buttressed about by law' (and by lawyers) can, it seems, be stung into prompt and radical action. Radical it certainly was for the Attorney-General of the United States to initiate injunction proceedings against the railways restraining them from raising rates. It was quite as dramatic as anything happening during Mr. Roosevelt's administration, and almost compensates for the fact that the gun proved not to have been loaded in Manchuria, and for the fuses being wet in Nicaragua. With a little more practice the President may be able to give to Washington press-despatches the old time interest. Once more we may open our daily paper with anticipatory thrills, and again must the anxious calcium man keep the spot-light trained on the White House.

It was a dramatic but easy victory. The railroads were in a false position and so were readily pushed to surrender. Their weakness lay in the fact that they were attempting to rush through a general advance in rates in anticipation of the taking effect of the new law under which all advances must be approved by the Interstate Commerce Commission before becoming effective. Under the old rule railway managers could increase rates whenever and wherever they pleased, subject only to a thirty-days' notice, and the burden of proof as to the unreasonableness of any given rate or advance rested on the protesting shipper. The new law will change this. Before making an advance the railways must satisfy the Interstate Commerce Commission that the proposed rate is proper and reasonable. This accords with the usual rule that persons proposing a change must justify their actions, and it is a just rule. The presumption is that at any rate already established by a railway and under which the latter has been operating, meeting its bills, and paying dividends, is at least not unjust to the railway, and if it be proposed to increase the rate the justification may properly be required in advance. A change in rate affects too many people and unsettles business too widely

to be proper except when clearly necessary. The railways have themselves repeatedly taken this position when decreases in rates have been ordered by State Commissions, and have not hesitated to ask injunctions from Federal Courts restraining State officers from putting new rates into effect. The method used by Mr. Wickersham is one which the railways introduced.

As a result of conference between Mr. Taft and various railway presidents it has been arranged that the railways shall withdraw the offending rates and that the Government shall not prosecute its suit. While this peaceful solution of the difficulty is welcome, it would have been interesting if not profitable to have had the suit pushed, in order to determine whether the raising of rates by 'conference' through the Western Trunk Line Association is in law 'combination in restraint of trade'. As a matter of fact, there is probably no contention but that the Association is a device for the purpose of evading the law. The defense is that the law itself, in making no discrimination between reasonable and unreasonable restraint of trade, is itself unreasonable; a contention that is approved by many outside as well as inside railway circles. However, as the matter now stands, the new rates will be passed on by the Interstate Commerce Commission, and fortunately there is little disposition to question the ability and fairness of the present Commission. In the event of the railways feeling agrieved at any decision they will have the right of appeal to an excellently constituted court.

Whether, as a matter of fact, the proposed increases were justifiable cannot be decided offhand. The railways have been doing an enormous business. For the year ended March 31, 1910, the gross business of 739 roads had increased 15.54 per cent over that for the corresponding previous year, and similar advances had occurred month by month for nearly a year. Not only gross but net earnings have increased. Of twenty roads reporting for the year ended April 30, all but two show substantial increases in the net profit for the year. One, the Fairchild & Northeastern, is an unimportant line, and the only striking exception to the rule was the Santa Fe, which, with an increase of gross earnings amounting to $9,149,782, fell behind $1,522,584 in net earnings. There can be no question that the cost of living has increased for the railways as it has for individuals. It is also true that American rates are low as compared with those of other countries, and that through a long term of years they have been falling. It is further to be remembered that the railways must protect their credit and that they need large sums of money for additional extensions, terminals, track, and equipment. It may even be pointed out that there has been little criticism of railway rates *per se*, but only of one rate as compared with another; that shippers and communities in general have been less concerned with the absolute charge for transportation than with the adjustment of rates so as to favor the community in competition with others. It by no means follows, however, that present rates are too low and the matter demands consideration.

To take the last matter first, it may be urged that, having no agreed basis upon which rates may be made, the only available means for determining the reasonableness of any given rate has been to compare it with existing and unchallenged rates. Presumably if the railways do not lose money by hauling goods at a certain rate in one case, they would not in another substantially similar case. So runs the argument at least, and the absence of a fixed standard has made it necessary to resort to such a means of measurement. While complaint has been mainly as to inequalities in rates there has been none the less a widespread conviction that rates as a whole are not too low. This seems to be based in part on the fact that railway men are unable to defend the present rates except on the basis that they 'move the traffic' and apparently measure the value of the service. This, however, being translated into the popular phrase, 'all the traffic will bear', and keeping in mind the well known fact that the railways have been built for the most part out of the proceeds of bond sales, value being given later to the stocks by the use of surplus earnings, has made the public skeptical as to some of the fixed charges of the railways. Certain notorious cases of manipulation have added greatly to popular prejudice in the matter.

It is exceedingly difficult to determine what the real earnings of American railways have been. Mere addition of surplus and dividends does not tell the tale. Too many ways of hiding or diverting earnings have been in vogue. An elaborate investigation of the Illinois Central, made at the instigation of Mr. C. S. Deneen, who as Governor of Illinois is ex-officio a Director, showed that despite many devices to milk the old main line, the earnings through a series of years had been, not the 8 per cent suggested by dividends, but approximately 20 per cent. Not improbably other roads have done as well or better. A little observation and study will convince any one that American railway managers and owners certainly have made money as fast, and in most cases faster than have their fellows engaging in other lines of business. The periodic talk of the railways being ruined by legislation needs, therefore, to be taken with due allowance. Despite large and frequent injections of water into the stock of the companies, it is now urged, and probably with a large basis of truth, that a physical valuation of the railways would show them to be worth practically the amount of their outstanding securities. Granted that this be true it is undoubted that much of the present value of railways is due to monopoly-value of terminals; in other words it represents at once monopoly and 'unearned increment'. It is a question, and a fair one, to what extent the people should be taxed, and a railway rate in the last analysis is a tax, to conserve to a special group of the people, not perhaps values of this sort already accrued, but similar values accruing in the future. This and similar far-reaching questions must enter into the fixing of railway rates, and it is well that in the future the matter is to be decided by an impartial tribunal rather than practically by one party to the controversy. The duty of each and every one of us is to help keep that tribunal impartial; fair both to the railways and to the public.

The California Oil Industry

By Courtesy Dr. Katz

*The Golden State has entered the age of oil. From modest beginnings it has risen to pre-eminence. Ten years ago California produced a scant 4,000,000 bbl., in 1909 her wells yielded 58,191,723, this year it will exceed 75,000,000. During the month of April the output was 6,622,061 bbl., which is at the rate of 80,000,000 per year. Moreover the permanency of the fields is assured for an indefinite period. W. W. Orcutt, the geologist of the Union Oil Co., has estimated that California can maintain its present yield of petroleum for fifty years. This is evidence of the conservative spirit of Mr. Orcutt, for the indications are that the Midway and Sunset fields alone could contribute that amount. It is not the phenomenal flood of oil from the Lakeview and other gushers in those districts that gives color to the claim. There are 255 producing wells in the Midway field, and 10 of those are veritable geysers of oil. The Lakeview has been spouting 48,000 bbl. per day for over three months, until now it has outstripped the best wells of Baku, and holds the record for the world. The significant point is that these wells are so scattered, and have given such evidence of the geological conditions existing there, that 75 square miles of territory may be considered definitely proved. Gushers are not to be looked for in every case; in fact they are not desired; but practically everywhere in this great area reasonable certainty exists of striking oil in the reservoirs overlying the Eocene formation. At the end of the Middle Miocene the rocks were subjected to folding and the general structural features had been determined. The surface was subsequently eroded, and the McKittrick formation laid down upon it unconformably, representing the detritus from the earlier rocks. Thus great irregularities of contour exist; there were valleys and hills covered over by the wash from the anticlinal ranges, and silt was deposited from the lakes, until the depression was fairly well filled. The oil is found chiefly in the deposits immediately overlying the ancient eroded surface. The gushers probably represent 'pools' in the more deeply scored portions of this early land-area: it is as if a canyon had been filled with sand and the oil had then been accumulated in the interstices, but it must be borne in mind that these detrital deposits covered both hill and valley over that old eroded region, and that the oil is held in them throughout their entire extension. No lean streaks have yet been found in the Midway syncline.

Gushers are of two kinds. The flow of oil may be due to gravity, under the pressure resulting from a high head. If porous oil-bearing strata extend from a trough or syncline to a considerable elevation up the leg of an anticline, such a pressure would be developed, just as in the case of an artesian water-zone. The oil would issue as if driven out under hydrostatic pressure. The other form of gusher is due to the expansion of compressed gases accumulated above the oil in a pool. Usually such gushers soon subside as the gas pressure becomes relieved by the outflowing petroleum. In the Midway district however, the force seems not to diminish, yet the structure of the district precludes the development of sufficient hydrostatic pressure to account for the phenomenon. The oil-bearing sand in this field is extremely fine in the great area embraced in the syncline. The coarsest will pass through a No. 30 mesh screen, and most of it will pass 80 mesh. This is very different from the coarse oil-sands of the Coalinga district, and the gravelly reservoir under the Kern river field. Except for an enormous force behind it the oil in such small pores as exist in this fine material would be held quite tenaciously, and would issue slowly into the wells. Such a force is found in the gas. As soon as these sands are entered in drilling the gas-pressure is found, and a gas-filled zone extends for 50 to 100 ft. above the oil. In the Buena Vista hills, which represent a later crumpling of the rocks which filled the old basin, the pressure is 600 lb. per square inch. In many of the wells the pressure mounts up to 1000 lb. per square inch, and this is only a fraction of the force exerted by the compressed gas within the rocks. At about this enormous pressure even the lighter hydro-carbon gases become liquid. From this E. A. Starke, of the Standard Oil Co., argues that the gas here does not exist in gaseous form; it is liquefied, and hence force is stored up in such form that it is sufficient to press out the oil for practically indefinite periods. It is worthy of note that no one knows the thickness of the oil-bearing zone in these sands of the Midway field. They have been penetrated only about 10 feet.

Before passing from this interesting field it is well to say a word about the splendid work of the United States Geological Survey. The reports of Ralph Arnold, in co-operation with Harry R. Johnson and Robert Anderson, on the McKittrick-Sunset and the Coalinga districts respectively, have just been published, as Bulletins 406 and 398. They have thrown a flood of light upon the geological situation in general, and will serve as a basis upon which the rock-structure will be more readily determined as data accumulate from further exploration. Mr. Arnold's work is above criticism: he is one of the keenest interpreters of stratigraphy who has ever studied the California oil districts; but everyone is limited by the facts available at the time, and a Government report sacrifies value if not immediately accessible. In the case of an industry which is developing by leaps and bounds like that of oil-production in California the time when a report appears is most important. When the report on the McKittrick-Sunset fields was written the exploitation of the 'Midway flats' had not fairly begun. Mr. Arnold showed acumen in suggesting that the impregnation of the sands might become greater as exploration progressed farther away from the coarser sands of the anticline, but from the evidence at hand he sounded a warning in regard to water. He said, "It has been the experience in analogous structural positions in other localities to find that the water in the beds increases toward the centre of the syncline, and as the Midway Valley is in a general way a great syn-

*Abstract of address at the semi-annual meeting of the California Development Board at Nevada City, California, June 4, 1910.

cline, it is more than likely that the beds underlying it will be found to contain more water than the same beds nearer the edge of the valley." The water-bearing sands were close to the oil-sands high up on the anticline, and the deduction which he made was reasonable, but development in the flats has shown that the oil-sands in the wide trough of the syncline are covered by impervious beds which in the deeper parts of the valley separate the water-sand from the oil-sand by nearly a thousand feet. The U. S. Geological Survey could contribute more in developing the industry if Congress would make it possible to issue results of field work at more frequent intervals. Progress-bulletins, containing the latest field observations, published monthly, would facilitate the exploration of the oil-areas. It is not necessary to await extensive correlation before giving information to the public. The isolated facts would be useful, and misconceptions are no more likely to happen one way than the other. As it is, the people proceed with imperfect knowledge, and risk their money on faith in such indications as are known. The more the Survey can point the way, the better will it be serving the purpose for which it is maintained.

Coalinga claims to be the greatest oilfield in the world, and it well may boast of its splendid production. At the moment it is yielding 55,000 bbl. per day, which is only 5000 less than the Midway. In April it turned out 1,555,561 bbl. It has 20,520 acres of proved oil-land, with 620 wells, which average over 88 bbl. per day. To fully exploit the territory it is estimated that 2800 wells must be drilled. That would indicate an enormous daily potential output. The sands are not uniform either as to their character or as to the gravity of the oil contained in them. Nevertheless the oil-sands are of such great extent that the estimate of 20,000 acres will probably be vindicated, as there has not yet been a dry hole drilled within the proved area. Adjacent territory of promise, but as yet untested, will undoubtedly contribute to the volume of production from this field. The development at Coalinga has been remarkable. In 1902 the field produced only 572,498 bbl.; it rose steadily to 1909, when it stood at 15,079,944, or more than one-fourth of the total production of the State. This year it will exceed 19,000,000. Next to Coalinga comes the Kern field, with 45,000 bbl. per day. The limits of this producing area are also being rapidly extended. In the south the Fullerton-Brea Canyon district is rapidly increasing its output. Last year it yielded 4,271,000 bbl. and other districts in Los Angeles and Orange counties produced 2,000,000, while the Santa Maria, Lompoc, and Arroyo Grande shipped 8,080,488. The possibilities from deep drilling are just becoming shown in southern California, where today one or two wells are a mile deep.

California ranks as the greatest oil producer in the world, and it is a free field, that is, there is a free market. One of the most vital factors is the Independent Agency, which is a combination of a large number of independent producers. It is the effort of this Agency to obtain the best price possible for the oil, while the large marketing companies naturally seek to buy oil as cheaply as they can. The Union Oil Co. is a member of this selling agency, which makes the Independents strong in competition with the Standard and Associated Oil companies. The latter represents the oil interests of the Southern Pacific railroad. The area controlled by the Southern Pacific is enormous, making it probably the largest single holder of oil-lands in the country. This arose from the granting by Congress of a land subsidy in the form of every alternate section. It is the existence of this ownership of alternate sections that is responsible for the hostility of the people toward the proposed legislation authorizing the Government to withdraw oil-lands from location. It would not result in conservation evenly and equitably applied. The lands of the Southern Pacific are patented, and production could continue upon them. To a certain extent adjoining Government lands would be drained. The argument is fair, though it should not be pressed too far. A well will usually not exhaust more than five or six acres, and sometimes not that much. The viscosity of the oil prevents a freer flow, and capillarity holds it back. Nevertheless a considerable percentage of the national reserves might suffer depletion. In the Kern field the practice of the Associated Oil in drilling lines of holes along the boundaries of its land is conspicuous. These rows of wells capture something from the neighbor who does not meet them with opposite drill-holes, and it also keeps the Associated lands from being drained by wells on adjacent property. Withdrawals might properly be made on unsurveyed lands, or on such portions of the public domain as are not affected by the railroad land-grant. It need hardly be urged that retroactive legislation is and always has been repugnant to the sense of right and justice in the people. It seems that there is no restraint in the Federal Constitution against the enactment of a law which would not only validate the withdrawals already made, but would place a bar to patent upon locations entered prior to the withdrawals; but Congress can ill afford to permit interference with a vested right when acquired in due compliance with existing statutes, even though it may not possess the finality of letters patent. The case would be the more aggravated if it should be allowed to operate to the detriment of individuals in contradistinction to the advantages which would be given in certain areas to a great corporation whose holdings were also acquired through Act of Congress. In any event a man should be protected in what he has legally acquired. If it be contrary to the public welfare that further locations of public land be made, no one could protest that he had been wronged by a legal general withdrawal of that privilege. Common law right is common sense justice, and the common sense of mankind rebels against retroactive legislation.

The market for oil is constantly widening. A few years ago coal was a competitor of oil on the Pacific Coast. Today crude petroleum has monopolized the field as a fuel except for domestic heating. Even in private houses the oil-furnace is coming into use. The cost of oil at the wells is frequently stated at 50c. per bbl. In 1908 the Government figures showed

52c. realized in California, which was the lowest of any State except Oklahoma and Kansas. In Pennsylvania it was $1.79 per barrel, though of a higher average quality. At the present time, taking into consideration the deliveries at low prices under old contracts, the average paid at the well is probably not more than 40c. Adding a pipe-line charge of 20c., a selling charge of 5c., and another 20c. for local distribution, the cost at tide-water does not exceed 95c. This makes California fuel oil approximately equivalent to good coal at $3.50 per ton. There is a further economy in the labor of firing, cleaning furnaces, and waste in handling, together with the more perfect utilization of the heat-value of the fuel. About 72% of the oil output of the State is used for fuel.

The facilities for distribution are also excellent. The Producers' Transportation Co. is operating an 8-in. pipe-line 210 miles to Port San Luis, serving the Sunset, Midway, Kern, and Coalinga fields, transmitting 20,000 bbl. per day. The Associated Oil Co., serving the same fields, operates one 8-in. pipe-line 350 miles to Port Costa, on San Francisco Bay, and a 6-in. line, 108 miles long, to Monterey. The Standard Oil, drawing from the McKittrick, Kern, Midway, and Sunset fields, transmits 35,000 bbl. per day to Point Richmond, 315 miles, through an 8-in. main. There are 21 pumping stations on this line. Oil for piping is heated to 180°F. by exhaust steam from the pumping engines. The friction of the heavy oils, which registers about 15° Beaumé, is reduced fully 90% by this elevation in temperature, each 10°F. corresponding to about 1° Beaumé in gravity. The cost of these pipe-lines, with all accessory equipment, has averaged about $10,000 per mile. Other lines contemplated are one from the oil districts of Kern county across the Tehachapi pass to Mojave, which seems necessitated to relieve the heavy traffic on the single-track railroad over these mountains, congested as it is by the joint use of the Southern Pacific and the Santa Fe. The Independents are also projecting a pipe-line to Arizona, which would serve the six railroads in that territory, as well as the copper districts of Globe, Miami, and Douglas, and the works of the Cananea Consolidated Copper Co. across the line in the State of Sonora, Mexico.

The consumption of oil on the Southern Pacific system west of El Paso and Sparks and south of Ashland amounts to about 9,000,000 bbl. per annum. In April last the oil burned on this system was 746,000 bbl. The locomotive mileage was 2,651,950, distributed as follows: freight service, 905,150 miles; passenger, 1,295,608; switching, 327,164; work train, 106,540; construction, 17,508. This shows a duty of 0.28 bbl. of oil of about 16° Beaumé per locomotive mile. During the period of nine months ended March 31, 1910, the duty was 16 gallons of oil per locomotive mile in freight traffic, and 8¼ gal. in passenger service. The locomotive boiler-pressure averages about 190 lb., and the efficiency obtained gives an equivalent of 163 gal. of oil to 2000 lb. of coal, or a trifle less than 4 bbl. of oil equal to 1 ton of bituminous. The efficiency varies considerably with the type of locomotive. The 8-wheel type gives an equivalent of 144 gal. to a ton of coal, the 10-wheel class, 151 gal., the 12-wheel wide fire-box, 158 gal. The mean equivalent of 745 engines is 152½ gal., or 3.58 bbl. of 42 gal., equal to 1 ton of coal. The new Mallet consolidated compound freight engines show an equivalent evaporation of 15.04 lb. of water per pound of oil, with a boiler efficiency of 78.52%. Otherwise expressed, 29.51 gal. of oil will haul 1000 tons 1 mile, or 1 lb. of oil will perform the duty of carrying 3.15 tons 1 mile. It has been said that the increased profits of the Southern Pacific, which have raised it from non-dividend paying to one of the best paying railroads in America, represent the economy resulting from the use of oil instead of coal as fuel. This may be an exaggeration, but there is enough truth in it to typify the great industrial importance of the utilization of crude petroleum for generating power. It has given fresh vitality to California and to great areas in the West. California oil goes to British Columbia, to Alaska, to the Orient, to Panama where the work is being done with the power developed from it, to every Pacific port in South America even as far as Punta Arenas on the Straits of Magellan, and the demand, domestic and foreign, is growing as fast as the fields can be developed. There are 6692 producing wells in the State at the present time, which correspond to an area being drained which does not exceed 33,460 acres. This is based on the fact that each well will produce from only about five acres. The proved area in the Midway field was 75 square miles, or 48,000 acres, and in the Coalinga field, 20,000. These are but two fields, and only a fraction of the possible productive area which may yet be proved in them. The other fields swell the total to an acreage so great that the land actually producing today is but a small portion of what is known to be available.

While ultimate exhaustion is certain, the danger is remote; the industry is a safe one. It is being capitalized as befits a safe and permanent industry. The exact amount of capital invested in the California oil industry as a whole is difficult accurately to estimate. It costs perhaps about $6000 per acre to drill and equip the wells, which gives a total invested in wells alone of $100,000,000. The pipe-lines represent about $10,000,000; the Point Richmond refinery cost nearly $5,000,000; other refineries, tankages, cars, ships, and the like, swell the figure for accessories to at least $50,000,000. The land being drained by wells would have an average value of $2000 an acre, or $60,000,000. This gives a grand total of $210,000,000. The output of 79,000,000 bbl. per year at 40c. is worth $31,600,000. Half of this is available for dividends, which would indicate that the oil industry as a whole was earning 7½% on the invested capital.

The California Oil Fields, Ltd., a British corporation, operating in California, produced last year 4,378,464 bbl., against 3,563,679 in 1908, 3,242,942 in 1907, and 2,512,655 in 1906. The production for the entire State of California in the same years respectively was 58,000,000, 48,000,000, 40,000,000, and 32,500,000 bbl. Operating profits of the California Oil Fields Co. in 1909 were $886,365, while dividends of 35% were paid. The California company sold its product principally to the Standard Oil Company.

Prospecting, Developing, and Mining

By R. W. Brock

*If the question were put to the members of this Institute, what is the most serious hindrance to the development of the mining industry of the country, they would, no doubt, unanimously reply 'wild-catting'. Money that should be invested in the development of the resources of the country, swells the profits of brazen and unscrupulous promoters; and the victims who would otherwise have become financial supporters of legitimate mining, pocket their losses, remarking that having bought their experience of mining, they will in future be careful to abstain from engaging in so risky a pursuit. The honest promoter, who will not make false statements or rash promises, finds it difficult or impossible to get money for his legitimate projects in competition with the glib fakir who is unhampered by considerations of conscience or fact. If 'wild-catting' is such a millstone about the neck of the industry, it is fitting that the Institute, whose chief aim is to promote the welfare of mining, should take steps to eradicate the evil; and that men, more especially mining engineers, whose interests are so closely identified with the industry, should do everything possible to discourage this evil practice.

While the mischief of 'wild-catting' is well recognized, it is not so easy to determine how to prevent it. The panacea is not to be found in protective legislation, although the laws might, perhaps, be made more effective. Possibly, however, the remedy lies in educating the public. This is a work that might well be undertaken by this Institute. The public must be instructed in that science, which may, for want of a better term, be called 'mining embryology'. At present, even in law, where fine, not to say hair-splitting, distinctions are supposedly drawn, any claim is termed a mine; any claim-holder, a mine-owner; any prospecting, mining. This looseness of definition and wrongful use of terms merely makes worse confounded the confusion in the mind of the layman. If, then, the public were taught to draw sharp distinctions between the meaning of the words prospecting, developing, and mining, an important step would have been taken toward rendering 'wild-catting' ineffective. For the result of such teaching would be an early realization of the fact that of many thousand claims in a district, only a limited number rise to even the dignity of prospects, while of the prospects but a score or so will ultimately develop into mines. Having this knowledge the public then will be in a position to recognize as a 'wild-cat' a claim or a prospect that is being offered or promoted upon the representation that it is a mine. Some fear that if the uncertainties in connection with the business of mineral development are too freely indicated to the public, this course would have a tendency to discourage the investment of capital in such undertakings. But this point of view is quite untenable. Frankness in this respect would inevitably be beneficial in effect. It is true it might deter the small investor, who can ill afford to risk his savings, from engaging in mining ventures; but such a result could not be regrettably regarded. Thus, were the public capable of forming a correct estimate of what may be referred to as the relative probabilities in mining, the distinction as between 'actual mining operations', 'development operations', and 'prospecting operations' would become readily apparent. Mining investment would then rank with and be regarded as equally safe as investment in other industrial undertakings, and this would necessarily have a stimulating rather than a depressing influence on investment included in the former class. Again, neither development companies nor the promoters of legitimate undertakings of this character would experience greater difficulty in securing capital to carry out their projects; for the public would be quick to grasp the exceptional opportunities afforded by ventures of this description.

Large profits are the exception in mining. The price paid for a mine or for mining stock usually represents the full value of property, and provides only for a fair margin of profit in addition to the return of the original capital invested; for there can be no reason or occasion to offer for sale a property below its intrinsic value as so readily determined from available data in respect of the developed ore and the costs of extraction. Hence, when fortunes are made in mining, it is usually by those who engage in 'development' enterprises. Here, of course, one must be prepared to reckon with the element of chance; but this in itself is not a deterrent to enterprise. A man accepting a risk with his eyes open is, if unsuccessful, in a different position to one whose loss or failure is attributable to the misrepresentation of others, or to his own misconceptions. Further, knowledge such as indicated will prevent the investor from paying for a prospect a price far in excess of its value; it will impel him to require that such capital as may be subscribed toward the prosecution of an undertaking in which he embarks be devoted strictly to that purpose; he will, furthermore, require to be satisfied that any development company with which he associates himself is provided with adequate capital with which to acquire and test, if need be, a number of prospects; and he will also insist that the best technical advice is secured in carrying on investigation and operation in connection with the undertaking. Under proper conditions, then, well organized and properly directed development companies would have every prospect of succeeding; and enterprises of this nature should afford a peculiarly promising and attractive outlet for the investment of capital in Canada.

The only individual likely to suffer by the education of the public is the unscrupulous promoter, whose welfare need not be a matter of concern. If his means of livelihood be taken from him, so much the better. Industrial conditions would thereby be so much the more improved; for if but twenty-five per cent of the money now misspent in the purchase of so-called mining stock were available under the

*Abstract of paper on 'The Necessity of Distinguishing Between Prospecting, Developing, and Mining', read before the Canadian Mining Institute.

conditions suggested, it is certain that the actual development and expansion of the industry would be greatly accentuated. Mining engineers are not wholly concerned in money making. They are equally interested in the establishment, on a sound and worthy basis, of the industry with which they are associated. To educate the public to a more sensible and better understanding standpoint of the nature of the industry, to direct money, now wasted in foolish or fraudulent schemes, into needed channels for the development of the mineral resources, if not a duty, is, at any rate, in keeping with the ideals of the profession. It is, therefore, urged that mining engineers, both as individuals and as a body, engage in an endeavor whereby they may at once benefit themselves, stimulate the industry, and perform a much-needed public service.

COST OF DRILLING

The figures given below cover the cost of prospecting for copper at Miami, Arizona, according to William G. Weber, as published in *Engineering-Contracting*. The data are based on an assumed average life of four years per machine. A drilling machine with tools sufficient to operate for that length of time would cost about $6000. The minimum amount of road required per hole is about 300 ft. When holes are drilled at 400 ft., 600 ft., or greater intervals, the item of roads becomes correspondingly greater. On the fairly steep slopes (20°) encountered in the Miami district, 75c. is an average cost per foot of road.

COST OF DRILLING

	Cost per ft. of hole.	
Labor—		
2 drillers at $6 per day	$0.48	
2 helpers at $4.80 per day	0.38	
1 sampler at $4 per day	0.16	
1 foreman at $6 per day (2 machines)	0.12	
	$1.14	$1.14
Roads—		
Labor at $2 per day	$0.50	
Foreman at $4 per day	0.05	
Powder, caps, and fuse	0.03	
Tools, etc.	0.01	
	$0.59	$0.59
Coal, coke, oil, etc		$0.27
Water		0.10
Teaming		0.10
Assaying, office, and incidentals, etc		0.16
Interest at 5% and depreciation		0.20
Total cost per foot of hole		$2.56

The monthly average of the cost per foot of hole drilled varies with one company from $2 to $3. In another instance, where holes are drilled farther apart and the drilling is poorer, the cost per foot has run as high as $5. When drilling is the only means of development being used on a property, the cost of camp maintenance and incidentals considerably swells the cost account. It would hardly be fair, however, to charge these items up to drilling when a comparison with other districts is being made.

Export of tin from Penang, Straits Settlements, during the month of February was 1820 tons as against 1750 tons in February last year.

A Bit of History

By Charles G. Yale

In the early days mining assessment 'ads' were the main source of income for the M. & S. P. At one time we came very near losing the business. The *Alta California* was the most important daily paper in San Francisco then, and had a good part of this advertising. There was considerable rivalry to get it. Our prices in the weekly were, however, less than those on a daily, so we obtained a good share. Finally the *Alta* people formed a plan to cut us out altogether, and got some of their political friends to present a bill to the legislature providing that all mining assessment and sale notices should be printed only in papers of 'general circulation'. The Mining and Scientific Press did not then come under that heading.

The members of our firm paid but little attention to the progress of the bill at the legislative session and the first thing they knew it had passed both Houses and had been sent to the Governor for his signature. Had this bill become a law it would have taken away half the profits of our advertising columns. Dewey and Ewer both dodged the task of talking the Governor over to our side, as no opposition had been shown to the bill, and, as stated, both Houses had passed it. I was then sent up at this late hour to try to get the bill 'killed'. My old friend Albert Hart happened to be private secretary to Governor Newton Booth, and I went at once to him to arrange an interview with His Excellency, not an easy thing to do in those last days of the session. He did this nicely, and I got an interview ahead of half a hundred waiting suitors. What was more to the purpose, Mr. Hart gave me the 'tip' on which I eventually won.

The proposed law, it happened, would benefit the *Alta* only, no other paper then carrying these particular 'ads'. It seems that the proprietors of the *Alta* had not been at all friendly to the Governor during his election campaign, and I had a good argument to begin with. Mr. Hart had the particular bill placed on top of the file ready for the Governor's signature and ready at his hand. By pre-concerted arrangement I was ushered in at an opportune time, and Mr. Hart introduced me to Governor Booth. I, as briefly as possible, told him of the object of the bill, and how it would injure badly a paper devoted to the mining interests of the State, and benefit only a single newspaper, the *Alta Californian*. He had not yet read the bill, but asked Mr. Hart for it, read it, asked me a few incisive questions, and dismissed me with no promise except that he would look into it further before signing. He never did sign it, and it, therefore, never became law. The *Alta* people never knew how their pet measure, carried so safely through both Houses, had been pocketed at the last minute, or what influence caused this to be done. It was not until daily mining-stock papers began to be published in this city that the volume of this class of advertising dropped off in the Mining and Scientific Press and at the same time other sources of revenue were developed.

Efficiency of Centrifugal Pumps

By F. W. Kerns

The efficiency of any machine is $\frac{\text{output}}{\text{input}}$. If P be the power put into a pump; H_2 the total external head the pump overcomes, including all friction head and the velocity head of final discharge, for which latter the pump should be given credit, as it is impossible to deliver water with no velocity; Q the cubic feet of water delivered per minute; w the weight of a cubic foot of water; and E the efficiency; then $E = \frac{QwH_2}{550} \times \frac{1}{P}$.

Referring to Fig. 1, let H_1 be the total friction head above the pump; h_1 the total friction head (including entry head) below the pump; $H + h$ the total gravity head; and $\frac{V_1^2}{2g}$ the velocity head of final discharge.

Then $E = \frac{Qw}{550}\left(H + H_1 + h + h_1 + \frac{V_1^2}{2g}\right) \times \frac{1}{P}$ (1)

To obtain the term within the parentheses, let a pressure gauge G, be tapped into the pump close under the discharge flange so as to indicate the conditions at the point of discharge of the pump proper, and the reading (in feet of water) corrected by adding the vertical distance between the point of tapping and the centre of the pump, or by piping the gauge down to the level of the pump centre. Also let a vacuum gauge g, be tapped into the suction elbow, level with the centre of the pump and close against the casing flange, as the suction elbow is sometimes replaced by a straight horizontal suction pipe, and cannot therefore be considered an integral part of the pump nor its friction loss charged against the pump. If now the supply surface remain at a fixed elevation and continuity obtains, the following energy relations may be written.

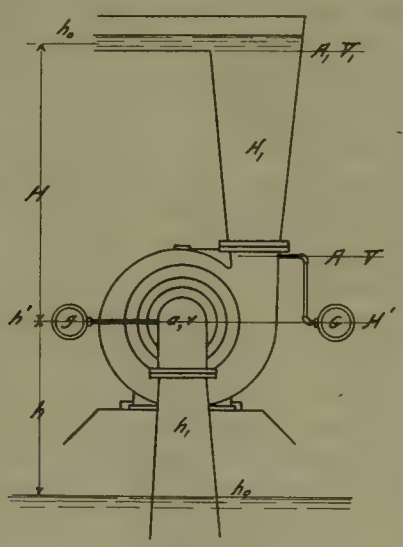

Figure 1

Below the pump, at the surface, the total energy is that of atmospheric pressure, h_0; and at the level of the pump centre, the total energy is that of absolute pressure (pressure above zero), h'; elevation, h; heat, h_1, due to friction; and velocity, $\frac{v^2}{2g}$; or writing the energy equation, $h_0 = h' + h + h_1 + \frac{v^2}{2g}$ (2)

Above the pump, at the level of the centre, the energy is that of absolute pressure, H_1, and velocity, $\frac{V^2}{2g}$; and at the point of final discharge, the energy is that of elevation, H; heat, H_1, due to friction; atmospheric pressure, h_0; and velocity, $\frac{V_1^2}{2g}$; or the energy equation is $H' + \frac{V^2}{2g} = H + H_1 + h_0 + \frac{V_1^2}{2g}$ (3)

Transposing and adding (2) and (3)

$H' - h' = H + H_1 + h + h_1 + \frac{1}{2g}(v^2 - V^2) + \frac{V_1^2}{2g}$ (4)

But the gauge reading $G = H' - h_0$; and the gauge reading $g = h_0 - h'$; and adding, $G + g = H' - h'$. Substituting in (4), and deducting $\frac{1}{2g}(v^2 - V^2)$ from both sides, $G + g - \frac{1}{2g}(v^2 - V^2) = H + H_1 + h + h_1 + \frac{V_1^2}{2g}$. Substituting in

(1), $E = \frac{Qw}{550P}\left[G + g - \frac{1}{2g}(v^2 - V^2)\right]$

But for continuity, $Q^2 = a^2v^2 = A^2V^2$, where a and A are the areas of opening corresponding to v and V respectively, and from this, $v^2 = \frac{Q^2}{a^2}$ and $V^2 = \frac{Q^2}{A^2}$, so finally, $E = \frac{Qw}{550P}\left[G + g - \frac{Q^2}{2g}\left(\frac{1}{a^2} - \frac{1}{A^2}\right)\right]$

The term $\frac{1}{2g}(v^2 - V^2)$ or $\frac{Q^2}{2g}\left(\frac{1}{a^2} - \frac{1}{A^2}\right)$ disappears in case a = A, that is, if the suction and discharge openings of the pump are the same size. Where they are not, this term must be considered as a correction to the observed gauge readings; for if the runner be removed and water forced upward by other means or allowed to flow backward through the pump, there will be a difference in the two gauge readings due to the difference in the velocities through the unequal openings, even though the pump be thus entirely eliminated. When a shaft extends through the suction elbow, its area must be deducted from the area of the elbow opening, when determining a.

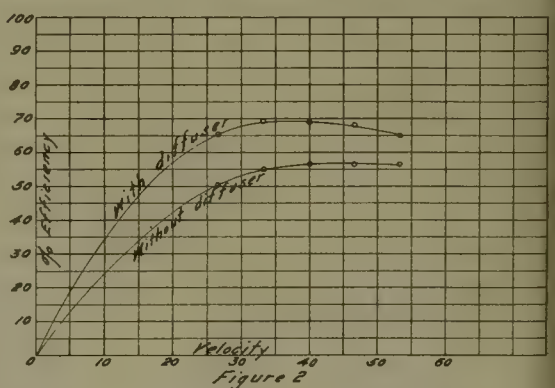

Figure 2

The above result may be reached more directly by considering the pump as introducing energy into

the water; thus the energy immediately below the pump, using the same notation as before is $h' + \frac{v^2}{2g}$; and immediately above, properly neglecting friction within the pump, $\frac{V^2}{2g} + H'$. The difference, $H' - h' - \frac{1}{2g}(v^2 - V^2) = G + g - \frac{1}{2g}(v^2 - V^2)$ must be the total energy head, H, introduced or overcome by the pump, which agrees with the result obtained above.

It is to be noted that the above method of measuring the efficiency credits the pump with any 'diffuser' effect introduced by placing a cone above the discharge to reduce the velocity head of final discharge or the pressure H' against the pump. Fig. 2 shows the results of tests made on the efficiency of a pump with and without a diffuser. In this case it is seen that the diffuser increased the efficiency of the system by 12 per cent.

ASSAY OF GOLD-SILVER CYANIDE SOLUTIONS

By Theo. P. Holt

Many methods have been published for the determination of gold and silver in cyanide solutions, which with proper care will give reliable results. Most of these, however, fail to meet the requirements of speed, accuracy, and a minimum of attention, desired by the cyanide chemist. In general they require three operations: (1) a precipitation or evaporation of the measured solution; (2) a fusion or scorification of the product, and, (3) a cupellation of the resulting lead button. The second operation is obviated by modifications of Chiddey's well known method, and the schemes outlined by William Magenau* and Mr. Barton† under most conditions are very satisfactory. In connection with experimental work at the Utah School of Mines and elsewhere, I have had occasion to test these methods on a large variety of solutions. I find that it is best to omit the zinc dust entirely and precipitate the precious metals along with the sponge lead on a square of aluminum foil. Because of the position of aluminum in the electromotive series of the metals, it is a more effective precipitant in an acid solution than zinc. It also readily replaces lead from solution, the lead forming a convenient collector for the small amount of gold and silver present. The process as outlined below permits of direct cupellation, is reliable, and requires little attention.

Take from 5 to 10 assay tons of solution in a beaker, place on a hot plate and heat almost to boiling. Add from 15 to 20 c.c. of a saturated solution of lead acetate, a 1½-inch square of aluminum foil, and 10 to 15 c.c. of strong hydrochloric acid. A heavy white precipitate of lead and silver chlorides appears at this point, but passes again into solution as the metals are deposited. Leave the assay on the hot plate until the solution clears up and the lead sponge has all collected on the aluminum. Decant the solution, pressing the water out of the lead sponge with a rubber tipped stirring rod, and transfer the assay to a 2½-inch square of lead foil. Take out the aluminum square, which will be found to separate readily from the lead, and roll the sponge with a round bottle to free from moisture. Fold up into a convenient form and drop into a hot cupel. The aluminum sheet should be $^1/_{16}$ inch or more in thickness, otherwise small pieces may become detached and remain with the lead sponge, causing the cupellation to spit. The assay requires very little attention. The re-agents are all added at one time and while the sponge may be ready for cupellation in 20 minutes, it may remain for an hour or more should the assayer be busy with other work.

I have tested the method on a large variety of solutions, and find that the losses are less than commonly occur in cupellation. A few examples from my notes may be of interest here.

No.	Solution assay.		Residue loss.	
	Au (mg.)	Ag (mg.)	Au (mg.)	Ag (mg.)
1A	0.17	5.19	0.00	tr.
1B	0.165	5.18	0.00	tr.
2A	0.845	25.15	0.00	tr.
2B	0.835	25.14	0.00	0.06
2C	0.85	25.07	0.00	0.04
2D	0.84	25.38	0.00	0.06
2E	0.84	25.09	0.00	0.04
3A	1.73	50.56	0.00	0.05
3B	1.73	50.62	0.00	0.00
3C	1.71	50.20	0.00	tr.
3D	1.69	50.47	tr.	0.56

The above assays were made on pipette measurements of a standard solution. The residue loss was determined by a fusion on the evaporated solution and the aluminum foil. The loss during cupellation varied from one to two per cent, but since it effected the assays much alike it does not appear in the results.

AUSTRALIAN MINING REGULATIONS

An act for the regulation of coal mines, passed by the Australian State of Victoria, has recently come into operation. It also authorizes the establishment of State coal mines. John F. Jewell, U. S. Consul at Melbourne, outlines its provisions as follows:

The State mines may be opened by the mines department, but when so opened up must be handed over to the railway commissioners to be worked. One of the most important provisions of the new act is that providing for the 'bank to bank' principle, which provides that "no person shall be employed below ground in any mine for more than eight consecutive hours, inclusive of 30 minutes as meal time, or for more than 48 hours in any week, except in cases of emergency." After stating that an interval of at least eight hours shall elapse between "one period of being below ground and the commencement of the next," the law states that "a person shall be deemed and is hereby declared to be employed below ground in the service of the owner of the mine, within the meaning of the act, from the time that he commences to descend the mine until he returns to the surface." A short time ago an extensive coal deposit was discovered a short distance from Melbourne. This mine is being opened up by the mines department and when a railway to the field is completed in March will be managed by and for the State Railways.

*Mining and Scientific Press, April 14, 1906.
†*Mines & Minerals*, April, 1908.

Tourmaline in California

By John L. Cowan

Official statistics of American gem mining place this industry almost in a ridiculous light, giving the value of the product at somewhere in the neighborhood of $300,000 annually. It is believed that there is more than one American gem mine that produces gem materials of a greater value, just as they come from the ground, than is credited to all the gem mines in the country. This discrepancy between facts and official figures is not due to any lack of diligence on the part of representatives of the Geological Survey, but must be attributed to the refusal of the gem-mining companies to give out accurate information, or, in some cases, to supply any information at all. They fear that statistics showing the real magnitude of their output would cheapen the product: that if the public were informed as to the large quantities of certain gem materials that are taken from the ground annually, it would expect to buy them at much lower prices than now prevail. The same fear that the people will get to know too much leads most gem miners to make of their mines 'dark secrets', so that visitors are unwelcome, and picture taking sternly interdicted. It is not at all inconceivable that a more liberal policy on the part of the gem producers would be rewarded by more liberal treatment at the hands of the people. The American public likes to buy things that it knows something about; and if American gems are ever to become popular it will be necessary that the producers gratify a legitimate desire for information as to where they come from and how they are obtained.

The three leading gem materials produced in this country are sapphire, turquoise, and tourmaline. Probably the greatest sapphire mines in the world are located on a branch of the Judith river, in Montana, but the output is all shipped to London to be cut, and no reliable information is ever given out as to the amount. The largest of modern turquoise mines are operated in New Mexico and California; and the world's greatest tourmaline mines are located in San Diego county, California, but secrecy is maintained as to the amount and value of the output. It may be perfectly true that this is the business of no one but the mine owners, but too much mystery is not conducive to popularity. Several years ago George F. Kunz, of New York, America's most famous gem expert, stated that it was quite possible that California might soon be known as one of the greatest gem-producing countries in the world. He pointed out that the tourmaline, spodumene, rock crystal, and other gems of the State have been better known to the people of Russia, Spain, Germany, and other countries of Europe than to Californians and that these gems are better represented in great museums of New York, Washington, London, and Paris, than in the State Mining Bureau of California, or the State University at Berkeley.

The most beautiful of all California gems is the tourmaline, pronounced by Max Bauer, the celebrated German mineralogist, to be the gem that most nearly resembles the diamond. It is only within recent years that tourmaline has been used to any extent in this country by jewelers, and even yet it has not reached the popularity to which its beauty, its rarity in nature, and the low price at which it sells (as compared with other gem materials of inferior merit) entitle it. Not even the diamond exceeds in beauty the carefully cut and appropriately mounted gems of this variety sometimes seen in rich shades of pink, ruby-red, and blue, selling at a fraction of the cost of stones of far smaller merit.

The original discovery of tourmalines in California is said to date back to 1872, when several specimens were found on Thomas mountain, in Riverside county. The Columbia gem mine was later located near the spot where these stones were found, but development has been hampered by litigation. Other discoveries have been made from time to time in the San Jacinto range, and a number of mines have been opened. Most of the specimens shown in the windows of local jewelers and lapidaries, of opaque pink tourmaline embedded in the rock, with a large number of small crystals radiating from a common centre, come from the Pala district, in San Diego county. Years ago an Indian named Vensuelada called the attention of white men of the neighborhood to the peculiar formation, and soon thereafter an old miner and prospector named Henry Magee located the property as a quicksilver mine, thinking that the pink crystals must be cinnabar. He sent samples to various chemists, none of whom were able to identify them, although they assured him that they contained no trace of quicksilver. He abandoned the claim, but it was not long until it was again located by Don Tomas Alvarado, a Mexican ranchman, who concluded that the odd-looking pinkish, bluish, and gray rock formation, studded with small pink crystals, must be a peculiarly ornamental variety of marble. He sent many specimens to mineralogists in various parts of the country, endeavoring to find out what his new building material was worth. Some of Alvarado's specimens passed into a private collection in New York. Here they attracted the attention of a visiting German mineralogist, who was familiar with the lithia mines of Europe, and was struck by the similiarity of the undetermined specimens to certain lithia-bearing ores. He obtained a specimen for analysis, and was then able to state authoritatively that it was as rich in lithia as any known in the world. The mine is now controlled by the American Lithia Co., of New York, and is an important producer, but no tourmaline crystals of gem quality are obtained from it. However, specimens are highly prized for mineral cabinets, and for that purpose have been sent to all parts of the civilized world. Other mines have been opened in the same region, notably the Stewart, Pala Chief, Tourmaline Queen, and Naylor-Vanderburg, yielding both tourmaline and kunzite.

Eighteen miles to the southwest of Pala is the much more important gem-producing district of Mesa Grande. This locality is most conveniently reached from San Diego, the San Diego & Cuyamaca railroad running back 25 miles to Foster, and a stage line from that point, through Ramona, extending 33 miles to Mesa Grande. Numerous claims have been located in the hills surrounding Ramona. Some of

these have yielded fine gems, but none have been developed sufficiently to determine their value. At Mesa Grande are the Himalaya and the San Diego tourmaline mines, and a number of prospects. Accounts of the discovery of the Himalaya mine differ. Crystals have been found in Indian graves of the neighborhood of great antiquity. It is generally supposed that these came from the site of the Himalaya mine, but this is uncertain. About 30 years ago some Indian children picked up several beautiful blue six-sided crystals, and from time to time cowboys and others found similar objects in the neighborhood, particularly after heavy rains that washed away the sand and clay, exposing the shining crystals to view. Then the children of the Mesa Grande school fell into the habit of frequenting the locality to look for the baubles. These were found in all sizes, some no larger in diameter than a slate pencil, and some two inches or more across. Many were nothing but quartz crystals, clear and transparent, but others exhibited beautiful shades of pink, red, blue, and green. Sometimes the boys sold particularly fine specimens to the school teacher, or to tourists stopping at Rancho Cereza Loma (a summer resort five miles away from where the bright stones were found), and in the end some of these fell into the hands of some one acquainted with their true nature. About twelve years ago, an agent of Lippman Tannenbaum, of the Himalaya Mining Co., of New York, located the claim. Since then development has proceeded steadily until the Himalaya tourmaline mine now ranks among the world's greatest gem-producing properties, and is recognized as the greatest tourmaline mine that has ever been discovered. The variety, beauty, and value of the gems found here are such that Mesa Grande is sometimes called the 'Kimberley of America'. For several years, surface or bench digging was followed exclusively, but the overburden of rock and earth became too great for removal at a reasonable cost, and was subject to slides and cave-ins in the rainy season, so that underground work was resorted to. An adit has been driven into the hill for several hundred feet, following the gem-bearing vein, with several lateral branches, also in the vein. The following description of the formation is abridged from Bulletin No. 37, of the California State Mining Bureau: "Both hanging and foot-walls are of hard blue diorite, and the ledge is of fine crystallized pegmatite, dipping from 26 to 33 degrees southwest. The upper pegmatite is usually stained with lithia and manganese, and large masses of lepidolite are associated with tourmaline. The pockets are large, and filled with talc and hydrous micas, in which the gem crystals occur embedded, many showing peculiar etchings. . . . Among the minerals noted were orthoclase, albite, lepidolite, amblygonite, small clear pieces of spodumene, muscovite, tourmaline (black, green, blue, deep red, and rose), pink and aquamarine beryl, hornblende, and epidotic rocks, spessartite, and essonite garnet, large and very transparent quartz crystals, talc and hydrous micas, and a dark brownish transparent crystal, which has not yet been determined".

No other tourmaline mine in the world has ever yielded crystals at all comparable in beauty and value with the finer specimens obtained from this wonderful mine. Many are transparent, of the finest gem quality, in perfect prisms, singly or doubly terminated. Pink is the predominating color, but many specimens are found in matchless ruby-red, green, and blue shades. Some are parti-colored in two or more sections, the different colors being sharply separated so that gems of ordinary size may be cut, one-half being pink and the other green or blue. In some specimens the color arrangement is still more remarkable. In the interior will be a core of green, surrounded by a thin layer of white, and this in turn enclosed in red. Brazilian tourmaline crystals showing a concentric arrangement of colors have long been known, but in these the red portion is in the centre, and the green on the exterior.

Operations in the Himalaya mine are remarkably simple. All the vein material is taken from the underground workings in ordinary mine cars, conveyed to the washing plant, where it is thoroughly washed for the removal of talc and mud which might obscure the gem materials and prevent their detection. Large nodules and crystals are easily picked out, but the entire mass must then be carefully sorted over by hand for the detection of small pencils and fragments. Mr. Tannenbaum's agent at the Himalaya mine is J. Goodman Braye, Jr., an African by descent, an Australian by birth, and an American by choice. His successful career as manager of the greatest tourmaline mine in the world (and possibly the greatest gem mine in America), is sufficient proof (if any proof were needed) that the accident of race and color constitutes no insuparable barrier to achievement.

On the claim adjoining that on which the Himalaya mine is situated is the mine of the San Diego Tourmaline Mining Co., which has been operated ever since 1901, and has yielded a large quantity of beautiful gem material. Here the vein material is a fine-grained pegmatite, in which black tourmalines occur in fan-shaped crystallizations. Near the centre are found pockets, in which are the crystals of gem quality. This mine also ranks well up among the great gem mines of California.

It is only within comparatively recent years that tourmaline has been used to any considerable extent in jewelry in this country. In fact, until after the opening of the Mesa Grande mines there was little tourmaline of gem quality on the market. All of the output of the Himalaya mine is shipped to New York to be cut, but that of the San Diego mine is cut in San Diego, where a number of skilled lapidaries are constantly employed. There can be but little doubt that as this beautiful gem material becomes better known it will gradually grow in popular favor until it takes first rank among American gem stones. The hardness of tourmaline is variable, usually being 7 or 7.5 in the scale in which the hardness of the diamond is 10. However, it is said that specimens at Mesa Grande are often found with a hardness of 8. Tourmaline is defined as 'A complex silicate of alumina, boron, magnesia, iron, and alkalies (soda, potash, lithia), with small amounts of water and fluorine'. Different names are given it according to its color.

Present Conditions at Ely

STAFF CORRESPONDENCE

The principal operations of the Nevada Consolidated Copper Co. are at Copper Flat, seven miles from Ely, Nevada, where five Bucyrus steam-shovels, with 3½ and 5-cu. yd. dippers, are loading into cars 240,000 tons per month of mill ore, and in like manner disposing of a great tonnage of overburden. In performing this work eight 45-ton locomotives, and one of 60 tons, are in use. The main pit, which is the centre of operations, is nearly 2000 ft. long, 1000 ft. wide at the top, and 180 ft. deep from the highest rim to lowest part of the excavation. The shovels are operating on four terraces. The long diameter of the pit lies north and south, the trackage for the ore trains entering from the north; the pit has drainage in the same direction into an arroya. The work at the head-end of the pit is extending toward a limestone hill, and will be continued south to the contact of porphyry with this limestone. The greatest progress of the shovels, however, is westerly, or in a lateral direction. The overburden, the greater part of which is taken to the waste dump, is 85 ft. thick. The rock in certain shoots of this porphyry capping, containing 75 to 80% silica, and 2 to 4% copper, is sent to the smelting plant and used for converter lining. The defined ore stratum, below the overburden, carries 80% silica, 3.5 iron, 2.1 copper, and 0.5 lime. The copper is disseminated through the gangue as chalcocite, and is considered a secondary enrichment of the monzonite-porphyry. The ore is 200 to 300 ft. deep, as was demonstrated by churn-drill work in the vicinity of the main pit. The body of ore against which steam-shovels are now working is about 60 ft. deep, although the pit is being made deeper. A second pit is being opened a short distance west from the one above described, where two new steam-shovels will be put in operation, the result of which will be to increase the tonnage of ore that can be shipped to the concentrating plant at McGill.

Steptoe Concentrating Plant, Ely District.

The milling and smelting plants are operated by the Steptoe Valley S. & M. Co., a subsidiary of the Nevada Con. The Nevada Northern Railroad Co., whose main line extends from Cobre to Ely, with one branch from Ely to the mines of the district, and another to the mill and smelter, is another subsidiary. The concentrating mill is built in eight sections, two sections making a unit, with a rated capacity of 750 tons daily per section; but this capacity has been greatly exceeded. It is stated that as high as 10,500 tons have been put through in 24 hours. With only seven sections now in operation the plant already handles between 8000 and 9000 tons per day. The ore is first passed through McCulley gyratory crushers. There are 8 sets of 15 by 36-in. coarse rolls, and 16 sets of 14 by 36-in. fine rolls, Allis-Chalmers type. In each section are 68 Wilfley tables and 48 A.-C. vanners; four elevators, 12-ply, 20-in.; four 6-ft. Huntington mills and one Garfield Chilean mill; eight Steptoe classifiers; eight 2-mm. revolving screens and two ½-mm. screens for dewatering; and 46 Callow tanks. The Steptoe classifier is a modification of the one devised by Pope Yeatman, as shown in Richard's 'Ore Dressing'. The modification, which effects radical changes, was made by Geo. F. Waddell, mill superintendent, and his staff. These classifiers receive the re-ground material from the Huntington and Chilean mills, and the middling from the first-floor tables, also the undersize of the 2-mm. trommels. They effect classifications for different sets of tables and vanners, each set receiving its classified product through a particular spigot. The result is said to be greater efficiency and speed in this branch of the work. Another change in the practice here consists in taking out No. 1 trommel, which was formerly used to take up an undersize before wet-crushing in coarse rolls. This trommel having been taken out, the entire feed of the mill passes direct to the coarse rolls, which operate dry instead of wet as formerly. This change has served to increase the capacity, makes a steady feed possible, with no choking of rolls. The change from wet to dry crushing, as applied to the coarse rolls only, and the installation of the Steptoe classifiers, are said to have resulted in adding 60% to the capacity of the mill. The process becomes a wet one after the pulp passes through the coarse rolls, of which there is one set to each section. With the proposed increase in mill capacity, that is expected to come with the increased ore supply from the mines, it is thought that ore may be put through the mill at the rate of one ton per minute per section. A tonnage recorder, which works as a meter, and devised by Fred Curtis, the chief sampler, indicates to the superintendent, or foreman, just what tonnage is passing through each section each hour. The mill concentrates approximately ten tons into one.

The concentrate is delivered to the 16 McDougall roasters in Atlas hopper-bottomed steel cars, each of 10 tons capacity, the cars of concentrate being weighed on track scales. The roasters are of the Anaconda type, set in two parallel rows, the calcined product discharging into calcine hoppers, and from these it is taken hot to the reverberatory furnaces in closed cars. There are five reverberatories,

Steam Shovels at Copper Flat, Ely, Nevada.

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Copper Flat, Nevada Consolidated, Ely, Nevada, Looking North.

each 19 by 110 ft., the waste heat from which is passed into eight Sterling and two Babcock & Wilcox boilers, the steam from which is utilized in the power-house and in heating the concentrator building during the winter season. The reverberatory slag is skimmed off and granulated in waste water from the mill and discharged through a launder on the flat below the plant. The matte is taken to the converter building in steel matte-pots, and poured into the converters through cast-iron runners. There are four stands of converters, with three shells to each stand. The converter slag, after being skimmed off into truck-pots, is taken hot to the reverberatories for re-smelting. It is tapped out of the pots through a cast-iron spout into the furnaces. The converter lining, consisting of silicious copper car-

bonate ore, is dried therein by the ashes from the reverberatory furnaces, consisting of partly consumed coke and coal. C. B. Lakenan, general manager for the company, states that in April the concentrators made a saving of 71.84% of the copper content, and that the smelting process resulted in an extraction of 95% of the copper in the concentrate. This ore carries 40c. per ton in gold and 2.1% copper.

A new Nordberg horizontal cross-compound blowing engine, to supply the blast for the converters, was installed in the power-house in February, and at the time of my visit it was undergoing acceptance tests. The steam cylinders are 26 by 56 by 48 in.; the air cylinders, 54 by 54 by 48 in., the low-pressure cylinders being steam-jacketed. The receiver is of the re-heating type. The engine is rated at 18,000 cu. ft. of free air per minute; speed, 75 r. p. m.; guaranteed duty, 1.28 lb. steam per 100 cu. ft. of free air compressed to 17 lb. The fly-wheel is 20 ft. diam., weight 52,000 lb. The steam is supplied at 150 lb., and superheated 100° to a temperature of 465°F. The engine is equipped with a Wheeler condenser and Wheeler-Edwards air-pump; an oil-filter system, whereby the bearings are kept flooded with oil. The old blowing engines heretofore in use will be kept in reserve. A system of air-coolers for the roasters, to replace the water coolers, is being installed. It consists partly of fans operated by electric motors.

The reverberatory ash, containing 70% fixed carbon, 20 ash, 5 volatile matter, and 5% H_2O, is used as fuel under the boilers in the power-house. The converter building is being extended to afford more room, and an additional reverberatory furnace is being built. In obtaining data herein, I am under obligations to C. B. Lakenan, general manager; S. S. Sorrenson, chief engineer; R. E. H. Pomeroy, assistant superintendent of smelter; Lindsay Duncan, mechanical engineer; George F. Waddell, mill superintendent; F. W. Solomon, mill foreman; and Fred Curtis, sampler.

The Boston-Ely Mining Co., the principal stockholders in which are residents of Boston, has 20 patented claims a short distance northwest from the Veteran holdings of the Nevada Con. The shafts of the two are about 1700 ft. apart. E. W. Ralph, manager for the Boston-Ely, states that, in sinking their shaft to a depth of 1160 ft., the first 865 ft. was in unaltered limestone, below which was intrusive material. Some leached material was found at the end of a cross-cut driven 215 ft. from the shaft at the depth of 710 ft. The contact of limestone and jasperoid was cut at 800-ft. depth by driving a 95-ft. cross-cut. This contact, which has a dip 53°, was cut by the shaft at 865 ft., and at this place copper carbonate was found. At 1127½ ft. a cross-cut was driven north to the contact, where a winze was sunk 150 ft., following the dip of the contact, obtaining sulphide material, running 25 to 30% iron, 50 to 60 silica, 10 sulphur, and 12 to 15 lime. The intention is to continue sinking on the contact. The hoisting has been done with gasoline power thus far, but this probably will be supplanted by a steam plant.

The Ely Central Copper Co. is sinking and developing at its Eureka and Clipper shafts. The former is situated 400 ft. east of the main pit of the Nevada Con.; the latter is 4000 ft. to the west, in limestone. The Eureka shaft is believed to be on the same east-west ore-zone as that of the Nevada Consolidated's Copper Flat pit, but the most of its Eureka group lies east of the fault plain, where the orebody, if found, will be at much greater depth. The shaft is now down 475 ft. At 462 ft. a streak of carbonate ore was obtained, some of which assayed 15.5% copper; this was on the fault-plain contact. At 465 ft. some iron-copper sulphide was found. A cross-cut was driven east at the 470-ft. station to the contact and an incline is being sunk thereon. Some driving is also being done north and south on the plane of contact. The character of the ore obtained in small stringers seems encouraging. The Clipper shaft has been sunk 205 ft. on what appears to be a fissure in the limestone, having a north-south strike, a dip of 60° west, of undetermined width. The gangue is lime and jasperoid, carrying iron and copper, consisting of carbonates in the cropping. The 3-compartment shaft cuts through the vein on the dip of the latter between the surface and the 180-ft. point. Sinking will be continued to a depth of 300 ft., and from this station a cross-cut is to be driven to the vein, which will be explored at that depth, in the hope of finding there a more concentrated orebody. There is a considerable flow of water here, requiring the good pumping facilities which have been installed. The plant contains three steam boilers and a small capacity hoist. The management of the Ely Central is now in the able hands of Lee Glockner.

N. A. McGill has leased the Southern Cross claim of the Chainman group, also the dumps of the entire group, and the Chainman mill. He is putting the mill in order for crushing, amalgamating, and cyaniding, and intends treating some of the dump material as well as ore from the mine. A 72-ft. raise has been made from the 400-ft. adit, and a drift has been run 200 ft. from the top of the raise to tap the orebody from which mill-ore is to be taken. Sam Cocroft has charge of the mill.

WORLD'S OIL OUTPUT

The world's oil industry is a constantly growing one, with the United States the largest producer, with an annual output more than double its closest competitor, Russia. The 1909 production is estimated at 281,000,000 bbl., compared with 278,000,000 the preceding year, and 262,000,000 in 1907. The output of this country last year fell off 10,000,000 to 170,000,000 bbl., but all of the other principal producers showed substantial gains. The world's production for three years is given below:

	1909. bbl.	1908. bbl.	1907. bbl.
United States	170,000,000	180,000,000	166,000,000
Russia	55,000,000	52,500,000	62,000,000
Galicia	15,000,000	11,000,000	8,000,000
Rumania	9,000,000	8,000,000	8,000,000
Dutch East Indies	21,000,000	16,000,000	10,000,000
India	5,000,000	4,500,000	4,000,000
Mexico	3,000,000	4,000,000	2,000,000
Miscellaneous	3,000,000	2,000,000	2,000,000
Total	281,000,000	278,000,000	262,000,000

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Graphite in Cyaniding

The Editor:

Sir—When I wrote the article 'Graphite—an Obstacle to Good Cyaniding', published in your issue of December 4, 1909, I was simply giving my experience with it, and the trouble that it gave in other mills here, not dealing with graphite ore in other parts of the world; and I still maintain that, "the trouble here can only be minimized by carefully excluding such ore from being sent to the mills," in spite of D. F. Foster's good results at Ashanti, as in his letter of your issue of February 5, 1910. I take it that, at Ashanti, the graphite is always present, whereas in Kalgoorlie, it only comes in occasionally, sometimes being easily detected, and often being so finely distributed that it is not noticed until it floats on the pans. Mr. Foster does not give the percentage of graphite in the Ashanti ore, but we have some that runs much higher than the 0.75% average in the analysis in my notes. Up to a certain point, the treatment of the two ores mentioned is similar, beyond that it differs greatly. At Kalgoorlie all the roasted ore must be slimed for subsequent agitation with 0.08% KCN. Damping down the roasted product with water or KCN was tried here 11 years ago with disastrous results, as the lime and magnesia present in large amounts in the average ores milled were converted into sulphates during roasting, and on this being wetted, the ore set like cement in the percolation tank, the consumption of KCN being high and extraction as low as 65%. This will show that the Ashanti ore is much easier to deal with than the ore here. Regarding the roasting of an ore containing graphite, it seems to me to be excellent work to burn out this mineral by manipulating the air-inlets near the firebox, but this has been unsuccessful here so far, although all these things have been tried with the Merton, ordinary and improved, and the Edwards duplex type of furnaces. Roasting has reached a high state of efficiency at Kalgoorlie. The roast is tested for sulphur as sulphide by the iodine method, no special test being applied for graphite, as it is not always known when it is coming in. What happens at Ashanti when there is a poor roast, which happens in the best regulated furnaces at times? Is the extraction low? With regard to residue containing graphite and fair values in gold, I may say that many thousand tons of this have been successfully treated here, proving that exposure to the atmosphere changes the condition of the residue somewhat. As to extraction, in 1909 the average was 93%, often being as high as 95%, but the graphite at times lowered it to 90 per cent.

Only one mill here that employs the wet crushing, all-sliming treatment is bothered with graphite, the mine being on the eastern side of the belt where most of this mineral is encountered. Its effect in the cyanide treatment seems to be much worse than in the roasting plants. Graphite is a very stable mineral, and no doubt a little is burnt in the furnace, but so far roasting has failed to eliminate all of it, and as I said before, it only comes in occasionally, being one of those little troubles that is a nuisance for a day or two and then disappears for weeks. The Associated Northern Blocks and Oroya-Brownhill group of mines, where much graphite has been met with, are almost worked out. The Associated gets a little, and the Great Boulder also where a good deal has been encountered of late in the lower levels, 2500 feet.

It is rather an interesting subject, and at Ashanti the problem appears to have been solved by quite a simple method; and yet here we cannot get the usual high extractions when graphite is present. In the published returns from the Ashanti company, I had noticed that roasting was part of the treatment, and wondered what the ore was like. Through the medium of correspondence in your journal, I have been enlightened on this and other points.

M. W. VON BERNEWITZ.

Kalgoorlie, Western Australia, March 4.

Federal Authority and Conservation

The Editor:

Sir—The suggestion has been made repeatedly that the simplest solution of the difficulties incident to the conservation policy would be to transfer the whole of the public lands to the States within which they lie. Many ardent conservationists favor this policy. Since the mining industry in the West is so intimately connected with the public lands, I would be glad of space for the consideration of this proposal.

In the first place it should be noted that in the treatment of problems of this sort the States, as the possessors of the so-called 'municipal authority', have much more power to deal adequately with them than can the United States. The authority of the latter rests on its ownership of the land, and, except in the circumstance that Federal lands are not subject to condemnation under State laws, it has no more authority in the matter than John Jones or Richard Roe would have as owner. The ownership of the land carries no right of sovereignty different from that which the Federal Government has over all land. There is no contention, I believe, that the United States Government has the right to pass regulative laws covering land in private ownership such as have been proposed for the public lands. Its authority in the matter of regulating water-power, for example, probably must rest exclusively on its ownership of lands necessary to the building of dams and erection of power stations. In States where riparian rights are recognized it would have these, as would any other owner. Where only the law of appropriation is recognized, it would have the same right, though there is a question as to the policy of utilizing it, to make appropriations of water to benefit its lands, as would a private citizen. In addition, it would be proof against condemnation suits. The power of Congress "to dispose of and make all needful rules and regulations respecting

the territory or other property belonging to the United States" is expressly granted in the Constitution, and under the ruling laid down by Judge Marshall to the effect that a power actually delegated to the United States should be interpreted liberally, the legal authority of the Federal Government to introduce a leasing or any other system of regulation of the public lands seems clear. Remembering that the public domain still includes a large portion at least of the forest, coal, oil, and phosphate lands, and of the important power-sites, it is evident that while the authority of the United States in the matter is only that delegated by the Constitution, it is still broad enough to form a basis for effective regulation. At the same time the authority is subject to strictly defined limits and it would be impossible, except by alteration of the Constitution, to extend it.

On the other hand there are practically no limits to what the State may do, except as set by each State constitution, and while these vary greatly the powers of all are broad. There is little question not only that the States may pass effective legislation, but it is conceivable that they might even enact oppressive laws. The railways profess to have already found State regulation even confiscatory. If the public lands were transferred to the States the power of the latter would be subject to very little limit. The present division of authority in the matter, by bringing into action not only local but general public opinion, is likely, as it seems to me, to produce better results than would a complete grant to either the State or Nation. Certainly it accords with the general theory and practice of our Government.

In the above I have taken no account of the arguments for and against the proposed transfer, that are based on policy. They are too numerous, and differences of opinion are too radical to permit summary here. The suggestions I have given are also, it may be confessed, those of a layman as regards the law. If they are not sound will you or some of your readers kindly set me right?

CONSERVATIONIST.

San Francisco, May 27.

Columbia University has received an anonymous gift of $350,000 for a building for the faculty of philosophy. A gift of $150,000 for the erection of an administration building and library at the Rensselaer Polytechnic Institute has been made by the Pittsburg Alumni Association. The medical school of the University of Pennsylvania has been given $100,000 by an unnamed alumnus to endow a chair to be known as 'the Benjamin Rush professorship of physiological chemistry'. Tufts College has been made the residuary legatee under the will of John Everett Smith, and will, it is said, receive on the death of Mrs. Smith, the sum of $500,000.

The prohibition against the use of telegraphic codes in Turkey has been removed and all code messages, except those in cipher, will in future be received for transmission at all telegraphic offices of the Ottoman Empire.

MINING INDUSTRY OF PORTUGAL

According to Louis H. Aymé, Consul-General at Lisbon, the mineral output of Portugal in 1908 amounted to $1,786,626.

Of the ten minerals mined, copper is the most productive—97,477 metric tons of concentrate, with a value of $632,254. Sulphur follows, with 24,522 metric tons, of the value of $596,478. Tungsten comes third, with 620 tons, of the value of $240,052.

Further details are given in the following table, which shows the percentages, weights, and valuation of the ten most important minerals:

Minerals.	Metric tons.	Value.
Antimony	76	$2,826
Arsenic	1,655	90,360
Auriferous silver	2,244	58,770
Coal	4,614	19,912
Copper	15,313	58,001
Copper matte	564	56,529
Copper precipitate	3,041	386,150
Copper and iron pyrite	81,417	128,551
Copper and lead	142	3,123
Gold	1,832*	36,990
Lead	481	9,225
Sulphur	24,522	596,479
Tin	28	9,153
Tungsten	620	240,053
All other	.....	90,504
Total value	.....	$1,696,122

*Troy ounces.

There were employed 7160 persons in mining—6426 men, of whom 2889 worked below ground and 3537 above ground, and 734 women, who all worked above ground. The fatal accidents during the year were 9, or 1.25 per thousand.

FOREIGN COPPER STOCKS

The British Board of Trade figures of copper holdings (in tons) are given below:

	1910.	1909.
STOCKS JANUARY 1		
London, Liverpool, and Swansea	95,670	40,960
Imports January 1 to April 30	53,036	47,538
	148,706	88,498
Exports same period	24,025	24,811
	124,681	63,687
STOCKS APRIL 30		
London, Liverpool, and Swansea	95,690	37,970
Apparent deliveries 4 months	28,991	25,717

The Associated Transportation Co. owns four modern tank steamers, has one on the way from Newport News to the coast, and has since placed orders for another; owns four large schooners, three barges, and three tugs. These, including the pipe-lines, are in the exclusive service of the Associated Oil Co. Of the $5,000,000 of the Amalgamated Oil Co. the Associated owns $2,500,500. This company owns and leases oil lands in Los Angeles county, and owns a pipe-line of 15,000 bbl. daily capacity into Los Angeles, where it has terminal facilities and a refinery with a daily capacity of 3000 bbl. The above pipe-lines give the Associated Oil Co. a daily capacity of 78,000 barrels.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling and smelting.

The quantity of lime produced in Canada in 1908 was 3,601,468 bushels valued at $712,947, or an average of 20c. per bushel; as compared 4,755,316 bushels valued at $974,595, also an average of 20c. per bushel in 1907.

Silver is found in the Central States in small quantity. In 1908, 292,237 oz. were recovered in treating the copper ores of Michigan, the lead ores of southeastern Missouri, and the zinc-lead-fluorspar ores of southern Illinois and Missouri. In the latter district the silver content is about enough to pay freight on the lead concentrate which is, itself, a by-product from the milling of fluorspar ore.

Petroleum reserves are hard to estimate. For California Ralph Arnold has calculated that 8,500,000,000 bbl. exist stored in the rocks, and that of this amount 5,000,000,000 may be expected to be produced. D. T. Day estimated for the National Conservation Commission, the total maximum and minimum possible yields in the United States at 10,000,000,000 and 24,500,000,000 bbl. respectively.

Zirconium, while now known to be more widely distributed than was formerly supposed, is still much less common than titanium, rarely making up 0.2% of a rock and being usually under 0.05%. It is most apt to occur in granites, rhyolites, syenites, nephelite syenites, phonolites, tinguaites, and tephrites, and is most abundant in those which are high in soda, such as the last four. Its most common form is the silicate zircon.

Phosphate rock occurs principally in South Carolina, Florida, Tennessee, Utah, Idaho, and Wyoming. In 1909, F. B. Van Horn, of the United States Geological Survey, estimated the available tonnages as follows: South Carolina, 3,000,000; Florida, 15,000,000; Tennessee, 103,500,000; Western States, 100,000,000. Surveys are too incomplete as yet to permit of more than the above approximations.

The oil shale deposits of New Brunswick, which cover large areas in Kings, Albert, and Westmorland counties, have been known for a long period. As early as 1862, some steps were taken toward their exploitation as a source of mineral oil. This enterprise, however, was soon abandoned after the discovery of the Pennsylvania and other oilfields, and it has been only within recent years that any work has been done in an attempt to develop the field.

Arsenic in Canada, up to 1903, was mainly produced at the Deloro mine, in Hastings county, Ontario. The arsenic was recovered at Deloro in the process of treating the auriferous mispickel ores found in the district. In 1902, however, the mine was closed although the mill continued to work on tailing and ore from the dump until 1903, when operations ceased altogether. This property has been recently taken over by the Deloro Mining & Reduction Co., and the entire plant re-built with the object of treating ores from the Cobalt district as well as the local mispickel ores. The ore shipped from the Cobalt district contains important quantities of arsenic, although practically nothing is now paid to the mine owners for this mineral. There are three plants in operation in Canada producing white arsenic, one at Copper Cliff, operated by the Canadian Copper Co., a second at Thorold, operated by the Coniagas Reduction Co., and the third at Deloro.

Sampling churn-drillings by splitting of a stream of sludge is easy but it is also easy for a careless sampler to neglect his work, especially at night. An unwashed trough may collect much concentrate; an uncleaned divider may clog and not split the sludge properly. Allowing the solids in a sampler to settle and decanting off most of the water before placing the tub over a fire, is a common and legitimate practice—but too often much solid matter is allowed to float out with the water. However, regarded not as a means of developing orebodies, but as a means of prospecting for them, determining their boundaries and obtaining a fairly close idea as to their tenor, the churn-drilling machine is certainly a rapid, efficient, and comparatively cheap instrument.

Raw silver ores amenable to the patio process of treatment are also usually amenable to cyanidation. An exception to this rule is where the ores contain 0.2%, or so, of copper in the form of oxide or carbonate, in which case, though they may be ideal for the patio process, the copper causes such a consumption of cyanide as to make the cost of cyanidation prohibitive. Fortunately this condition of affairs generally occurs only near the surface. In many old mines where the patio process was used the lower-grade surface ores were left, ostensibly because of being too low grade to treat. It quite often happens, however, that the real reason was because these surface ores were refractory to the process, containing the silver in combination with manganese. Such ores are found to be equally refractory to the cyanide process. The cyanide process has displaced the patio process, not because it gives a better percentage of extraction, but because it is a cheaper and quicker process.

'Caterpillar' or 'paddlewheel' traction engines are being used with great success to haul heavy machinery over the sandy roads in the construction of the Los Angeles aqueduct. This type of engine, instead of having the large hind wheel commonly known, carries its weight on five truck wheels which run on a track of plow steel, so protected that it is nearly impossible for sand to reach the bearings. The hind wheels are of the sprocket type, and engage an endless belt of 'shoes' or 'platforms' which pass around the sprocket and centre wheels, 18 inches distant, the latter acting as idlers. These platform wheels have the same tractive area as an ordinary round wheel 54 ft. in diameter. Power is furnished by a 40-hp. gasoline motor using distillate at a cost of less than 1c. per horse-power hour. Loads vary from 15 to 20 tons on level roads and the cost amounts to 20c. per ton-mile for the engines against 40 to 50c. for teams.

Special Correspondence

JOPLIN, MISSOURI

Deep Runs as Oronogo.—Granby Changes Plans.—New Mills. — Spring City Mines.—Galena Ground Drained.

The most important move of the last fortnight probably was the opening of the deep levels in the Oronogo Circle mines at Oronogo. The deepest ore-level in the entire district has here been made available for working. The company began deep mining several years ago opening a 230-ft. level which was then considered deep. Later the Herald and Empire mines at Galena surpassed this by operating down to 290 ft. The Oronogo company has been drilling for several months, the drill-rig being operated from the 230-ft. drifts. The results have been highly gratifying, as ore was found almost continuously down to 385 ft., the entire thickness being workable and of high grade; in fact richer than that hitherto worked at shallower levels. Two distinct runs were penetrated, part assaying over 12% zinc, and the entire face averaging 4 to 5%. This company is starting mill No. 7, which will now make four large plants operated and give a weekly 'turn-in' of 300 tons of blende and 40 to 50 tons of galena. Another move of importance is the plan of the Granby M. & S. Co., the largest single land-owning and operating company in the district, to develop and prospect its own lands instead of following the previous policy of sub-leasing and allowing the sub-lessee to do the prospecting. The company has been draining a large area in the eastern part of the Oronogo camp, and was successful until the water was lowered to 125 ft., when several large and disastrous caves occurred and caused the work to stop indefinitely. Many small buildings were destroyed and the pumping plant was damaged. This ground was formerly extensively mined for shallow ore and the entire tract is cut up by drifts and gouges. Deep mining is to follow the draining, as the company has discovered ore at similar depths and in similar formation to that mined in the Oronogo Circle. The Granby company has also started prospecting on its land at Chitwood, where a number of holes have been sunk, and others will be put down. The land is surrounded by good producers, although little work has been done on the tract itself. The mineral occurs in open ground from 154 to 180 ft. One of the largest recent deals in the district was the consolidation of the Yale and Providence mines at Webb City whereby the Yale will be known as the Providence No. 2, and both will be operated by the same company. The Yale is southeast of the city and has a large mill on a 30-acre lease where ore is taken from two shafts at 192 and 172 ft. in depth. Many improvements are to be made in the equipment and the capacity increased. A face of ore assaying 3% and running from 12 to 18 ft. high is worked. The Providence is a large property in the north Webb City sheet-ground field and is one of the pioneers there, having a highly successful history. Prospect work continues unabated throughout the fields and many important strikes have been made recently. In the vicinity of Toms Station north of Joplin recent discoveries of importance have been made. In Leadville Hollow zinc blende of high grade has been found. Matthes Bros., southwest of Joplin, owning over 2000 acres, have begun to open two additional shafts and will operate the 500-ton mill at full capacity. The Chitwood-Dale company has taken a lease at Prosperity. On an adjoining lease the McKinley mine which has long been idle is being re-opened. The old Monday mine in the Alba camp is being re-opened by Green, Coffe & Windland. Among the new mills is the Bird Dog No. 3 at Webb City, which has made the trial run with success. It is located on a sub-lease of the rich Kansas City-Bradford mine and is one of the large mills of the camp, having a capacity of 350 tons. Gates, Madera & Sawyer have completed their mill in the south Webb City field and will be ready for operation at once. The Ave Maria mill south of Webb City has been taken over by the Nowata company, who will make a test run in order to decide if the property will longer be worked.

At Spring City, in Newton county, the introduction of gas as fuel has livened matters materially. The old Delta mine, now operated by Creech & Co., is proving wonderfully rich. A rich stope beneath the old drifts will be taken up. The lateral extent of the orebody has not been learned. Complete recovery is impossible, as hand-jigs are used. The 'crush rock' will be re-worked when the mill is built. A mill is being built on a lease recently acquired from Arthur Scott. A shaft is in ore and driving has been started at a depth of 115 ft. Sludge tables and every modern appliance will be installed. Louis Anthony, of Texas, has bought a sub-lease of Adam Scott on the Bittick land and will complete prospecting before further development. Three holes have already been sunk showing ore at 135 ft. in a disseminated formation, whereas most of the ore in this camp is of the blanket variety. A shaft will be started on one of the good holes. Calamine and lead ores at a shallow level are being widely prospected. A company has taken a lease on a portion of the Adam Scott land and is working two shafts, one 40 ft. deep, the other 50 ft. Both will be sunk to 60 ft. where good calamine is found. Hand-jigs will be used for some time, though the company is planning a mill later. The Microbe company is to re-open the 100-ton mill on the lease of the St. Paul land. A new shaft is being sunk on a drill-hole. Excellent ore has been discovered at 150 ft. in several holes, the formation being similar to that worked in the old Delta mine. A new mill is to be erected on the Rose land just south of Joplin, where three hand-jigs have been busy for a long time, averaging 5 to 6 tons of ore per day. Some of the lead occurred in huge chunks. Operations are being carried on at 165 ft., where four drifts are driven into good ore. If the lower ground proves satisfactory a steam-mill will be built.

Prospecting in the Joplin District.

The draining of the Luscombe and Sapp forties southwest of Galena has been completed and 80 acres of valuable mineral land are thus added to the Kansas field. The operating company will reserve two ten-acre tracts, subleasing the remainder to the 110-ft. level, and reserving the right to prospect and mine the entire land beneath this depth. A mill has been bought at Miami and is being re-erected. Enough ore is in sight to last for several years. The draining of these tracts, together with the unwatering of the Boston, Foster, and Playter lands, makes a large additional acreage available for mining purposes. A large

mill has been started at Cave Springs where a deposit is being worked at 110 ft., unlike that of the Herald nearby, where the ore is found at more than 200 ft. in depth. Both zinc and lead are found in the new mine. A number of drill holes have been sunk, finding ore at various depths, including deep deposits as well as shallow. Another mine in this camp, operated by Buxton, Sloan, and others, is being worked by hand jigs and good 'turn ins' are being made on ore taken from below the 75 ft. level. Below the 100 ft. level a stope will be taken up. A deeper run will be worked later. Much of the ore had to be piled up, as it could not be worked profitably on hand jigs. Two shallow strikes have recently been made near Baxter Springs, which is unusual there. Newton Cox & Co. have taken the right to mine the shallow pockets on the Baxter Royalty land and are using hand jigs to clean the ore found in a chimney 100 ft. diam. and extending to the usual 50 to 70 ft. depth. The ore is of the pebble variety, particles varying in size up to that of a walnut. A second-hand jig plant is being operated by Rhodes & Sullivan on the Catholic forty, where ore is found in open ground at a depth of 20 feet.

AUSTIN, TEXAS

Development Hampered by State Laws.—Mineral Surveys.

The exploitation of the Toyah oilfield in western Texas has developed an interesting situation with regard to the legal rights of the State in the matter of holding public land which is believed to be oil bearing. It is claimed by the men who are seeking to acquire mineral rights to certain lands in that district that J. T. Robison, the State Land Commissioner, has arbitrarily refused their applications to prospect for oil and other minerals upon the land in question on the ground that "there is no evidence in the land office that the land is apparently mineral bearing." It is contended by the men who want to prospect these tracts that the mining law does not provide that such land must be officially classified as mineral bearing before it is subject to entry for prospecting purposes, and that the Commissioner is exceeding his authority. The law provides that land containing the minerals such as kaolin, baryta, salt, marble, fire clay, iron ore, coal, oil, natural gas, gypsum, nitrates, mineral paints, asbestos, natural cement, clay, onyx, etc., shall be sold for not less than $15 per acre when situated ten miles or less from a railroad, and not less than $10 per acre when the land is more than ten miles from a railroad. One-tenth of the money shall be paid to the State Treasurer on or before 12 months from the date of purchase. The remainder of the purchase money shall be paid in nine annual equal installments with interest at 4%. The law gives the applicant to purchase land that is believed to contain oil and other base minerals 12 months in which to prospect before making any payment, during which period it cannot be sold to other purchasers. It is this provision that is evidently defective, for the reason that under it a corporation could sink wells on the land and largely exhaust the oil supply before being called on to make the first payment. It could then abandon the ground without having paid the State anything for the land or the oil.

During the period that the State had a department known as the Mineral Survey a considerable part of the mineral region of western and southwestern Texas was mapped and classified under the direction of William B. Phillips. The legislature failed to make appropriation for carrying on the important work of this department and it passed out of existence. There is still a big territory which is believed to be mineral bearing that has never been classified. Under the ruling of Mr. Robison no prospecting can be conducted upon this land, simply because it has not been classified as mineral. Considerable attention is now being given to the mining of silver, copper, and zinc ores in the upper Rio Grande border territory, but these operations are all confined to private lands. The tin deposits near El Paso are also attracting attention. It is stated that another effort will be made at the coming session of the legislature to enact a new mining law that will encourage the development of the State's vast mineral resources.

JARBIDGE, NEVADA

Work Being Resumed. — Pick & Shovel. — Pavlak.—Buster. — North Star.—Jarbidge-Vulcan.—Bonanza Gulch.

Not much change in the Bourne or North Star company property has occurred, and the inactivity at this mine and consequent lack of results has had a depressing effect on the general public as far as Jarbidge properties or stocks are concerned. It has been extremely difficult to finance any property and consequently for a time there was little or no work done. Finally the Pick & Shovel Co. management changed and a little work was started under the charge of W. W. Scott, of Eureka, Utah. This has resulted in finding good ore and has encouraged the company to increase the working force and begin at other points. The Pavlak company, under the management of Sidney Coburn, has been carrying on a system of development which promises to place the Pavlak property first in line as a mine. A cross-cut is being driven from the mine east into the mountain to cut the Pavlak lode below the shaft. This is expected to cut the vein at a depth of over 300 ft. in a distance of 400. The cross-cut is now in 100 ft. and is within a few feet of another mine known as the Taft lode. Numerous stringers of quartz, talc, and iron have been cut, which are supposed to be feeders of the Taft vein, and as these stringers assay from a few dollars to nearly one hundred per ton, it encourages the management to believe that the Taft vein may have real value. The same company has four sets of lessees at work along the main vein, two south of the shaft and two north of it. The two south of the shaft have found good milling ore, but no high grade, and have consolidated their interests. Mr. Boylan has gone out to finance a small leasing company to properly develop the ground and put a small mill up to treat the ore. The lessees north of the shaft have been more fortunate and have some high-grade ore; in fact, the block north of the shaft promises to make the first shipment of high grade from the camp. Here they have stripped the vein the full 300 ft. across their lease and for 200 ft. have a narrow streak of high-grade ore from one to three inches wide along one wall that pans well. A series of twelve samples from this streak gave assay returns of $316 and $844 per ton.

Just north of the Pavlak ground and between it and the Bourne is the Buster group of claims which has been taken up by the same brokers who financed the Pavlak company. This property has a fine showing with a dike outcropping for 600 ft. in length up the hill-side. This company will also start a cross-cut from near the river and run about 150 ft. to the vein, then turn and run with the vein. The quartz on the surface is from a few feet to 30 ft. wide and shows small amounts of gold both in the pan and by assay. On the North Star property one of the lessees has resumed work and has six feet of vein matter which assays from $8 to $20. Clark and Fletcher have secured a lease on 600 by 600 ft. on North Star No. 3 claim, beginning 20 ft. from the face of the Bourne adit. This is a promising piece of ground, and the men are mining men who have both money and backing. The Jarbidge-Vulcan Mining Co. has secured the services of G. L. Snyder, of Denver, and proposes to develop its ground, lying up the mountain some distance east of the Pavlak and Buster. The vein where exposed on the surface carries small amounts of gold and there is rich float below it, which is believed to have come from some part of the vein now covered with slide rock. Large quantities of rich float are found on the ridge south of Bonanza Gulch. This ground lies south of the Pan and west of the Shovel claim. Several owners of claims along the ridge are trying to find the vein or veins from which this float comes. Some think it all comes from the Pick & Shovel lode, but there seems to be too much of it and it does not appear to be the same as any yet found on the Pick & Shovel. A Tacoma, Washington, company has bought a group of claims on the west side of the river and west of the lower end of town, about halfway between the river and Deer creek. These were known as the Blake group and were bought for cash. A 1000-ft. cross-cut connecting with a 250-ft. shaft is to be driven. Several large lodes which

pan well at the surface are present. Theodore Parks has moved his whole outfit up the river four miles to begin work on the Good Luck group. The Twin Falls Free Gold Mining & Milling Co. has just sent in an outfit to begin work on the Free Gold group of ten claims five miles up the river. There is a belt crossing this property which is in places 100 ft. wide and gold can be found by panning all along. The vein is the same that crosses the Jarbidge Wonder property. Just above the Free Gold on a parallel vein higher up the mountain and to the east, the Big Four company is preparing to start work. About two miles farther up the river near what is called 'the Forks' some rich float has been found and one vein opened that yields assays of $30 to $40 per ton.

MEXICO

Nueva Luz, Guanajuato. — Amparo, Jalisco. — Seguranza y Anexas. — Power Plant for Northeastern Sonora. — Yaqui River Smelting.—Zinc Mine at Cananea.— Fomento Laboratory.

A large shipment of new machinery recently ordered by Carl Henrich, manager of the Nueva Luz mine at Guanajuato, is on the way. This includes pumps adequate to handle 400 gal. per minute in three stages, from a depth of 2000 ft. There are three triplex pumps of 100 and 300 gal. respectively, driven by two-speed motors of 30 and 100 hp. Over 2400 ft. of transmission wire has been ordered from Siemens-Schuckertwerke to transmit power to the pumps. This company is now receiving financial assistance from the Government on the subvention granted for sinking the shaft. The work was recently inspected on behalf of the Government by M. Alcalá and J. Flores. The work was examined to a depth of 570 metres. The temperature is increasing rapidly. At 435 metres it is 103½° Fahrenheit.

The annual report of the Amparo Mining Co. of Philadelphia, operating in the Etzatlán district, Jalisco, Mexico, shows that the profits for 1909 amounted to ₱668,537.68, and that ₱600,000 were remitted to the Philadelphia office for the payment of dividends and the maintenance of a reserve. The dividends amounted to more than $250,000 gold. The total revenue in the year was over ₱1,500,000. The 50-stamp mill was in commission 344.69 days, crushing 63,398 tons of ore; the bullion and concentrate produced had a value of ₱1,400,017.36. High-grade shipments during the year netted ₱44,048. The cost per ton of ore for mining, milling, and marketing, with general expenses added, was ₱11.24. The company secured a profit of ₱2398 from its Embocada ranch and ₱14,600 from its general store. The ore blocked above the 700-ft. level at the close of the year was estimated at 360,000 tons, and the probable ore below that level at 350,000 tons. There is an old dump of approximately 50,000 tons. The company has ordered equipment that will increase its reduction capacity 100 tons per month. The mill is now treating on an average of 5500 tons per month.

The districts of Etzatlán, Hostotipaquillo, and others in the State of Jalisco have been seriously retarded in their development by the failure of the Compañia Hidroelectrica é Irrigadora to complete its installation and bring in power from the San Lorenzo river. The indications now are that the work will be finished in October. The power company is paying forfeits to the mining companies with whom it was under contract to supply power.

The new cyanide plant of the Seguranza y Anexas at Zacualpán is nearing completion. This will place that company in a position to become an important producer. At the annual meeting the other day the old board was re-elected with the exception of J. C. Doty, who retired in favor of Edwin L. Cole.

A large power-plant is under contemplation to supply the Lucky Tiger and other mines in northern Sonora. The works will probably be near Colonia Morales, on the Bavispe river, although there has been some talk of establishing them at Douglas, Arizona. A meeting was held the other day at Douglas to consider this project, at which were present L. R. Budrow and D. L. H. Forbes of the Lucky Tiger, Walter Douglas of the Copper Queen, John Langton, and E. Gybbon Spilsbury. The plant intended not only to supply power for the operation of the mill put up for the treatment of Lucky Tiger silver and gold ores, but also for the Cinco de Mayo, the Roy, and others. It is also contemplated to supply power for the operation of an electric line to haul the concentrate and high-grade ore from the Tigre district to Izabel, there to connect with the Phelps-Dodge railroad from Nacozari to Douglas.

About 35 men are working on the Montenegro Mining Co.'s property, six miles northwest of Nacozari. A shaft is being deepened to the 600-ft. level. The ores contain gold and silver. W. J. Mortell is manager. The Badger Mining Co. recently shipped 200 sacks of ore from its property, near the old Oso Negro mine. Gold and tellurium have been found in a 7-ft. vein of the old Waldorf mine in the Moctezuma district. The vein runs a long distance and new denouncements have been filled covering it for a length of 2400 metres. Announcement is made that the custom smelter of the Yaqui River Smelting & Refining Co. at Toledo will be blown in before the end of May. The successful operation of this smelter has been made possible by the construction of the Yaqui River branch of the Southern Pacific of Mexico to Tónichi. The plant has been thoroughly overhauled during the last few months. Pumps placed in commission several weeks ago to unwater the shaft of the Creston de Cobre mines have completed the work, and development is being resumed.

The Calumet & Sonora Mining Co. near Cananea has opened rich lead-zinc ore on its 400-ft. level averaging over 80% mineral. Twenty feet have been cut in the drift. Where first found the ore was 11½ ft. wide, and is now much wider. An additional boiler is being added to the mine equipment, and a new blacksmith and machine shop is being erected near the shaft. At the mill a new jig has been installed, also two Deister tables, one Wilfley table, and a grinder. The additional equipment will increase the output of the plant 40%, or will make the capacity 115 tons of concentrate per day. The shipments amount to about 250 tons of concentrate per week. The lead is shipped to Germany, while the zinc goes to the smelter at De Pue, Illinois.

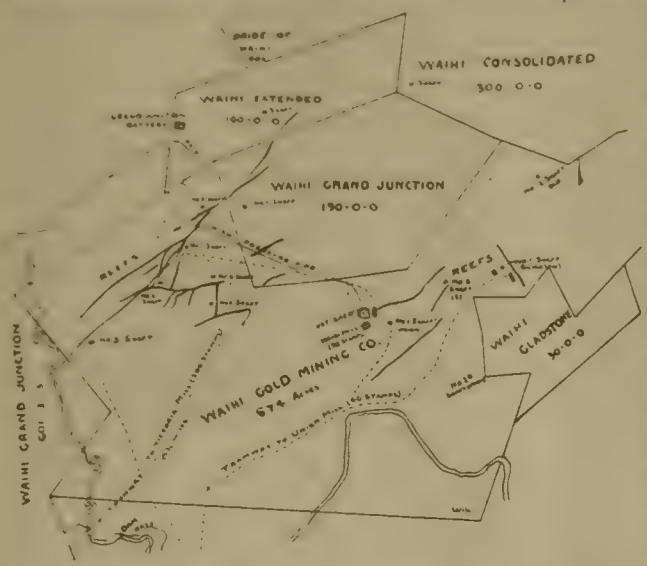
The Department of Fomento has broken ground for the new building, which will be its future home, on the northeast corner of the Avenue Cinco de Mayo and Betlemitas street. This building will include a large testing laboratory, the finest in the Republic.

LONDON

Royal Commission on Safety of Miners. — Conditions in State Quarries.— Waihi Output and Improvements.

There have been in Great Britain several Royal Commissions on safety in coal mines, and indeed one has been sitting now for three years. Another which is to devote itself to the health and safety of persons employed in metalliferous mines and quarries is about to be organized. The minute appointing the Commission issued by the Home Office is, as often happens in an official document, a trifle vague; I do not know whether the adjective 'metalliferous' refers to quarries as well as mines, but I suppose it does not. Metalliferous mines and quarries, with the adjective qualifying both, are not as extensive industries in Great Britain as are coal mines. The chief metalliferous mines nowadays are the ironstone mines in North Yorkshire and Cumberland, and the chief metalliferous quarries are the ironstones occurring in the oolite in Lincolnshire, Northamptonshire, and other east-midland counties. To our own circle of readers Cornish tin mining is the most important metalliferous mining industry of Great Britain, but it is a comparatively small employer of labor. Copper mining is practically negligible, and lead and zinc mining is restricted to small operations in Wales, Derbyshire, and Northumberland. Among the members of the new Royal Commission are R. A. S. Redmayne, chief inspector of mines, and R. Arthur Thomas, of Dolcoath. I take it for granted that general quarrying is included in the scope of the Commission, for R. T. Jones, secretary of the North Wales Quarrymen's Union is on the Commission. The slate quarries of

Wales are in a poor way having never recovered their foreign trade after the disastrous strike some years ago Owing to the absence of a protective tariff, French slates are found in use for building purposes not far away from the British quarries Great Britain also has some excellent granite quarries notably in the north of Scotland, Leicestershire, and Cornwall, but the Government, when building naval works, usually goes to Norway for the granite, much to the disgust of the British owners The new Commission is welcome, for it will help to elucidate a much debated subject, that is the health of miners and quarrymen Since the new law came into force saddling employers with full liability for accident and disease incident to the occupation, disputes have arisen concerning the causes of disease, especially among the Welsh quarrymen. The men blame the dust and fumes of explosives and the employers blame the unsanitary habits of home life on the part of the men. It must be confessed that the men have not been educated to the advantages of fresh air in their homes, and that they seldom ventilate their houses, all of which is not calculated to counteract any unhealthiness of their occupation. As the Commission contains representatives of both masters and men, this subject, among others, will receive full debate and consideration.



Mines at Waihi, New Zealand.

The yearly production of gold and silver at the Waihi, the premier mine of New Zealand, has increased steadily with never a break or setback since operations were started in 1890. The yield for 1909 was 190,912 oz. gold, 1,414,367 oz. silver, obtained from 416,813 short tons, dry weight, and selling for £959,594. The total production to date has been worth £8,180,218, and the total dividends have been £3,810,548. The mining, milling, and development costs during 1909 were £363,851; in addition £36,151 was spent on new plant, £36,963 was allowed for depreciation, and £40,778 has been allocated to the fund for providing electric current as described later. The dividends for the year absorbed £485,161 or 90% on the nominal capital and £38,845 has been provided for income tax. The mine contains a number of lodes, as described in A. M. Finlayson's article on Waihi in the April issue of *The Mining Magazine*. Of the ore mined during 1909, the largest proportion came from levels 7 and 8 on the Martha lode, the amount being just over 200,000 tons. The Royal lode yielded 74,818 tons, the Welcome 48,407 tons, the Empire 45,304 tons, and the Edward 38,430 tons. The reserve on December 31 was estimated at 1,335,586 tons. The metallurgical equipment comprises 330 stamps and 15 tube-mills. The plant is divided into three separate mills, the Waihi with 90 stamps and 4 tube-mills, the Victoria with 200 stamps and 10 tube-mills, and the Union with 40 stamps and 1 tube-mill (the latter put in commission during August last). As mentioned above, the company has a scheme on hand for generating electricity at Hora Hora rapids, 50 miles away, and a license has been obtained from the Government to erect a plant of 10,000 hp capacity The Waihi forms an excellent example of the occasional idiocy of English shareholders For some unknown reason, some of them take a delight in opposing and criticising For instance, at present, some have opposed the scheme for utilizing the Hora Hora falls, and say that profits should not be allocated for this purpose There was not the ghost of a reason for their arguments, and the agitators had no knowledge of their subject The fact is that the directors do not see fit to worry about stock exchange business.

NEW YORK

Government Injunction and Speculative Market. — Copper Production.—Guggenheim Dividends.—Heinze and United Copper.—San Cayetano.—Nipissing. — United Verde.

Market conditions in the East were felt to be improving, the general public was firm in the belief that, with the placing of large blocks of railroad bonds abroad, higher prices were to rule; in fact, everything was in readiness apparently for a strong upturn, when the action by the Federal Department of Justice, in securing an injunction against the leading railroads of the West, prohibiting them from increasing freight rates, caused a hasty abandonment of all market plans and precipitated a wave of liquidation that carried the market almost to the point of demoralization. No action by the present administration has been so much discussed or felt to be so radical. At the moment the underlying effort of the market is to regain its equilibrium, to get its bearings after sustaining a hard blow. There is a noticeable absence of any attempt to discredit the administration by questioning of motives. The entire sincerity of the Government's action is evidently admitted; how far reaching its effect may be is another question. Such summer campaign plans as may have been laid are evidently abandoned and a struggle for real regulation of the railroads is already launched. Stagnation already holds the issues not being liquidated, and after such selling movement shall have fully run its course a longer period of inactivity must ensue. The copper situation is not improving as much as was hoped. Exports for the month were 41,664,000 lb. which, while an increase over April export of 26,124,000 lb., does not indicate any marked improvement in the forthcoming figures of the Producers' Association. Butte production, it is true, shows a slight decrease, but some of the porphyries are known to have broken all previous records in the matter of output. The Phelps-Dodge properties and the Calumet & Hecla are not crowding production, the latter is now outputting about 5,500,000 lb. per month, or at the rate of 65,000,000 per annum, and is earning about $30 per share. The last quarterly dividend was $8 per share and the current dividend which is to be declared within a few days will probably be something less; $6 per share is expected. While the Butte production shows a slight decrease this is more to be attributed to the recent changes made in the camp than to any definite attempt to lessen production. Figures on the Nevada Consolidated production are not as yet available, but it is understood that the company made more copper than in any single previous month. Utah Copper output for May was 7,902,643 lb. Dividend declarations have been made by the entire group of Guggenheim companies. The Guggenheim Exploration Co. is paying 2½%; the Yukon Gold Co. 10c. per share; the American Smelting & Refining Co. 1% on the common stock and 1¾% on the preferred; Nevada Consolidated 37½c. per share; Utah Copper 75c. per share; Cumberland-Ely 10c. per share. It is worth noting that some of these payments may be paid out as dividends four times before reaching the pocket of the individual stockholder. Practically all of the Cumberland-Ely dividend will go to Nevada Consolidated; half of Nevada Consolidated's disbursement goes to Utah Copper; the Guggenheim Exploration Co. owns a large

holding in Utah Copper, so that it may be seen that a large part of the Cumberland-Ely profits will be paid out three and four times as dividends before reaching the 'ultimate consumer'. F. Augustus Heinze is to be counted on to do the unexpected and the sensational. During the recent court proceedings, when Mr. Heinze was on trial for alleged misuse of the funds of the Metropolitan National Bank, every effort was made to get at the inside history of United Copper, and to get some kind of an inventory of its assets, but without avail. Now that the fight is over and Heinze free, until further cases pending against him are brought to trial, he springs a surprise on the United Copper shareholders by giving them a rough inventory of their holdings. Mr. Heinze lists as United Copper assets: practical control of the Ohio Copper Co.; $75,000 par first-mortgage bonds of the Ohio Copper Co.; control of the Stewart Mining Co., of the Coeur d'Alene, held through the Montana Ore Purchasing Co.; two-thirds of the capital stock of the New York & Pittsburg Coal Co., which owns about 10,000 acres of coal land in Pennsylvania, figured to contain coal worth $17,940,000 net; there are some miscellaneous properties in Montana, including the Basin Reduction Works, and an undivided half interest in 540,000 acres of timber land in northern British Columbia. Mr. Heinze promises that, as soon as he can gain possession of the United Copper books, a complete financial statement will be issued and a plan for re-financing the company will be submitted to the shareholders. The Ohio Copper Co. must now be counted as one of the producing porphyries. For the quarter ended March 31, Ohio shows a net profit of $21,670. The ore now being handled is probably lower in average copper content than that of any of the low-grade milling coppers, as it runs but about 14%. On this grade of ore, however, the management claims to show a net of 75c. per ton on the present copper market. The last of the Ohio Copper bond issue, some $754,000, is to be sold; of this amount about $500,000 will be utilized to take care of outstanding obligations, while the balance will be expended in the completion of the last two units of the mill. The increase in the capital stock of the Ray Con., for the purpose of absorbing the Gila Copper Co., has been authorized by the special meeting of the shareholders, and the holders of Gila are now notified that exchange will be made up to July 1, on the basis of one share of Ray for three shares of Gila. The special meeting of the San Cayetano Mines, Ltd., was held this week and the proposed increase in the capital stock from $250,000 to $1,500,000 was authorized by the shareholders. Active development of the San Cayetano property at Guanajuato, by the Lewisohns, who control it, is expected, as soon as the financial plans, following upon the increase in capital stock, are completed. The work of overhauling the Yellow Jacket mill and re-opening the mine in Lemhi county, Idaho, has been begun by J. B. Hastings, who is in charge. The Yellow Jacket property has lain dormant for some years, being tied up in the estate of the late John E. Searles of the American Sugar Refining Co. The property was recently taken in hand by the Proprietary Mines Company of America and vigorous development of the immense low-grade orebodies is to be prosecuted under Mr. Hastings' management. A special meeting of the directors of the Nipissing Mines Co. has been called for next week, and it is expected that an interim dividend of 10% will be declared and paid; this will call for a distribution of $600,000, in addition to the regular quarterly dividend of 5% and 2½% extra, which will be declared at the regular quarterly meeting held later in the month. The payment of this interim dividend is made because of the assurance of large income from the present ore reserves, increased by the recent discovery of several large veins, and also because the company has a rather unwieldy surplus of about one and a half million dollars, which the management feels should be distributed to the shareholders, in view of the large earnings certain to be made within the next few months. The spirit shown in this regard ought to go far toward redeeming Nipissing from the stigma under which it has labored since the days of the Hammond-Guggenheim episode, when the collapse in the shares gave Cobalt a setback from which it has never fully recovered. W. A. Clark has not retired from the copper world, as is evidenced by his drawing this week his regular monthly dividend of 75c. per share on practically all of the stock of the United Verde Copper Co. There was quite a little interest created, some weeks since, by the sale at auction in New York of 500 shares of United Verde. The stock was evidently purchased at what was thought to be a bargain price by some speculator, who has since been busily engaged in trying to get his money back by loan or sale, and who has been greatly surprised to learn that, inasmuch as Mr. Clark refuses to make any bid for this block of stock, he has no market on which to sell or to give the shares a collateral value. Whether good, bad, or indifferent, the investment is plainly a permanent one, unless the recent purchaser takes his way back to the auction room, now as a seller instead of a buyer. Greenwater Copper Mines & Smelters Corporation is a concern into which a great number of Greenwater promotions were merged. It represents the investment of hundreds of thousands, and, since Greenwater has been abandoned as a mining camp, the company now has as its only asset a cash fund of some $240,000, the remnant of several times that sum. A fight for the control of the treasury has recently developed.

BUTTE, MONTANA

Anaconda Output.—May Production. — Butte Reduction Works.

The smelters of the Anaconda Copper Mining Co. are being operated to full capacity, which does not indicate any intention of shutting down mines or curtailing production in the Butte district on account of alleged overproduction and inability to compete with the so-called low-cost producers. The Washoe smelter is producing copper at the rate of about 18,000,000 lb. per year, the Great Falls smelter between 7,000,000 and 8,000,000, and the East Butte, including the copper from custom ore, about 1,000,000. The Clark smelter produced, including the Clark product and that of the Tuolumne company, about 1,500,000 in May. The total production of various companies in May was:

Companies.	Copper, lb.
Boston & Montana	8,200,000
Anaconda	8,000,000
Butte Coalition	3,040,000
North Butte	2,280,000
Original	1,190,000
Butte & Boston	1,100,000
East Butte	800,000
Trenton	770,000
Butte-Ballaklava	558,000
Tuolumne	500,000
Parrot	340,000
Miscellaneous	325,000
Total	27,978,000

The Anaconda Copper Mining Co. has taken possession of W. A. Clark's Original and Stewart mines in the Butte district, which were recently purchased. The formal change of ownership took place immediately after midnight on May 31, and the miners went to work under the new ownership the following night, after which all ore that was mined was shipped to the Washoe smelter at Anaconda. The smelting department of the Butte Reduction Works will be run for three weeks or a month on the ore on hand and in cleaning up the old plant, after which it will be closed. The concentrating department, which has been leased back to W. A. Clark, will continue to operate on the Clark and custom zinc ores. The smelting department will not be dismantled and the furnaces will remain intact. Connections will be made between the Original and Gagnon mines, and it is anticipated that eventually but one of these shafts will be used for mining, and that the old incline shaft on the Gagnon will be abandoned when the new Gagnon vertical shaft is completed. The latter is 1000 ft. distant from the old shaft and has reached a depth of something more than 700 ft. How the closing of the Butte Reduction Works will affect some of the independent mines which have been shipping to that smelter is not known. The Tuolumne company and the Keating Gold Mining Co. have been sending their ore there.

General Mining News

ARIZONA.

COCHISE COUNTY

The Black Diamond Mining & Smelting Co., which owns a group of claims in the Dragoon mountains, is to resume operations after an idleness of two years.——There are 100 tons of ore on the dump at the Swain property that will average 25 to 30% lead, and 5% copper, with some silver and gold.——The water is being lowered slowly in the Tombstone Consolidated, and it is thought that the work will be completed by the end of summer when the old drifts will be retimbered and the stopes opened.——The west drift from the bottom of the shaft at the Whitetail group, in the Paradise district, is in ore assaying 10% copper.——Work is to be resumed this month on the Bradshaw Arizona group in Round valley.——The flow of water in the south drift of the Mary property at Courtland is still so heavy that the company has not resumed work in that portion of the mine. The work of prospecting the Silverton with a diamond drill from the Mary workings is still being carried on.

GILA COUNTY

(Special Correspondence).—A stringer opened by a cross cut on the 660 ft. level of the Williams shaft in the east part of the National Mining Exploration property has been shown by 100 ft. of driving westward to be fully 30 in. wide. The copper content of the ore is increasing with development, due largely to the association of considerable copper glance with the carbonate.——The property of the Cole Development Co., including 17 claims, situated 20 miles west of Globe, has been taken under bond by the Little Miami Copper Mines Co., which was recently organized with headquarters in New York. The purchase price includes a cash payment distributed over several months and 75,000 shares of Little Miami stock, recently listed on the New York exchange.——A 60-day option on 20 claims, owned by the Dixon Copper Co., and situated 10 miles west of Globe, has been taken by John O'Keeffe, of El Paso, who is said to be acting as representative of Pittsburg capitalists. The agreement provides that if the option is exercised, the purchasers shall organize a development company capitalized at $3,000,000, with stock at $1 par, and turn over to the owners, in addition to a small cash payment, 750,000 shares of the new company's stock.

Globe, June 4.

PIMA COUNTY

An average sample of the ore taken from the New Gold Discovery mine, six miles southwest of Tucson, gave 15% lead, 14 oz. silver, and $8 gold per ton.

PINAL COUNTY

F. S. Hoyt, superintendent for the Superstition Mountain Mining Co., has joined J. W. French in the development of a group of claims one and a half miles northwest of Florence. A recent sample sent to the El Paso smelter netted $6.30 per ton. A 25-hp. gasoline hoist, compressor, and drill, are to be installed at the La Coronado mine, in the same district, an order for the machinery having been placed with Fairbanks, Morse & Co. The shaft is now down 260 ft., and the new equipment will enable the company to sink to the 500-ft. level by which time it is thought the sulphide ore will be opened.

YAVAPAI COUNTY

The shaft of the Commercial Mining Co., in the Copper Basin district, is now down 100 ft., the main efforts of the company being centered at this point.——John Malm is inspecting the plant of the Rigby Mining & Smelting Co., at Mayer, with the idea of remodeling the smelter and installing the Malm process as worked out in the test-plant at Denver.——The vein in the face of the drift at the Independence mine, in Chaparral gulch, is over 5 ft. wide, and assays about $9 per ton. A cross-cut is soon to be started toward the Little Jack vein which will be opened at a depth of 80 ft.——A new pump is to be installed at the Jerome Verde copper mine, near Jerome, as the flow of water in the bottom of the shaft has been extremely heavy lately. A contract has been closed with the Arizona Power Co. for power to raise the water.——A wagon road is being graded from the Pacific copper mine to Harrington, and when this is completed the company will install a large hoist and air compressor. There is a good showing of copper ore on the group and it is the intention of the operators to commence shipping to the Humboldt smelter at an early date.

YUMA COUNTY

Plans are being considered by the Clara Consolidated Mining & Smelting Co. for the construction of a sampler at Parker to handle the siliceous ores tributary to that district. These ores are necessary to flux the Clara Consolidated ore and have been found in a number of properties in the Parker district.——L. A. Dunham, who recently secured a bond on the Horn mine, south of Parker, has started a cross-cut adit that will tap the ore in about 400 ft., and is installing machinery to hurry the work. About 1200 ft. of development has been done on the property opening some good ore.

CALIFORNIA

AMADOR COUNTY

The 10-stamp mill being erected at the Monte de Ora mine, near Plymouth, is nearly complete and will commence crushing the ore about the middle of this month. The mine, which is operated by A. P. Morgan, has been well prospected and a large amount of good milling ore opened.——The conditions at the Keystone Consolidated have not changed and there is no prospect of an early resumption of activities.

BUTTE COUNTY

The weekly clean-up of the dredge of the Butte Creek Consolidated Dredging Co. last week amounted to $4700, the week before being $2800. The dredge is now working upstream, and is reported to be in a good grade of gravel.

EL DORADO COUNTY

The drift at the Last Chance mine, at Coloma, which has been operated for the past year by Albert Shafsky and L. N. Stricker, is in fair looking quartz and it is thought by the operators that a pocket for which the mine is noted will be opened in a short distance.——The Rising Hope gravel mine is being thoroughly prospected by J. R. Partridge and G. W. Englehardt.

INYO COUNTY

An adit is being run at the Golden Siren claims at Gold Storage to tap the shaft at a depth of 135 ft. C. D. Adamson, of the Golden Siren company, has staked several other claims in the same district, and will probably organize a company to build a mill that will crush the ore from both properties.——Recent work at the Casa Diablo mine, 20 miles north of Bishop, has opened some high-grade ore and the 30-ton mill has been kept busy night and day. The company is planning to install new machinery that will bring the capacity up to 100 tons per day. C. A. Fohrman is manager.——On a recent lot of ore from the Yucca mine, at Darwin, run through the old Coso mill, the clean-up amounted to 59.7 oz. gold, 18.8 oz. silver, and several tons of concentrate that assayed $294 per ton. The Yucca is one of the newer properties in the district being 1½ miles from the old Coso, and has only been opened to a depth of 160 ft. with a small amount of work on the vein.——Two shifts are now working on the property of the Wilshire Bishop Creek Co., and the water has been lowered below the second level which is 290 ft. from the surface. The compressor and pipe-line which were damaged by a snowslide last winter have been repaired, and the pump will be lowered to the second level preparatory to resuming work there.

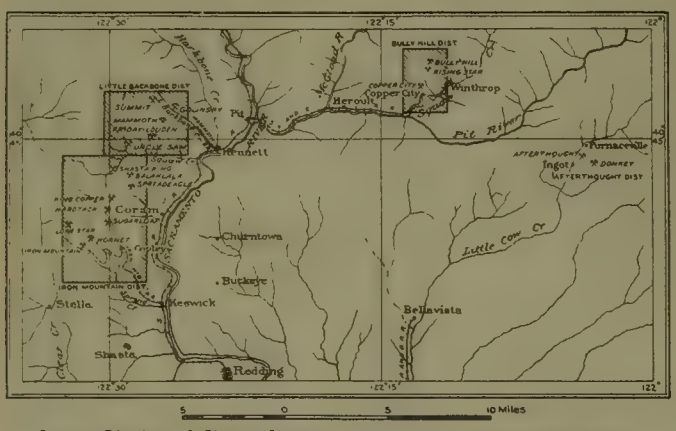
SHASTA COUNTY

The Evening Star mine, in the Old Diggings district, which was taken over recently by German capitalists, is shipping about 400 tons of ore per month to the Mammoth smelter.——No definite settlement has been made in the case of the Forest Service against the Bully Hill Mining & Smelting Co., at Winthrop, and it is reported that the smelter will be shut down on July 1. The smelter is situated in a district where there is neither timber nor agricul-

tural land to injure, but if the Government persists in its efforts against the company, the plant will be closed and the ore forwarded to the Coram or Mammoth smelter. Until recently the Bully Hill smelter had not been involved in the smoke troubles.

SIERRA COUNTY

Charles R. Thompson, who has a bond on the Young America mine, near Sierra City, is at the property with a party of engineers and it is reported that operations will



Copper Districts of Shasta County. (After Graton, U. S. Geol. Survey.)

be resumed on the group. The mill which crushed the ore from the upper levels was partly destroyed by fire a few years ago and has never been re-built.

SISKIYOU COUNTY

Preparations have been made to resume work at the Yellow Butte mine, 12 miles east of Weed. The company owns 320 acres of patented land where a shaft has been sunk on the vein to a depth of 350 ft. opening several bodies of chalcopyrite ore containing gold and silver. In all there has been done about 1000 ft. of development. L. D. Ball is manager.

TRINITY COUNTY

(Special Correspondence).—About all of the smaller hydraulic mines are preparing to make their clean-ups as this season is shorter than usual. The La Grange and Union Hill mines will run for some time yet.——An important mining deal has been made by the bonding of the Fields Consolidated Quartz & Placer mines to a syndicate of French capitalists who have had their representatives on the ground and found everything satisfactory. The holdings consist of 400 acres of quartz and timber locations with several quartz veins assaying from $7 to $18 per ton, and 1152 acres of gravel which pans from 14 to 25c. per cu. yd. The water rights take in the north and south forks of Indian creek and a head of 3000 in. of water for nine months in the year is available. The present ditch will have to be extended about ten miles to reach the gravel which has heretofore been unworked for lack of water.

Weaverville, June 6.

A contract has been let to haul the 600 tons of machinery for the new mill being erected at the Headlight mine, at Carrville, from Delta to the mine. When completed the mill will contain 40 stamps.——The Trinity River Mining Co.'s tunnel, a mile above Lewiston, is still occasioning considerable trouble by leaking. The company will place a cast steel pipe 8 ft. in diameter for 100 ft. at the lower end of the tunnel in an effort to control the flow.

TUOLUMNE COUNTY

(Special Correspondence).—The force at the Grizzly group of mines, near Tuolumne, is being increased and henceforth will be divided into three shifts.——The new 5-stamp mill at the property of the Phoenix Lake Mining Co., near Confidence, has been started.——Machinery is being installed at the Potato Ranch gravel mine, near Phoenix lake, and the property will be worked on a larger scale than at present.——Twelve men are employed at the Clio cleaning out a drift and making other necessary preparations for the resumption of operations.——A pack-train is bringing ore from the Nervi mine to the Golden Era mill.——Operations are soon to be resumed at the Longfellow mine and the shaft will be sunk to 1000 feet.

Tuolumne, June 4.

George Grant and G. W. Rowse, who have been developing the Old Dominion property near Columbia, opened a shoot of high-grade ore in a cross-cut from the main drift, the vein being about 4 ft. wide. The Dutch mill is running steadily crushing 100 tons of $20 ore per day.——It is reported that the App shaft is to be sunk another 300 ft. from the present working which is 1300 ft. below the collar of the shaft.——The property of the Pereira Mining Co., near Jamestown, was unwatered a few days ago and examined by P. Koppen, president of the company, and M. O'Brien, of San Francisco.——A contract has been let to sink the shaft at the Karnac another 50 ft., which will take it to the 160-ft. point, where a cross-cut will be run to the vein. The vein at a depth of 100 ft. shows 2 ft. of high-grade ore.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence).—It is stated that work will soon be put under way on the Buchanan mine, situated on Leavenworth mountain, at Georgetown. The property was a former heavy producer of high-grade ore.——J. W. Crandall, leasing through the Scepter adit 2800 ft. from the portal, has opened in a stope on the Astor vein a streak of ore 12 in. wide that assays from 300 to 500 oz. in silver per ton, with from 15 to 20% in lead. Shipments are to be started next week.——A. L. Stephens, manager for the Homestake Gold Mining & Milling Co., will award another contract during the coming week for the driving of the Homestake adit another 100 ft.——A contract will be awarded in a few days by G. W. Boyce for the sinking of the shaft on the Anamosa vein another 200 ft. This shaft is being sunk from the Rochester adit level, 1200 ft. from the portal.——Work of construction on the new 100-ton mill for the Conqueror Mining & Milling Co. is well under way. W. S. Pryor, the manager, expects to have the plant in operation within 60 days.——A 40-hp. boiler and a 30-hp. double-friction hoist has just been placed in position at the shaft of the Jersey Blue Mining Co., situated in Daily district.——A dam is being constructed by the Bard Creek Mining Co. for storage of water to generate electric power. N. Nelson is manager.

Idaho Springs, June 4.

GUNNISON COUNTY

Henry Cole and associates who are operating the Gold King mine at Sillsville shipped a carload of ore recently that assayed 3½ oz. gold per ton.——The mill at the Maple Leaf is reported to be making a good saving both on the plates and the tables, and the operators are preparing to sink the shaft to the 1000-ft. level.

LAKE COUNTY

Work has been started by the construction crew of the Denver & Rio Grande railway on the lower side of the track that is to connect with the lower shaft of the A. Y. & Minnie property in California gulch at Leadville. As soon as this switch is completed hoisting through this shaft will be started. Formerly this shaft was used for pumping but with a little improvement can be adapted for hoisting. In the meantime the work of repairing the buildings that were destroyed by fire a short time ago is being carried forward and new machinery has been ordered to replace that which was too badly injured to set up again.——William Jones, who opened a large body of zinc ore on the 225-ft. of the Robert E. Lee mine last season, has opened several stopes and will ship a carload of ore per day.——James E. Condon and associates who are operating the Fraction property on Fryer hill are hoisting waste from the 250-ft. level and cross-cutting to open the orebody that was worked in the levels above.——Two sets of lessees are working at the old Dunkin mine.

OURAY COUNTY

The Camp Bird mine is working a larger force at present than it has for some years and will soon add to this to carry on the extensive development outlined by the management. The mill at the Revenue is being remodeled and new living quarters erected. The company is now working 150 men and expects to add 100 shortly.——The San Antonio, at Red Mountain, was opened the latter part of May and shipping resumed.——The connection between the drainage adit at the Calliope and the old workings has been completed and mining operations started in the stopes.

SAN JUAN COUNTY

The W. B. Lowe Mining & Milling Co., which purchased the Yukon group of claims near Silverton last November, is preparing to open the property on a large scale, and is now grading for the foundation of a compressor and power plant. The property is developed by two long adits, one of which is now in 2600 ft., having cut a number of veins containing gold, silver, copper, lead, and zinc. This adit obtained a vertical depth of over 1400 ft. The mine is equipped with a 100 ton mill and is expected to become a big producer this season.——The Danville Mining & Milling Co., operating in Cunningham gulch, commenced shipping for the season by forwarding a car of ore to the Durango smelter. The company is now working 26 men.

TELLER COUNTY

An orebody from 8 to 12 ft. wide has been opened on the 600 ft. level of the El Paso mine by the sub-lessees, Edward Carey and Homer Trees. The ore was cut by a raise and will average $30 per ton.——Ward & Hill, lessees of the Pharmacist mine on Bull hill, are shipping 100 tons per week of ore that assays about $20 per ton.——The third unit of the Portland Gold Mining Co.'s new mill was placed in operation a few days ago, and is now running eight hours per day. The capacity of the unit is 100 tons per day, and this amount will be put through the mill as soon as the machinery is running smoothly.——Charles Crowder has secured a lease on a portion of the Burns claim of the Acacia Gold Mining Co., and will open the ground from the eighth level of the South Burns shaft. The block is in new ground and extends to the fourth level of the old Burns shaft which has a production record of over $1,000,000.——A shoot of high-grade ore which is reported as the richest ever opened in the property, has been found on the 1400-ft. level of the Golden Cycle mine.——A company of local operators has secured a lease on the Hoosier mine and will sink the shaft from the 800-ft. level to the 1000. The Hoosier has an excellent record and good ore has been proved below the 800 by a winze sunk on the shoot.

MONTANA

JEFFERSON COUNTY

At the Boston & Corbin properties sinking has been resumed and the shaft will be put down from the 700 of the Bertha mine to the 1500-ft. level. A cross-cut will be run at every 200 ft., and the orebodies which have been developed on the upper levels will be worked. The electrical equipment has been completed and will be in full operation within the next few days. The new electrically driven hoist has a capacity for sinking to a depth of 2500 ft. The new surface equipment at the London-Corbin has been installed. A head-frame has been completed, the hoist started, and sinking resumed in the bottom of the 60-ft. shaft.

SILVER BOW COUNTY

(Special Correspondence).—All of the Anaconda mines are in unusually good condition, and are producing at a rate that has not been equalled in several years. It is understood that more men than ever are employed, and that the Washoe smelter is producing copper at a rate of about 18,000,000 lb. per month, while the output of the Great Falls smelter runs between 7,000,000 and 8,000,000 lb. per month. The Clark reduction works have turned out about 1,500,000 lb. per month, which included the Tuolumne and other custom copper. The Pittsmont smelter produces the remainder of the Butte product, amounting at present to close to 1,000,000 lb., which includes East Butte, Butte-Ballaklava, and other custom copper.——The Anaconda company is not pushing development at present as the reserves are far ahead of requirements. Shaft sinking is going on at the Gagnon, Badger State, Right Bower and Belmont although just at present no work in the shaft is being done on the Right Bower, where the current work consists of driving on the 200 and 500 ft. levels. The Badger State shaft is down a little more than 1800 ft., and the Belmont over 1400.——A cross-cut has been run from the High Ore 2800 ft. level to a point under the shaft of the Anaconda mine, the latter being 2400 ft. deep. A diamond drill opening was made between the High Ore cross-cut and the Anaconda shaft through which the latter has been drained. Eventually, as the material is needed for waste and filling, the shaft will be raised, thus giving the Anaconda a depth equal to that of the High Ore, through which the former will hereafter be drained.

Butte, June 6.

NEVADA

ESMERALDA COUNTY

The 3 compartment shaft of the Florence mine, at Gold field, has been retimbered between the 580 and 350 ft. levels and is now being enlarged to three compartments from the 350 to the surface. When this is completed development will be started at the 425 and 500-ft. levels and sinking continued to the 1000-ft. point.——The Goldfield Consolidated is having plans of an extensive fire-fighting system drawn that will protect the entire plant, and in the mine bulkheads are to be placed so any portion of the workings can be sealed on short notice. The company has installed a bonus system in the underground work which will give the men an opportunity to increase their wages according to their ability.——Work on the 360-ft. level of the Lind lease, on the Booth and Oro claims, has opened 4 ft. of milling ore with ten inches of high-grade.——The shaft at the Nevada Victor, three miles west of Goldfield, is down 100 ft., and will be continued to the 200-ft. point where it is expected to open the vein.

NYE COUNTY

The main west drift on the 400-ft. level of the West End property at Tonopah and the raise 50 ft. from the face of the drift have both broken into ore of good grade. The discovery was made west of the fault that has previously cut off the value in the ore and 500 ft. from the shaft, and is important as there is a large amount of ground in that portion of the mine that has been regarded as barren but may now prove productive.——The Montana Tonopah during May produced about $35,000 worth of bullion, shipped 112 tons of concentrate, and milled 4500 tons of ore which was an increase of 200 tons over the April crushing. Underground the east drift on the intermediate level above the 390 shows a small improvement, the vein now being 12 in. wide.

WHITE PINE COUNTY

(Special Correspondence).—A considerable amount of structural material for the steel head-frame has been unloaded from the cars and stored near the Giroux shaft. While the old Alpha shaft of the Giroux group was sunk to a depth of 1200 ft. in the porphyry zone and cut a strong flow of water there, the new shaft was sunk off the mineral zone, in solid limestone, and at the depth of 1200 ft. opened no channels of water. There is now 200 ft. of water in the Alpha, and after the pumps have been installed at the 1200-ft. station of the new shaft a cross-cut is to be driven from this station into the porphyry zone to tap the water of that territory and drain it. The plan is to have ample facilities for handling the accumulated surplus, and after the lower workings of the Alpha have been drained it is believed the problem of keeping under control the natural flow of water will not be serious. The intention is to sink the new shaft to greater depth. The surface boundary lines of the Giroux holdings are being shown by establishing 125 corner posts, each of which consists of an iron pipe, 4 in. diameter, 4 ft. long, with two cross-rods at the bottom, set in a concrete base, 2 feet square and 3 feet deep. The pipe is filled with concrete, and has an iron plug screwed into the upper end; the top of the plug is lettered with the name of the claim, number of survey and corner, date and name of the com-

pany—all cut by a steel die. Beneath the iron plug and next to the concrete is a copper plate containing the same data. This work is being performed by Haff & Colwell Bros.

Ely, June 3.

NEW MEXICO

SOCORRO COUNTY

(Special Correspondence).—Probably the most encouraging development in the Socorro mines is the value of the orebody on the 600-ft. level east of the Little Fannie vein where the ore is 6 ft. wide, and assays $40 per ton.——The Ernestine Mining Co. was forced to curtail its output during the past week on account of lack of water for the mill, only 563 tons of ore being crushed and 45 sacks of concentrate shipped. The number of men underground has been increased and more extensive development is being carried forward.——Work has been started in the shaft of the Deadwood mines and sinking will be continued to a depth of 600 ft.——The Enterprise Mining Co. has let a contract to advance the drift 50 ft. on the vein which is over three feet wide.

Mogollon, June 3.

OREGON

BAKER COUNTY

It is reported that a body of free-milling ore has been found in the old Bonanza mine, and that the property may be re-opened.——The cross-cut adit at the Zenith property is in over 700 ft., and is being advanced to open the Putnam vein which it is expected to intersect within the next 50 ft. A 12-ft. vein that assayed $11.60 per ton was recently cut by the adit but no development work has been started on this as the Putnam is the main vein on the group. ——The Buffalo-Monitor mine made the first shipment of ore to the Sumpter smelter under the new management. The Buffalo-Monitor is on Buffalo mountain about six miles from Granite and in the past has shipped a considerable tonnage of high-grade ore to the smelter.

UTAH

JUAB COUNTY

The shaft at the Bradley is now in 200 ft., and grading has been started for the new hoist. The Opohongo is shipping three carloads of ore per week which is being mined on the 350 and 400-ft. levels.——The Victoria Mining Co., at Eureka, is to resume sinking in the bottom of the 500-ft. shaft and continue it to the 1000-ft. level. Sinking has been stopped at the 500 for some time as the company operated through the Grand Central workings, but now the shaft will be completed and a large hoist installed. The work is done under J. C. Sullivan.——At a meeting of the directors of the East Tintic Development Co. an assessment of 1c. per share was levied and it was decided to suspend operations at the mine until a considerable revenue be derived from this assessment.——The directors of the Yankee Consolidated levied an assessment of 2c. per share which will be delinquent June 24.

WASHINGTON

STEVENS COUNTY

The Germania tungsten mine in Cedar canyon, 28 miles west of Springdale, is producing regularly, and it is announced that the Tungsten King property, 11 miles north of Deer Park, will begin shipping in 30 days, while the Baird-Harrison property is expected to enter the list before the close of the year. The Germania company owns 640 acres of patented land and 35 mineral claims. Though its property is known to be traversed by five veins, development work has been confined to one, which has been opened by 3000 ft. of development. These workings show a quartz vein having an average width of two feet, well mineralized throughout with tungsten in the form of wolframite, with occasional shoots of high-grade ore. The property is equipped with a 40-ton mill, which produces five grades of concentrate, varying from 58 to 74% in tungstic acid. Steady production at the mill began 60 days ago, since which two cars of concentrate have been shipped, while a third is being loaded. The two cars shipped aggregated 53 tons, and the net returns were more than $600 per ton or upward of $30,000 for the two cars. The ore is marketed through an agency at Cassell, Germany, to the Krupps of Essen, and is shipped to Hamburg, the freight rate being $18.60 per ton, of which $2.60 covers all costs after New York is reached. The Tungsten King claims, owned by the Deer Park Mining Co., is the oldest property in the district and consists of 80 acres of school land leased from the State for 30 years. A. E. Barnes announces that a mill, now in course of construction, will be in operation in 30 days, producing from 30 to 60 tons of concentrate per month. The company is capitalized at $250,000, and that sum, to be paid in installments during three years, was recently bid for the property by a mining man of Spokane.

CANADA

BRITISH COLUMBIA

(Special Correspondence).—The leading feature of the mining situation at Nelson this week is the beginning of shipments from the Consolidated company's Queen Victoria property, with an initial consignment of 61 tons. This property though low grade will permit of a big production, as the orebodies are extensive.——R. H. Leach, managing director for the Britannia Mining & Smelting Co., and his associates, have secured the Clyde-Belt group of claims.—— The ore shipments from the Granby company's mines at Phoenix passed the 500,000-ton mark with the output of the last week. Work continues steadily at the mine and the shipments are being kept up to a high average.——The British Columbia Copper Co. is now about ready to resume smelting operations at the Greenwood smelter and will start up any day. It is expected that the 25,000-ton test shipment from the Rawhide claim of the New Dominion Co. will be put through the Greenwood plant at an early date. ——The Contact group of claims on Moresby island has been bonded for $100,000 to Hugh Cannon, of Grand Forks. Butte capitalists are interested and development work is to be commenced very soon.

Rossland, June 4.

ONTARIO

In the cross-cut northeast from the 222-ft. level of the No. 2, one of the principal veins of the Coniagas mine, at Cobalt, was cut a few days ago, showing 4 in. of smaltite ore with considerable native silver. This is the first of the important veins to be picked up on this level though it is expected that the No. 6 vein will be opened in a short distance.——The Campbell & Deyell sampler, near the La Rose property, has been completed and is now in a position to handle custom ore. The plant is entirely automatic and is designed to handle 30 tons of ore per day.——The Argentum Mines Co., which is operating the Foster property, is to install a Calyx drill to prospect below the lower levels of the mine.——Four inches of ore that will average 4000 oz. of silver per ton was opened by the No. 10 cross-cut on the 100-ft. level of the Crown Reserve mine.——Convinced that many of the veins on the Nipissing property are not found even with the thorough method of trenching now used the management has decided to install two large turbine pumps at the lake and wash away the over-burden so the surface of the rock can be carefully examined. As there are 846 acres in the property the undertaking will occupy considerable time.

MEXICO

SONORA

At the Calumet & Sonora, two miles north of Sonora, the company is stoping on a 4-ft. vein of lead-silver-zinc ore on the 60-ft. level. At the mill the company is installing a new classifier, jig, one Wilfley, and two Deister tables which is expected to raise the output of the mill 40%.——The Lucky Tiger is shipping approximately 10 tons of concentrate per day.——The Pilares Mining & Development Co. and the Purdy Gold & Silver Mining Co., have commenced operations and will be shipping high-grade ore in a short time.——Since the installation of the new pumping plant at the Creston de Cobre property, 30 miles west of Hermosillo, the work of cross-cutting has been going steadily forward. The company is planning to install a reduction works at the mine in a short time.——An aerial tramway will be installed shortly at El Tigre, and a central power-plant is contemplated.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

Jay A. Carpenter is at Millers, Nevada.

J. Claude Jones visited San Francisco this week.

E. B. Kirby was in San Francisco and Los Angeles this week.

Sumner S. Smith is at Jackson, Amador county, California.

Allen H. Rogers, of New York, is at Santa Rita, New Mexico.

E. Gybbon Spilsbury has returned to New York from Arizona.

Walter Harvey Weed has been at the Minas de San Pedro, Chihuahua, Mexico.

Arthur Lakes is making geological examinations in Arizona and California.

B. R. Binns has charge of the mines of the Sterling Borax Co., at Lang, California.

Newton S. Kelsey has gone to the Atlin district, British Columbia, to examine dredging ground.

F. A. Crampton is manager at the mines of the Arizona Copper Belt Mining Co., Wickenburg, Arizona.

Arthur Lakes, Jr., of Denver, is making mining and metallurgical examinations in Summit county, Colorado.

H. Hendrickson is now assistant engineer for the Maxwell Land Grant Co., with headquarters at Baldy, New Mexico.

James W. Abbott, who has been in the hospital at Salt Lake, has recovered and is again on duty at Pioche, Nevada.

E. C. Engelhardt has left the Mary Murphy G. M. Co., of St. Elmo, Colorado, to become superintendent for the Cooke M. & R. Co., Cooke, Montana.

E. Paul Jones, recently chief engineer for the Risdon Iron Works, has become superintendent for the Yuba Construction Co., Marysville, California.

William Letts Oliver has resigned his position as superintendent of the cyanide department at the North Star mine, Nevada county, California, to enter private practice. He will open an office in San Francisco.

MAY COPPER REVIEW

By M. E. Appelbaum*

During the early part of May the metal established a new low level, since the mark made during the panic of 1907. However, when the 12½c. delivered 30 days level was reached, tremendous purchases were made by domestic as well as European consumers and this caused a sharp rally to 12⅞c. delivered 30 days, at which price the metal held firm during the balance of the month. While the domestic consumers are using tremendous quantities of copper, nevertheless the new orders which they are getting are insignificant and unless business shortly improves, the domestic consumption cannot keep up at the rate established. Consumers have orders enough on hand for the next month or two. So far as the European situation is concerned, the visible supply has decreased during the month about 3000 gross tons. Exports during the month of May were in the neighborhood of 50,000,000 lb., which, together with 68,000,000 lb. domestic deliveries, represents about the production. The net result for the month has been a decrease in the visible supply of about six to seven million pounds. Unless the domestic manufacturers shortly receive new and large orders for finished goods, the metal cannot be expected to advance, and, considering the general industrial unsettlement, it is difficult to become enthusiastic about the immediate future. At the same time, it should be kept in mind that the world's visible supply is not a large one should the industrial situation improve and it is believed by many conservative people in the trade that same is bound to occur before the summer is over.

*President of the New York Metal Selling Company.

Market Reports

LOCAL METAL PRICES

San Francisco, June 9.

Antimony	12 -12¾c	Quicksilver (flask)	47½-48
Electrolytic Copper	14½-15¼c	Spelter	7-7½
Pig Lead	4.70-5.05c	Tin	36¼-36½c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
June 2	12.63	4.35	5.04	53⅝
" 3	12.63	4.35	5.01	53⅜
" 4	12.63	4.35	5.01	53½
" 7	Sunday.	No market.		
" 8	12.63	4.35	5.00	53⅜
" 7	12.56	4.35	4.97	53¼
" 8	12.56	4.35	4.97	53¼

ANGLO-AMERICAN SHARES.

Cabled from London.

	June 1. £ s. d.	June 9. £ s. d.
Camp Bird	1 8 6 ex div.	1 8 0
El Oro	1 6 9	1 7 0
Esperanza	2 13 9	2 13 9
Dolores	1 8 9	1 8 9
Oroville Dredging	0 9 4½	0 7 6
Mexico Mines	8 8 9	8 12 6
Tomboy	0 19 3	1 0 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, June 9.		Closing prices, June 9.
Adventure	5¼	Mohawk	50
Allouez	39	North Butte	31½
Atlantic	6¼	Old Dominion	35
Calumet & Arizona	61	Osceola	131
Calumet & Hecla	585	Parrot	14
Centennial	16	Santa Fe	1¼
Copper Range	63⅛	Shannon	11⅛
Daly West	8	Superior & Pittsburg	11¾
Franklin	11¾	Tamarack	60
Granby	39	Trinity	5½
Greene-Cananea, ctf	7⅝	Utah Con	21
Isle Royale	19	Victoria	3
La Salle	11½	Winona	7¼
Mass Copper	7¼	Wolverine	113

(By courtesy of J. C. Wilson, Mills Building.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, June 8.		Closing prices, June 8
Amalgamated Copper	65⅝	Miami Copper	20½
A. S. & R. Co.	75⅞	Mines Co. of America	⅝
Boston Copper	18½	Montgomery-Shoshone	⅜
B. C. Copper Co.	5⅛	Nevada Con.	19¾
Butte Coalition	18⅜	Nevada Utah	⅞
Chino	11¼	Nipissing	11½
Davis-Daly	1¼	Ohio Copper	1⅞
Dolores	6¼	Ray Central	2½
El Rayo	3¼	Ray Con.	16¾
Ely Central	1	South Utah	1½
First National	3⅜	Superior & Pittsburg	11⅜
Giroux	7⅛	Tenn. Copper	25
Guanajuato Con	1	Trinity	6
Inspiration	7⅛	Tuolumne Copper	3¼
Kerr Lake	8¼	United Copper	6⅛
La Rose	4¾	Utah Copper	43½
Mason Valley	7½	Yukon Gold	4⅜

SOUTHERN NEVADA STOCKS.

San Francisco, June 9

Atlanta	$ 12	Mayflower	$ 3
Belmont	3.95	Midway	28
Booth	15	Montana Tonopah	98
Columbia Mtn	6	Nevada Hills	88
Combination Fraction	50	Pittsburg Silver Peak	68
Daisy	6	Rawhide Coalition	25
Fairview Eagle	15	Rawhide Queen	26
Florence	2.20	Round Mountain	47
Goldfield Con	8.65	Sandstorm	3
Gold Kewenas	6	Silver Pick	7
Great Bend	2	St. Ives	11
Jim Butler	28	Tonopah Extension	81
Jumbo Extension	19	Tonopah of Nevada	8.60
MacNamara	28	West End	66

(By courtesy of San Francisco Stock Exchange.)

OIL DIVIDENDS FOR MAY, 1910.

From the Official Monthly Statement of Oil Securities of the San Francisco Stock Exchange.

Company.	Shares issued.	Par value.	Capital.	Acreage.	Location.	Last date.	Dividend. Amount per share.	Total to date.
Alma Oil Co.	380,000	$1.00	$400,000	120	Kern River	4 15 '10	$ 3	$171,000.00
Amalgamated Oil Co.	50,000	100.00	50,000	*	Salt Lake Field, L. A.	5 15 '10	1.00	1,500,000.00
Amer. Petroleum (pfd.)	25,000	100.00	25,000	*	Coalinga and Sherman	5 1 '10	1.00	1,310,165.50
Appolo	200,000	2.50	200,000	40	Kern River	3 20 '10	1	4,000.00
Associated Oil Stock	400,000	100.00	400,000	*	Kern, Coalinga, McKittrick.	3 1 '07	1.50	1,548,368.54
Associated Oil Bonds 5s.	.....	.....	3,006,000	*	Kern, Coalinga, McKittrick.	.....	....	.....
Bay City	100,000	5.00	100,000	200	Midway	2 10 '10	20	90,000.00
Blue Moon	189,759	1.00	200,000	20	Coalinga	.....	....	.....
Brookshire	500,000	1.00	500,000	933	Santa Maria and Midway	1 1 '10	1	442,500.00
California Midway	822,800	1.00	1,000,000	160	Coalinga	.....	....	.....
California Oil & Gas	900,000	1.00	1,000,000	80	Coalinga	.....	....	.....
Carbon Oil & Mining Co.	80,703	1.00	100,000	100	Coalinga	5 15 '10	25	740,883.24
Chicago Crude	1,000,000	1.00	1,000,000	100	Kern	3 25 '07	0½	15,000.00
Claremont	500,000	1.00	500,000	280	Kern and Coalinga	5 28 '10	2	345,000.00
Coalinga Central	150,000	1.00	500,000	120	Coalinga	.....	....	.....
Coalinga Pacific	65,000	1.00	165,000	40	Coalinga	12 23 '09	10	107,250.00
Columbia	999,226	1.00	1,000,000	*	Fullerton and Whittier	5 25 '10	½-½	291,782.11
Cresceus	320,000	1.00	320,000	40	Midway	.....	....	.....
Dabney	1,000,000	1.00	1,000,000	120	Midway	.....	....	.....
Del Rey	785,490	1.00	1,000,000	40	Kern River	5 15 '09	0½	11,782.50
De Luxe	100,000	1.00	100,000	40	Coalinga	.....	....	.....
Eldorado	100,000	1.00	100,000	10	Kern River	.....	....	.....
Emplre	200,000	1.00	200,000	80	Coalinga	5 31 '10	....	2,000.00
Enos	251,248	1.00	500,000	220	Kern and Santa Barbara	.....	....	.....
Esperanza	160,000	1.00	160,000	170	Coalinga	12 27 '09	9	49,450.00
Euclid	350,000	1.00	350,000	10	Kern and Coalinga	5 1 '10	1	131,000.00
Four Oil	300,000	1.00	300,000	20	Kern and Coalinga	2 25 '10	1	213,000.00
Fulton	100,000	10.00	100,000	120	Sunset	.....	....	.....
Globe	600,000	1.00	600,000	20	Kern River	4 1 '10	1	87,000.00
Graciosa	1,000,000	1.00	1,000,000	*	Santa Maria	.....	....	.....
Home	100,000	1.00	100,000	140	Coalinga	5 20 '10	2	478,000.00
Homestake	10,000	10.00	10,000	160	Coalinga	4 14 '10	10	78,250.00
Illinois Crude	200,000	1.00	200,000	10	Kern River	5 1 '10	1	92,000.00
Imperial	100,000	5.00	100,000	2180	Kern and Coalinga	5 19 '10	5.00	2,500,000.00
Junction	250,000	1.00	250,000	80	Kern River	6 1 '09	1	20,000.00
Kern River	20,000	5.00	20,000	80	Kern River	5 1 '10	10	104,000.00
Linda Vista	385,850	....	.....	20	Kern River	5 9 '10	1	76,770.00
Lucile	26,704	1.00	50,000	40	Coalinga	12 20 '09	10	42,727.04
Mascot	500,000	1.00	500,000	160	Midway	5 20 '10	1	20,000.00
McKittrick	500,000	1.00	500,000	1200	McKittrick	.....	....	.....
Mecca	422,500	1.00	500,000	120	Kern River	7 15 '09	3	71,825.00
Midway of Oregon	1,000,000	1.00	1,000,000	640	Kern and Sunset	5 26 '10	10	190,000.00
Monte Cristo	500,000	1.00	500,000	80	Midway	.....	....	.....
Mountain Girl	350,000	1.00	350,000	*	Mexico	5 1 '10	11⅛	3,648,576.94
Mexican Petroleum	10,000,000	5.00	10,000,000	*	Maricopa	.....	....	.....
M. & M.	1,000,000	1.00	1,000,000	140	Kern River	10 13 '08	4	40,000.00
Nevada County	250,000	1.00	250,000	30	Kern River	.....	....	.....
New Penn. Petroleum	500,000	1.00	500,000	147	Santa Maria	.....	....	.....
Palmer	1,802,010	1.00	2,000,000	880	Santa Maria	5 20 '10	1	286,401.00
Paraffine	300,000	1.00	300,000	40	Midway	5 15 '10	1	21,000.00
Peerless	100,000	10.00	100,000	160	Kern River	9 20 '09	6	801,000.00
Piedmont	389,000	1.00	500,000	10	Kern River	5 9 '10	1	26,877.30
Pinal	150,000	1.00	200,000	*	Santa Maria	5 31 '10	10	917,085.50
Premier	900,000	1.00	1,000,000	160	Coalinga	5 20 '10	1	20,000.00
Producers	80,000	5.00	100,000	600	Midway	5 1 '10	1.00	80,000.00
Radium	250,000	1.00	250,000	*	Santa Maria	.....	....	.....
Record	100,000	2.00	100,000	40	Coalinga	5 16 '10	7½	70,000.00
Republic	500,000	1.00	600,000	80	Coalinga	.....	....	.....
Rice Ranch	300,000	1.00	300,000	40	Santa Maria	5 10 '10	1	165,000.00
Rico	100,000	1.00	100,000	60	Midway	.....	....	.....
Royalty	20,000	1.00	20,000	20	McKittrick	5 18 '10	1½	16,066.66
S. F. & McKittrick	50,000	10.00	50,000	151	McKittrick	5 1 '10	30	370,000.00
Sauer Dough	199,500	0.50	200,000	270	Coalinga and McKittrick	5 21 '10	2½	527,278.50
Section 7	400,000	1.00	400,000	65	Coalinga	.....	....	.....
Section 25	40,000	1.00	40,000	290	Midway	5 28 '10	25	30,000.00
Sesnon	100,000	1.00	100,000	35	Kern River	5 4 '10	8	118,000.00
Shawmut	500,000	1.00	500,000	*	Coalinga	.....	....	.....
Silver Tip	75,000	1.00	75,000	20	Coalinga	2 25 '10	10	30,000.00
Sovereign	500,000	1.00	500,000	20	Kern River	4 15 '10	1	95,000.00
S. W. & B.	377,000	1.00	400,000	40	Coalinga	9 10 '09	1	41,470.00
State	100,000	1.00	100,000	20	McKittrick	.....	....	.....
Sterling	250,000	1.00	250,000	160	McKittrick and Kern	3 15 '10	12½	778,250.00
Sunset Monarch	497,241	1.00	500,000	*	Sunset and Midway	.....	....	.....
Superior	500,000	1.00	500,000	40	Sunset	2 12 '10	1	57,500.00
Thirty-Three	100,000	5.00	100,000	160	Kern River	4 6 '10	20	690,000.00
Traders	15,000	100.00	15,000	410	Kern, Coalinga and Midway	5 15 '10	1.00	209,146.50
Turner	500,000	1.00	500,000	320	Coalinga	.....	....	.....
United	80,751	....	.....	*	Controls Union	5 20 '10	50	2,259,710.92
Union	249,626	100.00	500,000	*	All Fields of State	5 20 '10	50	6,617,881.15
Wabash	300,000	1.00	500,000	80	Coalinga	5 16 '10	1	126,000.00
West Coast (com.)	10,408	100.00	25,000	*	Los Angeles	.....	....	.....
West Coast (pfd.)	10,408	100.00	25,000	*	Los Angeles	3 21 '10	2.00	83,264.00
West Shore	100,000	1.00	100,000	80	Kern River	12 21 '08	3	235,000.00
Wolverine	100,000	1.00	100,000	60	Kern River	.....	....	.....
W. K. Oil	500,000	1.00	500,000	320	Coalinga	.....	....	.....
Western Union	10,000	100.00	1,000,000	10,000	Santa Maria	1 15 '07	2.00	184,951.00
Hanford	.....	.....	.....	.....	.....	1 30 '06	2.00	80,000.00
Kern Oil	.....	.....	.....	.....	.....	11 19 '09	22	12,000.00
Pittsburg	.....	.....	.....	.....	.....	12 8 '09	12	1,124,000.00
Reed Crude	.....	.....	.....	.....	.....	11 11 '07	24½	124,800.00

Total dividends for May, 1910, $1,326,626.62; total to date, $31,281,903.12. *Information not obtainable.

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EDITORIAL

THROUGH train service has been re-established on the San Pedro, Los Angeles & Salt Lake railroad, the line having been re-built where washed out some months ago.

ARIZONA and New Mexico, it now seems, must wait still another session of Congress before being granted Statehood. It is a constant marvel what variety and abundance of reasons our Washington statesmen find for not doing something against which no good reason at all is urged.

RUMORS to the effect that Mr. John B. Farish would retire from consulting practice have been current. We are authorized to specifically deny the rumor and to announce, as we are glad to, that Mr. Farish hopes to continue his professional work as long as he lives and to have his son, Mr. George Farish, succeed him.

ONE of the most delightful exchanges which comes to our desk is the *Congressional Record.* It is as inconsequent as a dictionary and nearly as comprehensive. We go through it with perennial interest and occasionally find something worth while. This week we have abstracted some data on underground mine refuge chambers, a really important subject. In connection with the article the description on another page of the successful drilling of holes as much as thirty inches in diameter may be read with especial interest.

PENSIONS for workmen will undoubtedly become more common in this country as time goes on. Recognition of faithful service must be made. The intelligence and ambition of the workmen necessitate it. Direct profit-sharing has not proved successful, the most advantageous form, perhaps, being that of opening to workmen the opportunity to acquire stock in the enterprise with which they are identified, at fixed and reasonable prices. This has been done by Phelps, Dodge & Company, Inc., by the United States Steel Corporation, and others. Several years ago Mr. Andrew Carnegie placed in trust the sum of $4,000,000, the income from which was to be applied to the payment of pensions to employees of the Steel Corporation, and the plan has resulted so successfully that the Corporation has added $8,000,000 to the fund. It is eminently fit to make such provision for the needs of loyal workmen, but the distribution of such moneys is in some degree a gratuity. It is not based upon any co-operative principle other than that involved in the physical association of master and man. Encouragement to provide against times of stress by investment in an insurance policy makes

appeal to better instincts, and ennobles the relation of employee to employer, rather than to make the future benefits depend on mere adherence to a job.

REVISION of the mining law is everywhere admitted to be needed. The American Mining Congress at its last session appointed a committee to urge upon Congress at Washington the necessity for a thorough revision and the desirability of mining men being consulted in making changes. What is needed is a Congressional investigation as to the operation of the present laws and the character of changes needed. Public hearings should be held in Washington and at various Western cities so that the fullest information may be available. We understand that Mr. E. B. Kirby and the committee have in mind some such procedure, and they should be supported in urging it. Radical changes are needed in many directions, but uninformed action may do much damage. Public hearings tend to crystallize public opinion and facilitate correct action.

APPROPRIATIONS for the Geological Survey and the Bureau of Mines have been fixed in the Sundry Civil bill which has passed both House and Senate at Washington, and is now in conference. In connection with the Geological Survey the principal change is a gratifying increase from $225,000 to $300,000 in the amount appropriated for geologic work proper. Appropriations heretofore made to the Survey for technologic work are, in the main, transferred to the Bureau of Mines. As the bill passed the House the sum set aside for the Bureau included: for general expenses, $54,000; for moving offices and laboratories, $14,600; for rent and stationery, $10,000; for investigation of mine accidents, methods of mining, treatment of ores, and other technologic investigations pertinent to the mining industry, $310,000; for analyzing and testing fuels, $100,000; for preparation of reports, $5000; for salaries of the Territorial mine inspectors, the inspectors being authorized to inspect coal and other mines in the District of Alaska to which District the provisions of the Act of March 3, 1891, are extended and made applicable, $4000; for expenses of inspectors, $4500. The House refused to appropriate for continuing the investigation of structural materials begun under the Geological Survey and transferred to the Bureau of Mines when the latter was formed, and appropriated instead $50,000 for this purpose to the Bureau of Standards. The Senate reinserted the current item of $100,000 for this work under the Bureau of Mines, and the matter went to conference with results not announced at the time of this writing. While there is room for some difference of opinion as to which Bureau should have charge of much of the work, there is no room for doubt that it was taken from the Bureau of Mines in the House by sharp practice. However this matter may be settled, the new Bureau will begin work with appropriations adequate for a large amount of useful work. It is understood that the increase in the principal appropriation to the Bureau of Mines from $250,000 to $310,000, made on the floor of the House, was to provide for additional mine rescue stations.

Romancing About Mining

It is almost cruel to criticise, it is so easy. The cruelty and the ease of it are even greater when the mark is a literary gentleman employing his artistic temperament in the floating of mines esthetically. Mr. Julian Hawthorne is an artist! The significance of the term depends upon the tone of voice, as anyone may see by trying. We have no objection to literature; we read Professor James' guesses on the accidental in nature, and Goldwin Smith's views on history. But really and truly this romance which we have just read is the most astounding! The worthy customs officer of Salem, even when he filled 'The House of Seven Gables' with gruesome mystery, never dreamed such dreams as have been inspired in his son Julian by the lure of Mr. Eze Mark's pocket. "An artesian well to the earth's centre would be the ideal gold and silver mine. Up would rush the long imprisoned genii of wealth with a roar heard in the moon" (we like that simile; it is impressive, almost magnificent), "and would spread in stupendous floods over the surface—a flood hundreds of miles thick, and thousands in area" (as for the latter we refrain from giving Mr. Hawthorne the scientific reasons why it's all bosh and nonsense). It may be said in passing that Mr. Hawthorne is a confirmed baryspherist. He probably doesn't know it; nevertheless we are ready to vouch for the truth of it. He believes that the heavy metals sank by gravity to the centre of the earth; that dear old Mother Earth therefore has a golden heart. Here is another reason for the worship of Demeter, and perhaps some mythologist may connect it with the Eleusinian mysteries. That 'golden heart' might entice Mr. Hawthorne, but either respect for dame Demeter or recollection of the misfortune of the person who killed the goose that laid the golden egg, Mr. Hawthorne gives wise admonition; "but let us not dig that well," he says. No, Mr. Romancer, we will not! We are willing to dig deep for gold, but that would be too deep; we think there is a good deal of anathema hurled by the Articles of Faith against works of supererogation. The romance in which we find all this is a pamphlet entitled 'Julian Hawthorne & Company'; it concerns the known and the unknown in the universe at large, on the earth in general, and at Cobalt, Ontario, in particular, at which point real silver has for some years been produced by plain men on a very profitable basis. We believe that mining on a large scale will continue at Cobalt for a long time to come; what fate will befall Mr. Hawthorne & Company is expressed in the ever-ready Mexican phrase *quien sabe*.

The Ohio Mines Company has also entered the literary arena. The production of this corporation is a history called 'The Gold Book'. It is worked out á la Knickerbocker, starting with the dawn of time and the cradle of the race. We read of Cadmus, 1594 B.C.; of Jason and his Argonauts; we follow Hannibal, and Caesar, and sail westward with Columbus and—so on. We sweep the earth; we hear the roll-call of the mining barons. "Hearst Estate," "here, with forty millions"; "James G. Fair Estate," "there with twenty-five millions," all the

way down through the Crockers and Haggins and Mackays and Floods to poor little Robert C. Johnson with only $5,000,000! Having reviewed the history of the world in relation to gold, we are at last inducted into the presence of the arch-venerable "Yavapai the Wonderful," which for the benefit of gentlemen in the Transvaal we will say is in the quite remarkable territory of Arizona. The Ohio Mines Company has issued in addition a report by Mr. W. A. Warwick which seems sound, sane, and conservative. It is an easy calculation for a prospective investor to estimate the value of shares in the company on the basis of Mr. Warwick's report. This is well and good. We wish it stood alone. The thing we object to is coupling with it matter which will give the reader the gold fever, so that he will deliver over his money while still suffering from the attack.

Mr. Ballinger and the Cunningham Claims

The Pinchot-Ballinger investigating committee, it is now announced, is not likely to present a report to this session of Congress. While not wishing to discuss the matter in detail in advance of the presentation of the report, we have reproduced on another page a summary of certain phases of the case, printed originally in the *Nation*. In this connection it seems worth while to point out a few things concerning which there is much misapprehension.

It has been quite generally assumed that the Cunningham claims were tinctured with fraud and that any disposition on the part of the Secretary to forward their patenting was to be condemned. We do not believe this assumption is warranted. Mr. Horace V. Winchell, concerning whose knowledge and integrity there can be no question, has presented the evidence so fully and so fairly as to leave little doubt that these famous claims were located and carried forward toward patent in strict conformity to the then existing law. The latter, it is admitted, was a poor law and was properly changed at a later date; but that cannot affect rights accruing under it while it was on the statute books. It was proper enough, so long as any question remained, for Mr. Garfield and other officers of the land office to insist that the claims be put to proof. The fact that receivers' certificates had been issued did not close the matter, and Judge Curtis H. Lindley so advised the Guggenheims when they were considering the purchase of the claims. The resultant necessity for the claimants to defend their title is a hardship on them, but may become incident to acquiring any piece of public land. In the face of the repeated charges made by agents of the Department, it was entirely proper that the matter should be fully investigated. It is equally proper, however, that if the rights of the claimants prove well founded, they be respected and the patents be issued to them. The matter is still under review and has been needlessly drawn out and complicated by popular clamor founded on misunderstanding of the facts. The claims are likely to be allowed, and it will be done, we believe, on the basis of the law and evidence and not because of any improper desire to favor any individual or corporation at the expense of the public. Furthermore, while we yield to none in our interest in conservation, we believe that it is in accord with sound public policy that the block of ground represented by the Cunningham claims pass into private ownership and be permitted to be developed. The value of the claims, as we have already shown, has been grossly exaggerated. For the founding of a new enterprise under such difficulties as must be met in Alaska, 5000 acres of coal land is none too large. If the claims be allowed and ultimately pass under the control of the Copper River railroad, the amount of coal involved will not be disproportionate, nor will it give the owners a monopoly of the market. It is also to be remembered that the price paid for the land, with that spent in surveys and in perfecting title, is not low or out of ratio to lands containing an equal amount of coal in the States. The public has apparently made up its mind to the effect that Mr. Ballinger should resign, and with that conclusion we have no quarrel. We protest, however, that in this one particular, public opinion is based upon false assumptions and misunderstandings.

BY THE WAY

The Pinchot-Ballinger investigation has been completed. There is much difference of opinion as to the conclusions properly to be drawn from the evidence, and the following summary published in the *Nation* will be read with interest.

The long-protracted hearing in the Ballinger investigation came to an end last week with the oral argument of the attorneys. On neither side was an attempt made to cover with convincing precision all the points in dispute. This indeed was impossible in the limited time at the disposal of counsel, as would be shown by the attempt of any impartial student to settle a single one of these questions. Not until the briefs have been submitted, and the evidence studied in the light that they should furnish, will a trustworthy conclusion on the whole case be possible. Nevertheless, the survey of the case afforded by the oral arguments makes the present an appropriate time for weighing the general controversy.

In the first place, there are some points about the nature and genesis of the case of which the public needs to be reminded. Especially as regards Mr. Glavis, it is necessary to recall to mind the character of his initial connection with the matters involved. Whatever basis there may be, or may be alleged to be, for supposing that the animating force behind the developments for the past ten or twelve months is of a political or personal nature, no such allegation can be made as to Mr. Glavis' first resolute interposition in the Alaskan coal claims. No Rooseveltian plot can have been at the bottom of his zealous interference in the year 1907, to prevent the patenting of the Cunningham and other claims without searching inquiry. Mr. Ballinger was at that time Commissioner of the General Land Office; but Mr. Garfield was Secretary of the Interior, and Mr. Roosevelt was President. An intense desire to preserve for the nation valuable lands to which the private claimants were not in his judgment lawfully entitled is the only motive which could at that time have actuated Mr. Glavis. Not only was there no possibility of a politi-

cal motive, but personal animus was equally out of the question. His efforts were made within the Land Office, and they were successful. There arose at that time no complaint or scandal. It is not impossible that Mr. Glavis was over-zealous or that his judgment was at fault; but the fact is that for two years, unremittingly, he stuck to this line, no matter who was Land Commissioner, or Secretary of the Interior, or President. Eventually, he had recourse to the Attorney-General, Mr. Wickersham, and finally to the President. Mr. Taft called upon Mr. Ballinger and others for replies; and, having examined these replies, he exonerated Mr. Ballinger and his subordinates and authorized the discharge of Mr. Glavis. Only after his discharge, and more than two years after the beginning of his activity, did Mr. Glavis enter into a public agitation of the case through *Collier's*.

A second point, which should be clearly apprehended, is that the question before the committee, the President, and the people, all along, has not concerned corrupt conduct on the part of Mr. Ballinger. The question is and always has been, whether he has fulfilled the peculiar responsibilities of his office with single-minded fidelity to the rights and interests of the Nation. To show that those interests have not been in safe hands, it is not necessary to convict him of a pre-conceived purpose to betray them, or to prove the existence of any corrupt motive. If, in point of fact, he has been eager to facilitate the patenting of doubtful claims; if, in point of fact, he has been conspicuously wanting in zeal for the protection of the Nation's rights—the charge made by his opponents is established. The accusations against him under this head relate on the one hand to his attitude toward the Forestry Service and the Reclamation Service, and, on the other, to his conduct concerning the Alaskan coal lands, especially the Cunningham claims. The question of fact and law involved are anything but simple; but as regards the coal lands, some indication of the situation may be given.

It is agreed on all hands that the existing law on the subject of Alaskan coal lands is utterly unadapted to the situation concerned. That law is designed to prevent the taking up of large tracts by private owners, the normal amount permissible being limited to 160 acres. But these lands cannot be worked profitably in small parcels; and everybody agrees that a radical change should be made in the law. Meanwhile, however, there are two opposite attitudes which may be adopted. One is, that so far as possible the land should remain the possession of the Nation until such time as legal provision shall be made whereby large holdings can be worked, with the people coming in for their full share of the benefit of such working; the other is, that inasmuch as the land cannot be worked in small parcels, the Government should look with leniency upon devices whereby, while superficially observing the law, private interests may contrive to get possession of large and extremely valuable tracts upon the easy terms designed for small holders. That there is a certain amount of sentiment in the Far West in favor of this latter view is probable; that it is the view taken and promoted by the capitalists interested in getting possession of the lands goes without saying. And what seems established with a fair approach to conclusiveness, in spite of the complexities and contradictions of the mass of evidence, is that Mr. Ballinger's acts were largely influenced by this view of the case, and that, but for the dogged opposition of Mr. Glavis, this view would have prevailed long ago in the Cunningham claims. To substantiate this assertion it would be necessary to adduce a number of special circumstances, all pointing in that direction, which have been brought out in the evidence. There is hardly one of them for which some explanation has not been offered, and to examine the pros and cons thus presented is here out of the question. It is only by considering them in conjunction, and getting their net result after all criticisms and explanations have been allowed for, that one can estimate their true significance. For this reason, it is so regrettable from the standpoint of Mr. Ballinger that the extraordinary series of inaccuracies and concealments took place which was the centre of public attention two weeks ago. In consequence of these developments, the President's letter of exoneration and the Attorney-General's summary and opinion have been largely deprived of the weight that would naturally attach to them. In default of a reading of the evidence—an impossible task to all but one person in a hundred thousand—it is upon the judgment of such referees that people naturally rely. That both the President and the Attorney-General were themselves fully assured of the justice of their conclusions, we entertain not the slightest doubt; but it is by no means so certain that in arriving at these conclusions that they were not unduly guided by ex-parte information and assistance.

No survey of the case, however broad and general, can omit a reference to Mr. Ballinger's conduct on the witness-stand. In several instances, when questioned by Mr. Brandeis concerning extremely simple matters of fact, he made a pitiable exhibition of shiftiness, evasion, and—to call things by their right name—untruthfulness. To deny a thing and almost in the next breath to admit it when denial was plainly useless; to say he knew nothing about the matter, and, after a little prodding, to show that he remembered it quite accurately; to present the appearance of one willing to lie, and yet afraid to stick—this is a showing not only lamentable in itself, but doubly significant in regard to the trustworthiness of his statements in general; and it is significant as bearing on the question of his fitness for the custodianship of the great national interests of which the Secretary of the Interior is the trustee. We would not magnify the circumstance; we would not say that Mr. Ballinger's character is to be measured by these manifestations. Some men, not particularly dishonest, thus instinctively grasp at straws when placed in an uncomfortable position; and we would not say that more than this is true of Mr. Ballinger. But it is not to the keeping of such men that we entrust great national possessions for the seizure of which shrewd and unscrupulous and powerful private interests are constantly on the alert; nor is it to the statements of such men that we give the benefit of every possible doubt when confronted with opposing evidence.

Los Pilares Mine, Nacozari, Mexico

By Courtenay De Kalb

A geological problem of extreme interest is presented by the splendid mine which has made the Moctezuma Copper Co. one of the great enterprises of Mexico. The property belongs to Phelps, Dodge & Co., and is situated near Nacozari, in Sonora, Mexico, 75 miles south of Douglas, Arizona. Opinions are not in accord concerning the genesis of the Los Pilares orebody. Undoubtedly it is complex. No simple theory may account for it. In fact the development done at the present time, despite the enormous extent of the workings, is insufficient to demonstrate the order and character of the geologic events that here occurred.

Nacozari, Mexico.

The orebody is a zone or belt surrounding a central core, elliptical in horizontal cross-section, measuring approximately 2000 ft. on the major axis by 800 on the minor. This form was suspected but not proved when S. F. Emmons made his investigation of the deposit in 1905. His observations were remarkable for their comprehensiveness, considering the brief period of time in which he had opportunity to study the mine. As a point of departure it may be well to recapitulate his conclusions. He showed that there had been an epoch of dynamic movement producing fault planes, shattering the mass of Pilares mountain, accompanied or followed by the introduction of silica and metallic sulphides, cementing the shattered fragments into a breccia. Eruptive action followed, during which time diabase dikes were introduced, and these were succeeded by a dynamic movement opening new cracks through which surface waters could enter. Mr. Emmons distinctly sets aside the probability of the existence here of a volcanic stock around the periphery of which mineralization occurred. The contrary has not yet been proved, but the general appearance today strongly favors such a conception. The mass of rock which was at once the locus and mineralizer for the orebody is probably rhyolite. Mr. Emmons tentatively classified it as a quartz monzonite, but he also called attention to the possibility of its being a highly altered and silicified variety of andesite. The rock is certainly interlaced by minute veinlets of secondary quartz, as well as being impregnated by grains of the same mineral. The stock-like character of the mass is now strikingly apparent, but the warning of Mr. Emmons that "circular orebodies, or so-called chimneys, often result from the mineralization of a shattered area, enclosed by three or four intersecting fault-planes," must be borne in mind until more detailed study of this occurrence can be made. It is unquestionably a chimney-like mass, impregnated with sulphides of iron and copper, enriched around the elliptical periphery. The interior rock mass contains pyrite and chalcopyrite, disseminated after the manner of the sulphides in the monzonite porphyry deposit at Ely, Nevada. The entire core of siliceous rock at Los Pilares will average, so far as present workings reveal its character, as much as 1% copper. This brings it within the category of the disseminated porphyry deposits. It is not now looked upon as a source of commercial ore, however, only the enriched surrounding zone, like a circular vein, which yields about 3% copper, being taken out for concentration. This body of impregnated rhyolite porphyry spreads out upon the surface in the form of a cap. The limits have been well determined in one direction, though they remain uncertain on the opposite side. Where definite observations are possible the porphyry is seen to overlie the original andesite of the country. The cap has been deeply eroded at places, but on reconstructing its shape it appears like a mushroom, with the mineralized stock for its stem. The cap is partly overlain by andesite breccia. It may have been a laccolith, now largely exposed by denudation.

The present commercial ore in portions of the mine is sharply bounded by slip-planes, on the outer rim as pointed out by Mr. Emmons. This is not universally the case, however, on the inner boundary, the orebody quite as often possessing no limits recognizable to the eye, but gradually shades from commercial to non-commercial ore. Brecciation is persistent in the deeper levels as well as near the surface. Bornite and other secondary copper minerals were abundant in the upper part of the mine. These have practically disappeared below the 700-ft. level. The ore has become a dense fine-grained pyrite with chalcopyrite replacing the porphyry. The average composition of the present output of the mine is approximately:

	Per cent.
Copper	3.00
Alumina	12.52
Silica	50.24
Iron (metallic)	14.18
Sulphur	11.04
Lime (CaO)	0.47

It is interesting to observe that despite the secondary enrichment nearer the surface, the ore in depth, which is regarded as primary, shows no appreciable diminution in copper content. It is not certain, however, that the elliptical enriched zone

does not represent a concentration from the core of porphyry toward its outer edge, although the tendency to the formation of shoots of greater width and of irregular shape indicates the existence of channels which may have served for the rise of solutions from below. The orebody in places is as much as 300 ft. wide, while the more usual width is from 50 to 150. The northwest end is the most irregular as it is also the widest portion of the mine. The alteration has been excessive at this point, and there is here an excess of water in the orebody.

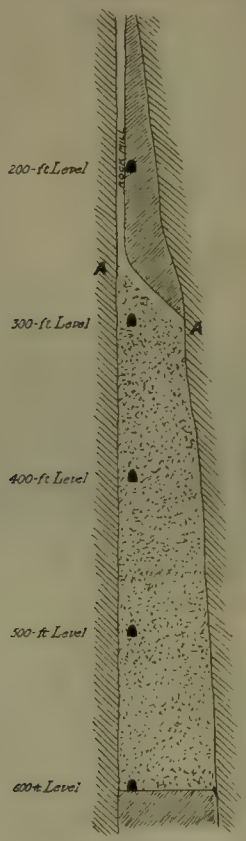


Fig. 1.

The mining methods are of great interest. No attempt has been made to cave, and in only a few situations has square-setting been adopted. Less than 10% of the workings is held open by square sets. The system is first of all that known in New Zealand as 'shrinkage' stoping, that is, allowing the stope to remain filled with broken ore, only the excess bulk produced by breaking being drawn off and sent to the mill. After a suitable amount of ground has been thus removed from 100 to 300 ft. high according to local conditions, the broken ore is all drawn and if ore still remains in that back, or other conditions require it, its space is filled with broken waste milled down from the surface. The same system, however, is not employed throughout the mine, conditions necessitating various modifications. On the northeast or 'caliche' side, a stope on the 200-ft. level, 600 ft. long by 15 to 30 ft. wide, is being carried by the shrinkage system to the capping. It will be drawn empty and the capping and walls shot down to fill it. From the 600-ft. where the orebody ranges from 100 to 300 ft. wide, upward to the 200-ft, level, where the orebody ranges from 300 to 100 ft. wide, stopes 50 ft. wide are being carried across the strike of the deposit, leaving 50-ft. pillars between. Filling is done progressively as the stope advances so that consolidation will have occurred in the 'fill' by the time the 200-ft. level is reached, when the pillars will be removed by top-slicing. The decomposed country rock makes an admirable fill-

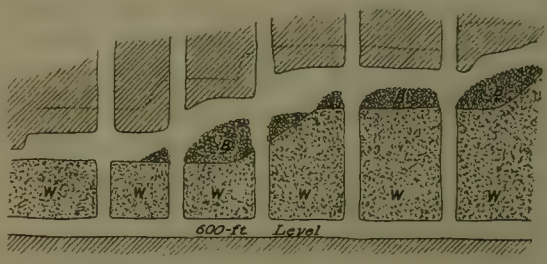


Fig. 2.

ing, and consolidates so rapidly as to make a hard smooth floor in the stopes at once. The ore can be shoveled as readily from this newly made 'fill' floor as from boards.

In Fig. 1 is shown the method, now in progress on the southwest or 'Evans' side of the mine, in vertical section. The stopes from the 600-ft. level are carried up by successive cuts and fills. The waste is sent down rock-mills from the levels above. When the 300-ft. level is reached the surface of the fill will be left inclined, as shown at AA. Upon this the ore above is broken, and the stope is carried upward to the capping by the shrinkage system, the excess bulk being drawn from the foot of the stope

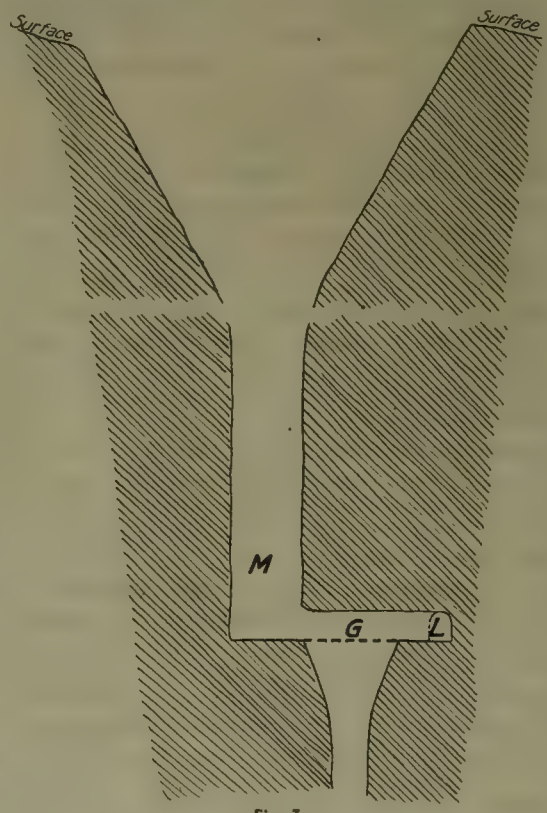


Fig. 3.

through suitable drifts and cross-cuts. Two or three pillars are left in the lower stopes to insure stability of the walls. These will not be recovered until the ground is worked to the surface. Then they will be removed by top-slicing. It will be seen that this is the direct opposite of the method used in the wider stopes where the upper levels are worked out before the stopes reach the 200-ft. level, after which the pillars are won by top-slicing. The method of working a 'cut and fill' stope is illustrated in the longitudinal section, Fig. 2. This shows the operation as now being conducted from the 600-ft. level on the southwest side of the mine. Mill-holes are first driven 50 ft. apart. These serve for delivery of the barren rock for filling the stopes, and also for cutting points. The ore is cut in stepped slices, following the usual overhand-stoping system, the men standing on broken ore, BB, as the cut advances, and the broken ore in turn resting on the rock-fill W, W, W, below. The stope shown has a length of 350 ft., with a maximum width of 75. In the beginning the length of these open stopes was limited to 150 ft., with 50-ft. pillars between, but as experience of the strength of the ore was gained the length was increased, until today no fear is entertained in leaving long stretches unsupported. The span of 75 ft. in places has proved perfectly safe, but in some stopes the conchoidal slips, evidently due to pressure resulting from expansion of volume during alteration, present enough danger to necessitate narrower arches. In a portion of the ground these slips are very numerous. It is here that square-setting is practised.

The fill-holes, as seen, lead directly into the stopes, but they do not extend to the surface from the stopes below the 200-ft. level. The main rock-mills for delivery of rock to lower levels terminate in bins from which the material is drawn into 20 cu. ft. cars, trains of seven being made up and drawn by 3-ton Goodwin electric locomotives to the mill-holes leading into the stopes. These holes are spaced 50 ft. apart, on the southwest side of the mine, following the strike of the deposit, and on the northeast side, where the orebody is wide, they are similarly spaced transversely, or across the deposit. The rock for filling is broken by deep shots around funnel-shaped quarries at the surface, terminating downward in large mill-holes 15 by 15 ft. in section. In these mill-holes are off-sets, as shown, each provided with a grill of iron-faced timbers spaced 18 in. apart. The rock banks at the off-set, partly covering the grill. Here workmen can break the larger masses to suitable size, without being exposed to danger. The total cost of rock-fill delivered into the lower stopes and spread with an even top ready for continuance of mining, does not exceed 25c. per ton.

Large Open Stope, Los Pilares Mine, Nacozari, Mexico.

On the 400-ft. level where the orebody is narrow, and the shrinkage system is used, drifts 5 by 7 ft. are driven in the country rock at a distance of about 10 ft. from the vein. Cross-cuts 5 ft. wide are then driven, 15 ft. centre to centre, through which the excess bulk of ore is removed by shoveling. The walls at other places are so sound that stopes of enormous dimensions are opened, some of these being 250 ft. in height by 110 ft. in width, which stand without any filling. In stoping, both Waugh and Shaw drills are employed. One-inch cross-steel is employed, with bits expanded to 1¼ and 2¼ in. The dynamite used is 40%, and the sticks are 1⅛ in. diam. These drills average a duty of 50 ft. of hole per diem, and the normal output per machine is 40 tons of ore. The length of holes drilled is from 6 to 7 ft. The cost of mining, while not definitely stated, is low, propably less than $1.50 per ton. Even where square sets are used the cost does not ascend to $2.50 per ton. The mill-holes are unlined, but the

ore-chutes are lined with 2-in. plank. The manways are timbered with boards 2 by 12 in. diam., fitted with bevel-joints at the corners. This insures stability and safety.

The ore is assembled and dumped into chutes leading to main loading bins on the 700-ft. level. A principal gangway, or adit, traverses the central porphyry core from the portal on the northwest side of the mine, extending about S. 35° E. 5000 ft. to the main shaft, cross-cutting the elliptical orebody along its major axis. In this adit is a 36-in. gauge track, over which the ore is hauled to the portal in 25-ton steel side-dump cars, made by the Ingoldsby-Dusey Car Co., in trains of seven, by 6-ton General Electric Co.'s locomotives. The power is transmitted from the central power-station at Nacozari. The cars are then delivered to the steam-locomotives which take them to the mill down a greatly detoured railroad six miles long. Timbers and other mine-supplies are taken by the trolley to shafts at the points of intersection of the aforementioned adit with the vein. Timber-framing, drill-sharpening, and general machine-work are all done on the surface near the shafts. Drills are sharpened by a Leyner machine, which is operated by Mexicans and Japanese. No American labor is employed aside from shift-bosses and timbermen. The Mexicans have been trained to all classes of work, which is done in accordance with the best methods used in the United States. The direct supervision of the mine is under Charles A. Smith, assistant superintendent.

Salt fields are very extensive in western Ontario. The salt beds form part of the Onondaga formation of the Silurian age, and the saltiferous horizons underlie a territory extending from Kincardine to Lake Erie, bordering Lake Huron and the Detroit river. The basin measures an extreme length of 150 miles, with a maximum width of 40 miles at the centre tapering toward the end. This would cover an area of 2500 square miles. An idea of the immense deposits of salt contained in this area may be gathered from the fact that a bore-hole sunk at Goderich, in Huron county, to a depth of 1517 ft., went through six beds of salt ranging in thickness from 6 to 36 ft.; whereas at Windsor, in a well 1672 ft. deep, four beds were traversed, one of which is said to measure 250 ft. in thickness.

Government foresters are inspecting the proposed route of the Humboldt & Eastern railroad, and it is believed that some definite action will be taken shortly to have active construction work started on the line. As proposed the road will extend eastward from Humboldt bay for 175 miles to the upper Sacramento valley. Seventy miles of the line will extend through the Trinity national forest reserve in Trinity, Humboldt, and Shasta counties.

The Geological Survey of Canada will have nearly a dozen parties in the field in British Columbia this season and work will be done on the ore deposits of Atlin district, Portland Canal district, Hazelton district, Vancouver island, the Tulameen platinum deposits, West Fork of Kettle river, Slocan, Boundary, East Kootenay, and Ice River districts.

Refuge Chambers in Mines

Suggestions for equipping safety chambers in coal mines and connecting them with the surface by drill-holes have been frequent of late. While in metal mining there is not the same urgent necessity for them, there have been instances where such chambers might have resulted in the saving of lives and the subject is not without interest. The following plans and account were prepared for the Charleroi mines of the Pittsburg Plate Glass Co. by Jesse J. Johnson and presented by John K. Tenner in the course of a debate in the House of Representatives at Washington on mine rescue work.

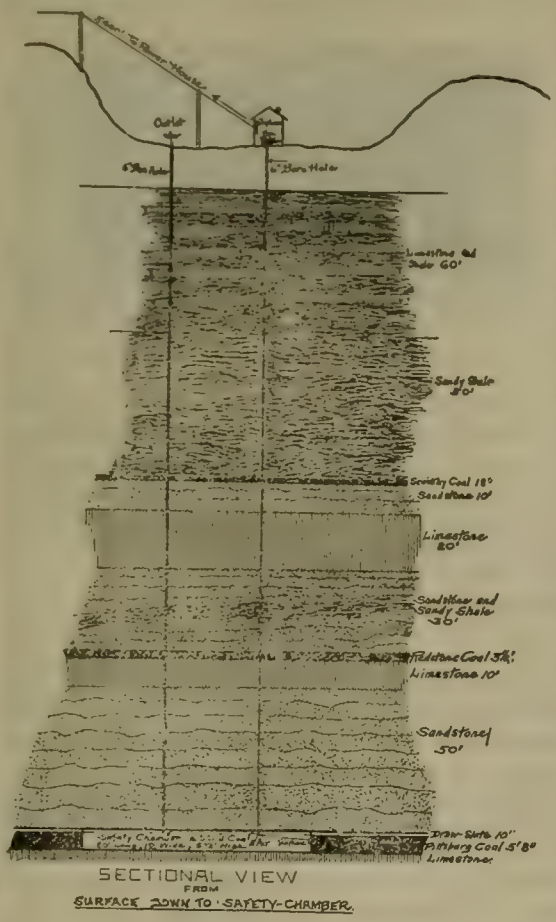
In a great many explosions the majority of those lost are killed outright; but in numerous cases, men have traveled long distances after the first shock of the explosion, only to meet death in their tracks by the after flow of gas. On actual tests of a bore-hole 6 in. diameter, having a depth of 300 ft. from surface to the coal, the readings show the velocity of the air passing up the bore-hole was 2000 ft. per minute. It is a matter of scientific interest that life was sustained in the Cherry mine, Illinois, one week after the mine fire started in an atmosphere in which there seems to have been upward of 5% of carbon dioxide and an atmosphere in which lamps would not burn. It is therefore reasonable to conclude that if several underground life-saving stations with bore-holes to the working veins had been previously installed at the Cherry mine, a number of the entombed miners could have reached these stations and a supply of fresh air and plenty of food could have been delivered from the surface.

One of the chief difficulties confronting the rescuers in mine disasters is the lack of information to know how and where to proceed into the parts of the mine where lives could be rescued. At the Courrieres, France, disaster, on March 10, 1906, the most fearful disaster which ever overtook any mine in any part of the world, where 1211 lives were lost, four hundred and forty three miners descended No. 3 pit, and of these only 13 or 17 escaped; 500 went down No. 2 pit, and of these 401 escaped; 852 went down No. 4 pit, and of these 175 escaped; making a total loss of 1211. The rescuers report that many lives might have been saved if they had only known in what direction to explore, and this is amply proved, as either 13 or 17 persons escaped alive from No. 3 pit at noon on the Sunday following the explosion, and later 13 more were rescued after 20 days' entombment in No. 2 pit. On further examination, evidence was found showing that hundreds of these men lived for days, some for weeks, living on bark from posts and putrid flesh.

At Cherry, Illinois, when on November 13, 1909, where about 300 lives were lost, similar conditions as at Courrieres prevailed. The 20 miners rescued one week after the mine fire started could have been rescued one or two days earlier had the rescuers known the situation of the miners and known in what direction to explore. On November 23, four rescuers reached the third vein. They found from 150 to 169 bodies, the count varying. Some of the men had made fans from drill machine parts, but no

barricades had been built. None of the notes indicated that the men had been conscious after Monday following the fire. This is conclusive evidence that a great many of the entombed miners lived 60 hours after the fire started.

At Primero, Colorado, February 2, 1910, 75 lives were lost. Eleven men retreated after the explosion to a room, where they remained a number of hours, but becoming impatient at delay in being rescued and in an effort to find good air started out into the entry and were suffocated by after damp, with the exception of one man named Virgen, who was rescued. The portion of the mine in which these 11 men worked was 1600 ft. from the nearest explosion and was absolutely unaffected by the explosion, and



Plan of Rescue Chamber at Charleroi, Pennsylvania.

in it the air remained good, due to the short circuiting of the after-damp currents around it. Had they been able to communicate with the outside and obtained instructions to stay in safety until reached all would have been saved.

The evidence gathered is conclusive that this subject is worthy of consideration and would certainly justify the expense in installing the underground life-saving stations to save the lives of miners who are not in the immediate zone of the explosion. The location of underground life-saving stations is a matter for every mine manager to decide for himself, and I can only suggest some ideas as to the size of the entrance and location of doors for isolating the air within a certain area surrounding the underground life-saving station. At distances each way from the entrance to the life-saving station suitable to conditions, I would erect two doors of boiler plate, built in recesses in the ribs of the entry, so that they will work flush with the sides of the coal; would also erect one door at the entrance to the safety chamber from the entry, and another one at the place where the chamber is widened from the entrance entry. The chamber should only be 12 ft. in width and not over 80 ft. in length, and all walls should be whitewashed. It should be equipped with a telephone connected through the bore-hole with weatherproof cable to reach the surface, thence by telephone line to surface plant. It should be equipped with a large roll of brattice cloth, a medicinal box of first-aid appliances, safety lamps, and a number of oxygen flasks. The sides and roof of the chambers should be lined with concrete, and should be connected by two 6 or 8-in. bore-holes with the surface. One bore-hole could be used for inlet air to be driven by a small fan and the other bore-hole for the outlet air. Water and food could be delivered from the surface by means of the bore-holes.

Another suggestion has been offered, which is to use a 2-in. pipe inside of the 6 or 8 in. By compressing to 80 lb. 100 cu. ft. of free air per minute could be sent through a thousand feet of pipe with a loss of only 5.8 lb. in pressure. Judging from the rescue apparatus, it takes an average of 10 litres of fresh air per minute for each man. This is about one-third of a cubic foot; so with 100 cu. ft. of air you could have sufficient air to sustain 300 men.

Long-span concrete bridges are receiving attention so extensively that there can be no question about the firm position this type of structure now holds in engineering practice. In this country there has recently been completed the 233-ft. Walnut Lane span in Philadelphia, and the Rocky River bridge of 280-ft. clear span is now under construction at Cleveland. A bridge having a central span of 281 ft. has been designed by the city engineer of Spokane to carry Monroe street across the Spokane river. A span of 285 ft. has been adopted to carry the New York barge canal over a gorge in the vicinity of Medina, New York. The 710-ft. span of the proposed Henry Hudson Memorial bridge at New York has been the subject of so much discussion that it is at once recalled when the design of long-span concrete structures is mentioned. This bridge, however, is apparently not likely to be constructed for some time, owing to the action of the city authorities in withholding further appropriations for the engineering work. With the exception of the Henry Hudson bridge, the longest span yet proposed is that of a bridge recently placed under contract by the civic authorities of Rome. This will cross the Tiber with a span of 328 ft., having a rise of 1:10 and carrying a roadway 65.6 ft. wide. The cost of this bridge has been estimated at £50,000. A bridge comparable with it in every respect is now more than half finished at Auckland, New Zealand. It has a total length of 910 ft., and its main feature is a span of 320 ft., which will carry a 40-ft. roadway at an elevation of 174 ft. above the ground.

Reclaiming Flooded Drift Mines in Alaska

By W. H. Lanagan

During the summer of 1909 and the winter of 1909-10, three different methods have been put into practice to reclaim flooded drift mines in the Nome district, Alaska, the object being the freezing of a bulkhead in a drift in order to shut off the flow of water from wet ground that had been inadvertently tapped while drifting in adjacent dry frozen ground. On the Bessie Bench, famous as one of the greatest producers of the Third Beach, one drift was successfully frozen off during the summer of 1909 by means

Fig. 1. Front View of Drill.

of an ammonia vapor refrigerating plant. On the same claim another drift was frozen off in February 1910 by means of a circulating solution of calcium chloride, cooled by a system of pipes in the open air. On No. 1 Below Discovery on Dry creek, two bulkheads were frozen in drifts by the use of cold air alone. The work was done during the middle of the winter.

In each case the flooding occurred in workings that were being carried on in what is called the 'slough-over' pay-streak, which parallels the Third Beach throughout, at a distance of 100 to 300 ft. south of it. This pay-streak appears to have had its origin in the concentration that took place on the sea-floor just beyond the belt scoured by the surf, and wherever the Third Beach was rich, the 'slough-over' has yielded a good profit. An exactly similar formation can be seen in the bar that parallels the present beach-line, at a distance of 100 yd. to the south.

A large portion of the Third Beach on the Bessie claim was frozen, but on the west end the work was carried into the thawed ground on the left limit of Saturday creek, and a heavy flow of water had to be pumped during the latter part of the work. The depth to bedrock was 120 ft., and after the pumps were pulled the water filled the old works and rose to a height of 60 ft. from bedrock. As a rule there is a belt of very low-grade beach and sea-bottom material between the Third Beach and the 'slough-over' pay-streak, but on the Bessie there is gold in paying quantities distributed over the old sea-bottom for a distance of several hundred feet to the south of the Third Beach. The value of the ground is not high enough, however, to warrant the heavy expense of pumping, and so care has always been taken to leave a safe pillar of frozen ground between the work and the old flooded stopes. In only a few cases have maps been kept that showed accurately the outlines of the old works that had to be avoided; drilling from the surface has often been resorted to for the purpose of establishing the outlines of flooded ground. In some cases ground contiguous to flooded works has been safely taken out, without the aid of maps or drilling, by feeling the way ahead of each thaw with a small drill-hole ¾ in. diam. When water is struck, the drill-hole can be plugged and it soon freezes back; the stoping never approaches closer than within 5 or 6 ft. of the flooded ground. Where there has been no circulation of water in flooded works for several years, a coating of ice from 2 to 5 ft. thick is found along the walls. In approaching work of this kind it has sometimes been possible, by discarding the

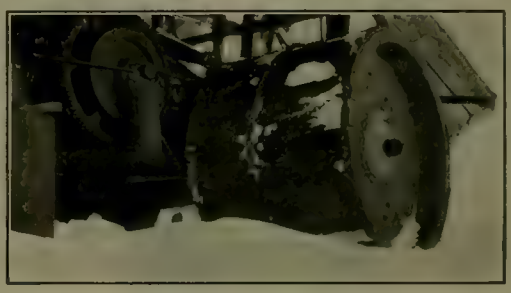


Fig. 2. Driving Gear and Drive Wheel of Drill.

steam-point when several feet from the old works, and breaking down the gravel with warm water from a hose, to remove all of the virgin ground right up to the ice-wall. Whatever method is used, the best practice is to remove the ground farthest from the flooded works first, so that in the event of flooding the amount of ground lost may be as small as possible.

The idea of tapping the flooded drift with drill-holes from the surface and using an ice-making machine to freeze a solid bulkhead and so to shut off the water and confine it to the old flooded works, came from John Brower. He, of course, obtained much information regarding the operation of refrigerating machinery from the companies operating cold-storage plants in Nome, but the details of the application of the process to the work in hand were worked out by him, and the success of the work is due to his originality and good judgment.

The flooded drift in which the bulkhead was to be frozen had been driven in frozen ground; after the drift was flooded the water raised in the shaft to a depth of 60 ft. and remained at that point. There was no circulation of water in the drift, and the presence of stagnant water would not draw the frost from the walls and floor, but would form a coating of ice. Consequently only the water had to be frozen, together with what material had sloughed from the walls and roof of the drift before and during the flooding.

The depth of the ground in which the drilling was done is 120 ft. The drill used was a unique affair designed two years ago by Mr. Brower to meet the peculiar conditions of the Nome tundra. A view of the front or drilling end is shown in Fig. 1. The principle of the ordinary power churn-drill is used,

but the power is furnished by a 10-hp. gasoline engine; the traction wheels are 6 ft. diam. and about 6 ft. wide, lagged with 2 by 6-in. planking. Moving over the thawed swampy tundra in the summer is greatly facilitated by the large wheels. A steel cable replaces the ordinary manila drilling cable. The bit is 5 in., drawn out to cut a 6-in. hole. The drill-stem consists of two stems joined together, and has a length of about 35 ft. No casing is used in frozen ground, and a drilling speed of 50 to 60 ft. per 10-hour day is not uncommon. The driving gear is shown in Fig. 2.

The width of the drift to be frozen was about 5 ft. Two lines of three holes each were drilled in the drift; each was carried into the bedrock for a distance of 2 or 3 ft. below the bottom of the drift; the distance between lines was 2 ft. and between holes 1½. A string of 1-in. pipe extending from the surface to the bottom and return, was placed in each hole. An ammonia-vapor refrigerating plant of 6 tons capacity, that is, with a refrigerating effect equivalent to the melting of 6 tons of ice in 24 hours, was used. The compressor was driven by the 10-hp. gasoline engine on the drill; the condenser was supplied with surface-water probably not colder than 50 F. The action was that of the ordinary refrigerating machine; the ammonia-vapor was compressed and sent to the condenser, where it was cooled to a liquid; it was then released by means of expansion valves into the pipes set in the drill-holes, whereupon it abstracted from the water in the drifts most of the heat necessary for its conversion into ammonia-vapor and the subsequent expansion of the vapor. The water about the pipes congealed into ice as its heat was withdrawn. The ammonia-vapor upon its return to the surface passed through the compressor and condenser, became liquid, and was again released into the pipes.

The machine was kept in continuous operation for 14 days. The fuel consumption under a 10-hp. load did not exceed 25 gal. of No. 1 distillate per 24 hours; the cost of this at 22c. per gallon amounted to $5.50, and the cost of two attendants, one on each shift, would bring the daily expense up to $18. On account of the freezing of the sloughed material in the drift it was not possible to reach the bulkhead itself after the freezing was finished and the water pumped from behind it, so the exact amount of freezing done is not known, but the bulkhead has safely withstood the pressure due to the 60-ft. head of water, for a period of several months. This piece of work was done by Mr. Brower under contract with the owners of the Bessie claim. The contract price is not definitely known, but it was much greater than the actual operating cost, since it had to cover the first cost of the refrigerating machine and the remainder of the equipment. The foregoing piece of work was done during the summer. The ammonia-process has the advantage over the two methods described hereafter, that neither of the latter can be used except during the winter.

No map showing the drift to be frozen in the second case was available, so it was necessary to search for the drift with the drill. The ground is 120 ft. deep, and 12 holes were put down at intervals of 6 to 8 ft. before the drift was found. Six holes were then drilled in the drift. Their relative position is shown in Fig. 3. The interval between holes is 18 to 24 in. It was found later that the holes in the drift had practically the same relative positions as on the surface 120 ft. above. The drilling was done without casing, as is the usual custom in frozen ground in the Nome district.

The arrangement of the freezing apparatus was as follows: A line of 1-in. pipe extending from the surface down into the bedrock, 2 or 3 ft. below the floor of the drift, was placed in each drill-hole; ordinary U returns were used at the bottom. On the surface a light trestle, 150 ft. long, supported 12 strings of 1-inch pipe, connected in pairs by returns at the far end. The surface pipes were connected in series with the drill-hole pipes, and a small circulating pump was added.

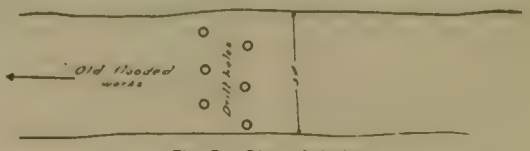


Fig. 3. Plan of Drift.

The circulating solution was one of calcium chloride; the proper strength was determined by testing in glass tubes until a solution was obtained that did not freeze when exposed to a temperature of 45°F. below zero. From the pump the solution passed through an air-cooled coil of pipe, and down the first drill-hole; upon its return it passed out through 300 ft. of surface pipe, and was cooled before entering the next drill-hole; and so on through the six holes and back to the pump.

The circulating pump was driven by a 2½-hp. gasoline engine. The circulation of the solution was continued for 14 days without interruption. The temperature during the period, which was in February 1910, ranged from a few degrees below zero to ten above. It is claimed that three or four days would have sufficed for the freezing had it been done in the latter part of January, when the temperature ranged from 20 to 40° below zero for several days.

At the expiration of the 14 days, pumping was started from the shaft south of the bulkhead, but freezing was not discontinued until six days later, as the fuel cost was only a few cents an hour, and very little attention was required. When the water was pumped out, the bulkhead was under a hydrostatic head of 60 ft. It was found when the drift had been cleaned out up to the bulkhead that a cylindrical column of ice with a radius of 18 in. to 2 ft. had formed about each pipe as a centre. The interlocking of these columns produced a solid mass of ice about 5 ft. thick. The pipes could be plainly seen through the clear ice. They will be recovered next summer by turning steam through them for a short time.

The cost of this work was considerable, owing to its experimental nature, the first cost of the equipment and the drilling necessary to find the drift. If the operation were repeated in a place where the position of the drift was known, the total drilling

necessary would not be more than eight holes, a total of about 1000 ft.; this could be done at a cost not greater than 60c. per foot, or $600 for the 1000 ft. The cost of setting up and operating the freezing plant, with a reasonable charge for the use of the equipment, would bring the total cost of the work up to $1000. This process can, of course, be used only during the winter, when the temperature is low enough for effective cooling.

On No. 1 Below Discovery on Dry creek (a claim near the Third Beach line, about one mile east of the Bessie), J. M. Crabtree and J. C. Murray tapped the

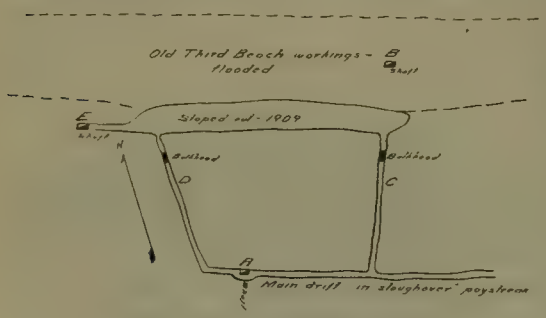


Fig. 4. Plan of Workings.

old flooded workings of the Third Beach while prospecting to the northward from their work on the 'slough-over' pay-streak. No maps of the old works were available, and innacurate reports of the southward extension of the old work led to the flooding of Crabtree & Murray's mine when they thought themselves protected by 20 ft. of solid ground. Fig. 4 shows the general arrangement of the work. While driving the drift *C* to the northward from the main drift in the 'slough-over' pay-ground, the water from the old works broke through and filled the shaft *A* to a depth of 60 ft. from bedrock. The flow of water, however, was not nearly so heavy as on the Bessie claim. At *B* an old shaft in the flooded ground remained standing; an Emerson sinking pump with a 3-in. discharge was set up in this shaft and the water-level reduced to bedrock. At the same time a new shaft was sunk in frozen ground at *E*, and Worthington pumps of 1½ and 2-in. discharge were installed on bedrock. A drift was then run to the east, the old works were broken into and a block of virgin ground adjoining the old works on the south was stoped out, the water being handled in the meantime by the Emerson pump in shaft *B* and one of the pumps in the shaft *E*. The water pumped from the mine was used in sluicing, and by its aid the work was continued until November 11, although the sluicing elsewhere in the Nome district was over before October 1. This is the latest sluicing of record on the Seward Peninsula: the first sluicing of the season of 1909 was done with snow-water on May 12, six months before. Most of the water for the Dry creek work came from a small reservoir in Dry creek itself; the ice was 18 in. thick over the pond when the stoping was completed, and the sluicing abandoned. The mine-water supplemented the creek-water: each day before starting to sluice, warm water was run through the boxes for a few minutes in order to thaw them out.

While the stoping was going on from shaft *E*, a timber bulk-head was built in the drift *C*, about 8 ft. south of the edge of the stope; the entire drift, about 3½ ft. wide by 5 ft. high, was filled with pieces of timber 8 ft. long, laid lengthwise of the drift. All the chinks between timbers in the north face of the bulkhead were plugged with wedges, and the face was then plastered over with a mixture of snow and water, forming a slush, against which was directed a stream of cold air brought down the shaft *B* by means of a ventilator similar to that used on shipboard. Layer after layer of slush was put on and frozen until there was a thickness of more than 3 ft. on the north or water-side of the bulkhead. The drift *D* was connected with the old works during the course of the stoping from the shaft *E*, but the connection was made through a very small opening: this was frozen up without a timber backing such as was used in the drift *C*. When the pumping at *B* and *E* was stopped and the 60-ft. head of water came against the bulkheads, the one at *C* leaked so badly that it was necessary to pull the water-level down to bedrock again by means of the pump in the shaft *B*, and it was then found that the timbers had not been moved from place, but the slush on the north face had honeycombed instead of being frozen into solid ice and the water-pressure had crushed it, allowing the water to leak through the spaces between the timbers. The timbers were therefore discarded and a new bulkhead built of wet sand, frozen on a little at a time, after the manner shown in Fig. 5. The 6-

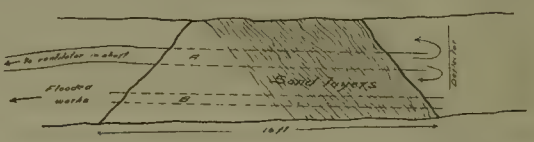


Fig. 5. Elevation of Drift 'C.'

in. iron pipe *B* was set in the base of the bulkhead to furnish drainage for any accumulation of water on the upper side while the bulkhead was being built; the 10-in. iron pipe *A*, 14 ft. long, was set into the centre of the bulkhead and used for conveying cold air from the ventilator in shaft *B* to the lower side of the bulkhead, to which layers of wet sand and small gravel were frozen until the total thickness was about 12 ft. Wooden plugs were driven in both ends of the pipes *A* and *B*. This bulkhead has proved an entire success.

The ice plug at *D*, however, gave way after the new bulkhead had been put in at *C*. The accumulated water in the old works was once more pumped out through the shaft *B*, but the stope had caved so badly that it was no longer possible to reach the drift *D* with a cold-air pipe from the bottom of the shaft. It was the cracking and caving of the stope-walls that brought about the failure of the bulkhead in the drift *D*. The position of this drift was established on the surface by survey, and a hole drilled into it with a Keystone gasoline drill. The depth of the ground at this point is 80 ft. By means of a stream of cold air from the drill-hole a bulkhead was frozen in the drift after the manner shown in Fig. 6. Sacks about half filled with wet sand were used. The first layer *A* was built just north of a low place in the roof, and the upper sacks of the layer were pulled

down until they rested against the projection from the roof. A hammer was used to pack the sacks tightly against one another and against the walls of the drift. When the drift was completely filled, freezing with the cold air was started. About 24 hours' freezing sufficed to harden the first layer of sacks to such an extent that there were no leaks when the drift north of the bulkhead filled with water, but the pump in shaft *B* was kept running and the head of water pressing against the sacks was not allowed to exceed 8 or 10 ft. until two more layers of sacks

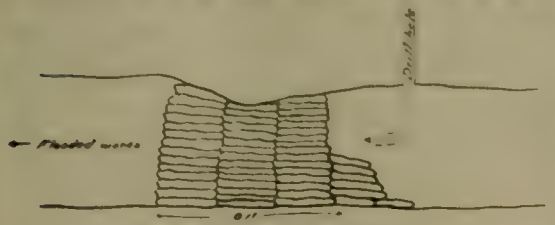


Fig. 6. Elevation of Drift 'D.'

had been thoroughly frozen into place behind the first one. During the five days that freezing was carried on the temperature was generally not below zero. This bulkhead has now been under pressure for several weeks and has shown no signs of yielding.

In comparing the three methods, the ammonia process has the advantage, since it can be used at any season of the year; the first cost of the equipment is greater than that necessary for the other two methods, but the cost of actual operation is about the same. The use of calcium chloride or other solution of low freezing point must be confined to the winter season. The cold-air method can be used only during the winter months, and in workings where the flow of water can be handled at a reasonable cost.

Appropriations for the beginning of the construction on the $11,543,000 breakwaters to be constructed at Colon, Panama Canal Zone, will be available after June 30. Work has already been begun on the service buildings that will be required for the work. There will be two breakwaters. The west one, extending from Toro Point at an angle of 42° 53′ from Colon light, will be constructed first. It will be about 10,500 ft. in length, with a width at the top of 15 ft., and a height above mean sea-level of 10 ft. The width at the bottom will depend largely on the depth of water. The survey of the bottom of the bay along the line of the breakwater showed the greatest depth to be about 43 ft., and at this point the embankment will approximate 180 ft. in width. The east breakwater will be an isolated structure constructed at an interior angle of about 135° to the west breakwater, and will be about 5700 ft. in length, with the other dimensions practically the same as those of the west breakwater. The amount of fill estimated required in the construction of the breakwaters is 4,915,000 cu. yd., about one-half of which will be material excavated on the Point for the core of the west breakwater, and the balance Porto Bello rock. The construction of the inner end of west breakwater will proceed by driving piling for trestle on which a track will be laid and train-loads of material hauled out on it and dumped.

Wet Gold-Assay

By Roman Dulce

The following is a description of a wet process for the assay of gold which I believe many will appreciate. It enables a man to carry a portable outfit easily to remote places. The necessary apparatus can be carried in a suit-case and need not weigh over 15 lb. The procedure is: make up a solution of 100 parts of water to 2 parts of resublimated iodine and 4 parts of iodide of potassium. This solution is a rapid solvent for gold. Next weigh out one assay-ton of pulp, transfer to a porcelain mortar, add 50 c.c. of the iodine solution, and grind for 10 minutes. Let stand for one hour to insure the solution of all gold in the ore. Should the solution turn clear in the meantime it shows that there is an excess of reducing agent present in the ore, and more iodine and iodide of potassium must be added until the brown color of the solution becomes permanent. Next filter and wash off the iodine solution from the pulp, add to the filtrate 3 grams of mercury, and shake vigorously in a glass stoppered bottle until the solution clears. The gold will then be all precipitated from the solution and amalgamated with the mercury. Transfer the mercury to a porcelain evaporating dish, wash with clean water, and add 10 c.c. HNO_3 and warm gently until vigorous action commences. The mercury will collect in one globule, and finally dissolve completely, leaving the gold in a compact button. Pour off the nitrate of mercury and wash the gold button with distilled water if available; if not, ordinary water, slightly acidulated with nitric acid, will do. Finally dry over a lamp.

The button can be weighed as soon as dry if a button-balance is available. Where there is no button-balance to be had a number of other methods can be used. A form of ivory scale for blow-pipe buttons is calibrated for this kind of button. Also the microscopic method described by Beringer in his 'Text Book of Assaying' can be employed. For the ordinary prospector, however, the following method is probably accurate enough. A number of buttons of different sizes are made and weighed on a delicate balance; they are then mounted on a card with glue and used to compare with the buttons obtained in assaying with the above process. This is adapted to all ores that can be successfully treated by amalgamation, cyanidation, or chlorination. With certain variations it can be adapted to almost any ore. Even an ore rich in copper, by a preliminary treatment with nitric acid to remove the copper, might be tested in this way.

Electric fuses are the detonators used when electrically firing high explosives such as dynamite. Such a fuse consists of a copper capsule or shell containing a detonating charge surrounding a fine platinum 'bridge' which joins the tips of the insulated copper wires of various lengths. The ends of the copper wires are secured in the copper shell by a composition plug which also serves to keep moisture and water away from the charge. The fuse is detonated by passing a current through the copper wires and across the platinum bridge.

FAST TUNNEL DRIVING

During the month of May 1910 the Laramie-Poudre tunnel was driven from two headings a distance of 825 ft. The heading from the west end was advanced 332 ft., while that from the east portal was advanced a distance of 513 ft., thus breaking all American records for a single heading in a calendar month. In January 1909 the Cripple Creek drainage tunnel was driven 435 ft., and in January 1908 one of the headings in the Gunnison tunnel made 449 ft., and in October 1908 the Elizabeth tunnel, near Los Angeles, was driven 466 ft. The rock in the Cripple Creek drainage tunnel and in the Laramie tunnel is very much the same, being hard firm granite in each; whereas in the Gunnison and the Elizabeth the rock was very much softer, and in the latter quite a large portion of it was shale. The rock through which the Laramie tunnel is being run is so hard that 27 holes have to be drilled in the face of each heading and loaded with the most powerful modern explosives to break it successfully. The men work under the bonus system and receive an extra amount of pay for each foot driven over 250 in each calendar month, and on such a record-breaking run as that of last month this bonus amounts to a considerable sum, consequently both workmen and the contractor, James A. McIlwee, are superlatively happy. The Laramie tunnel, as driven, is 7½ ft. high and 9½ wide, and is nearly oval in form, thus obviating the necessity of taking out any corners and affording every possible facility for rapid driving. In fact this was what the consulting engineer, D. W. Brunton, had in view in using this particular form. The undertaking was entirely new, and no makeshift machinery had to be employed, so that in designing the big hydro-electric power-plant there was nothing to be considered except actual conditions, to which every part of the plant was made to conform. The rate of driving as given above is from the official surveys and measurements of Charles R. Hedke, chief engineer for the Laramie-Poudre company, and there can be no question as to the distance driven during the month.

Driving 513 ft. in a single heading in a calendar month is quite an achievement, but when the difficulties under which the work from the western end is carried on, are considered, 332 ft. is almost as good. The Laramie tunnel is driven on a grade of 17%, sloping from the west toward the east, and consequently the material removed from the west end had to be hauled up grade, whereas on the east end the loaded cars run down grade, and only empty cars have to be hauled up. In addition to this, the west-end workings do not run directly out into the open air on grade, but are connected with the surface by a 200-ft. incline. This was done to avoid about 1400 ft. of water-bearing rock and wash which, had it been opened up, would have drained directly down the tunnel into the heading. Even with this precaution a considerable amount of water seeps in and has to be pumped, so that when the difficulties of pumping, up-hill haulage, and hoisting through an incline are considered, it will be seen that the 332 ft. driven on the west end is a creditable performance.

SOLVING THE SMELTER SMOKE PROBLEM

By A. H. Martin

The bag-house under construction for the Mammoth Copper Co. will contain 2960 wool bags, each 18 in. diam. by 30 ft. long. The smoke from the blast-furnace flues will be drawn by two 400-hp. fans into the discharge chamber. From this it will pass through 38 cooling pipes into the bag-house discharge department. The pipes are each about 200 ft. long, and will reduce the temperature of the smoke from 400 to 200°F. From the discharge chamber the smoke will pass into the series of bags by ingress through the iron floor, and will ultimately discharge into the atmosphere by means of a number of small stacks. Zinc oxide feeders are attached to the fans, which will be used whenever free sulphuric acid is carried by the fume, zinc oxide being fed to neutralize the acid. Before the gases leave the bag-house free air will be drawn in and the fume diluted to such an extent that any portion of harmful smoke escaping the bags will be so diluted as to be harmless. About 1,526,420 lb. of structural steel will be used in the construction of the bag-house, and its total cost will approximate $300,000. The materials are being furnished by the American Bridge Co. of New York and St. Louis.

The Balaklala Copper Co. has decided to install the Cottrell fume-controlling device, invented by F. G. Cottrell, of the University of California. In this method the solid particles, which cause the damage to crops, are separated by electric-discharge. The plant will have an electrode area of 100 sq. ft., and is designed to handle 70,000 cu. ft. of smoke per minute. The device consists of a precipitating chamber in which are placed 126 electrodes. These are strips of iron 4 ft. long by ¾ in. wide, with saw teeth their entire length. Between the electrodes are placed flat plates of iron about 6 in. wide. An electrical current of 27,000 volts is delivered to the electrodes, and as the smoke circulates between the positive and negative electrodes the solid particles are precipitated on the adjacent plates. The experimental plant shows that 90% of the solid particles carried by the smoke is precipitated by this method. The gases from the main flues are drawn into the precipitating chamber and are driven into the main stack by two fans 186 in. diam. The wheels are 90 in. diam., and the combined capacity is 500,000 cu. ft. per minute. There will be nine permanent units in the plant, seven for constant service, and two for reserve purposes. The total cost will approximate $100,000.

Tin was first discovered in the Black Hills of South Dakota in 1876, when Richard Pearce, of Denver, recognized cassiterite in the placer gold from the northern part of the hills, and in 1877 Fred J. Cross identified it in the material from Elk gulch in the southern hills. It was not discovered in place until June 1883, when A. J. Simmons, of Rapid City, sent specimens from the Etta mine, two miles south of the Keystone, to San Francisco for determination. The Etta claim was at that time being prospected for mica. Shortly afterward tin was found in place at Nigger Hill, since called Tinton, but at that time well known for its rich gold placers.

Mining on the Mother Lode in Amador County, California

By William H. Storms

When Alvinza Hayward first came to Sutter Creek, in the early fifties, his capital consisted of a few hundred dollars in money, indefatigable perseverance, a keen insight into the character of men—particularly their weaknesses, and a splendid faith in his own ability to accomplish anything he undertook. His optimism was by no means limited to the size of his purse, as he was soon to demonstrate in his early operations on the Mother Lode. The great Lode was at that time wholly an unknown quantity. It was recognized that a great gold-bearing belt extended through the foot-hill region of the Sierra Nevada for a hundred miles or more, but beyond this nothing was known of it. Quartz mining was new, nothing beyond the superficial development of a few veins having as yet been undertaken. Placer mining had been carried on with vigor throughout nearly all the counties along the west side of the Sierra, and the miners had learned rapidly in that expensive school, experience, how to work gravel mines.

Eureka Consolidated Mines, Sutter Creek, California.
(From an old photograph.)

It was early learned that the gold in the gravels, both those of the modern deposits and of the 'ancient deep rivers', came from the quartz veins and rocks over which these streams had flowed. The unsolved problems in quartz mining were largely mechanical. Already from Grass Valley to Mariposa, several quartz mines had been equipped with rude hoisting, pumping, and milling machinery, and several disastrous failures had resulted. One mine, the Seaton, I believe, near Drytown, in Amador county, was equipped with a steam-engine which had driven the paddle wheels of a steamer that came around 'The Horn'. None of the machinery of those early days was at all suited to the duties required of it.

One of the first mines was located and exploited in Amador county in 1851. It was owned by several preachers, and was known as 'the Ministers' claim'. This was the Spring Hill mine, now a portion of the famous Keystone at Amador City. The ministers bought a steam-engine to operate their mill, the mine being worked through an adit. The engine was built to order in Sacramento. The main shaft in the mill was a stick of timber having gudgeons of round iron driven into auger holes in the ends for bearings, these ends being strengthened by bands of strap-iron. Cams were improvised by driving bars of iron into the wooden shaft, their outer ends being bent downward somewhat to reduce friction. The stamp-stems of wood were square, and tappets were provided by driving spikes into the stems at proper height. The revolving cam-shaft raised these rude stamps, which dropped in succession, crushing the quartz in the wooden iron-lined mortars. The stamp-heads were shod with iron. In lieu of plates below, the sand from the mortars flowed through a rocker 8 ft. in length, which was kept in motion by a crank connecting with the clumsy cam-shaft. This crude mill proved unsuccessful, but was a few months later replaced by a better one which embodied such improvements as were suggested by experience.

The first mill in which amalgamation with quicksilver was tried was near the Spring Hill, and for a time proved a dismal failure, but later, it being learned that the 'quick' contained a quantity of lead, the condition of the mercury was improved by retorting, and the saving of gold thereafter became much more satisfactory. Quartz mining now engaged widespread attention. The most extravagant ideas were entertained of the value of the ore, and its wealth-producing potentialities were thought to be unlimited. To such an extent did these optimistic opinions obtain that many favored reducing the size of claims from 240 to 120 ft. along the Lode, with two extra claims for the discoverer of a vein in a new district. Some declared the quartz contained a dollar a pound, which the conservative ones were unwilling to admit, stoutly contending that it would not go over a thousand dollars per ton. At a convention held at Rancheria, July 7, 1851, Mr. Davidson, one of the preachers owning the Ministers' claim at Amador City, advised moderation in these estimates, and said that in his opinion, and having no desire of deceiving them, the rock would probably not average over ten cents per pound, though he believed this estimate to be conservative. He was undeceived when he started his mill at the Spring Hill a few days later. Still, this mine with its rude equipment was sufficiently rich to pay not only extravagant expenses, but handsome dividends as well.

Not every mine on the Lode had a bold outcrop; some that did have never proved profitable. Among the rather obscure veins was that of the Badger mine just south of the town of Sutter Creek. The Wolverine, joining the Eureka on the north, was one of those having a solid outcrop of iron-stained quartz 5 to 12 ft. in width and 200 ft. or more in length. Yet the Wolverine was never largely profitable, whereas the Badger and Eureka were.

Alvinza Hayward at this time associated himself with a man named Robinson, who owned the Badger mine, named after his native State of Wisconsin. Together they opened the mine to a depth of a hun-

dred feet or more, and for a time it paid well: so well that they were enabled to provide a better hoisting plant and also to build a small mill. About the time Hayward and his partner had succeeded in getting their property suitably equipped, the grade of ore became too poor to longer yield a profit, the expenses of mining and milling exceeding $12 per ton. Then followed dark days. For a time both men stayed courageously with the losing venture, hoping that pay-ore would again be discovered at greater depth. The shaft was sunk deeper, but the ore got poorer rather than better, and Robinson, disgusted with the lack of success when so many seemingly better opportunities presented themselves, left the Badger mine and his partner, to win fortune for himself under more encouraging conditions. Here Hayward's tenacity of purpose showed itself. He could have gone to any one of a score of other places and doubtless have done better than he was doing with the Badger, but he had started to develop the mine and was unwilling to give it up until he had thoroughly satisfied himself that further work would be folly. He went as far as his limited means would admit, but the much wished for pay-ore remained undiscovered. When his money was all gone and his credit heavily taxed, Hayward was visited one day by Oscar L. Chamberlain, his one time partner in the placer mines in Calaveras county. Chamberlain had been successful in the humble business of raising potatoes on his ranch in Calaveras and had just sold out for $6000 and was about to leave for his Eastern home. Hayward took him through the workings of the Badger mine, expounded his theories and expressed his faith in the future greatness of the property with so much force that he finally talked Chamberlain into joining him and putting in his $6000. Chamberlain frankly said he considered it a desperate chance, more likely to fail than to succeed, but philosophically remarked that as the miners would still want to buy potatoes if the mine failed, they could go back to the unromantic occupation of growing 'spuds' for the miners who were successful, and moreover, he did not like to desert his old partner in the hour of his distress.

Development of the Badger mine was now continued with renewed energy under the stimulation of Chamberlain's money, but $6000 does not go far in the development of an unprofitable mine, and the sum was quickly absorbed. Credit was the only thing now left to the owners. They went ahead on this basis until finally only one man, John Keyes, of the firm of Clute & Keyes, was willing to carry them. Eventually Hayward and Chamberlain owed nearly $100,000, and merchants, ever liberal and well disposed toward men of the type of Hayward and Chamberlain, could carry them no longer. The partners worked harder than any man in their employ. When fuel was low, Alvinza Hayward was repeatedly known to go up on the hillside and 'pack' down enough wood to keep up steam at the hoist until he could persuade someone to trust him for a cord or two of wood. They owed thousands of dollars to their miners, but for some reason these men appeared to share the faith of Hayward in the ultimate success of the mine and continued to work as well as though they were being promptly paid.

One Sunday morning Hayward and Chamberlain were sitting in front of their cabin, which also served as an office, a few yards from the shaft. They were sitting in front of their cabin, which also for, as Chamberlain put it, they had "reached the last ditch." They noticed a group of miners near the shaft engaged in earnest conversation. After a few minutes, several men left the group of miners and slowly walked up the hill in the direction of the office. "Jig's up!" was Hayward's terse remark. "Looks like it," was his partner's equally laconic response. The men approached and one of them, in the capacity of spokesman for all, said: "Mr. Hayward, we have stood by you till now without money for months, and we are willing to stand by you a while longer, but the boys say they can't work without some tobacco."

"All right, boys," responded Hayward, "I'll see that you get some tobacco."

The men returned to their companions and the shift went below. Hayward turned to Chamberlain and said, "You must go to Jackson and buy a box of tobacco for them. Here's my watch. You can raise enough money on that—these men must have tobacco."

A few days later the shaft came into rich ore. Nothing was said to the men about it, but the work was urged on with greater vigor than ever. Hayward found that the shoot was pitching northward into the Eureka ground adjoining. Robinson had gone away in the spring of the year 1857, but now returned in the latter part of September of the same year. Meeting Hayward, that gentleman complained bitterly of a lack of success, but at the same time expressed his intention of staying with it, and pretended that he wanted Robinson to put up more money, which the latter refused to do. By the exercise of considerable finesse, Hayward managed to successfully bargain with Robinson for his interest in the Badger and finaliy bought it for $7500. Hayward continued to work the mine, but still carefully refrained from making any outward show of success until late in the fall, when he allowed the fact to leak out that he had 'struck it rich' in the Badger mine. Robinson was suspicious, declaring he had been defrauded, and for a time threatened to take summary revenge on his scheming erstwhile partner. Hayward flatly denied any underhanded work, and after much bickering and the intervention of mutual friends, a reconciliation was effected, which was made still more binding by a present of $1000 from Hayward to Robinson's son at Christmas time. A love feast followed. Hayward bought a keg of beer, and he, with Robinson, proceeded with many friends to blithely celebrate the occasion. The bar-tender failing, after numerous liquid rounds, to draw the cheering beer with sufficient promptitude, Hayward undertook to expedite matters by knocking the spigot from the barrel, whereupon the beer spurted in all directions and much of it was wasted. As an improvement on the removal of the spigot, Hayward smashed in the head of the keg with a heavy hammer, and free beer was then readily accessible to all. Everybody directly concerned in the performance promptly imbibed to the extent of his capacity, and

in most cases they exceeded it. Hayward and Robinson now walked around town with joyous faces, their arms entwined, Hayward the while industriously ringing a good-sized dinner bell. The reconciliation was certainly celebrated in true Western style.

The rich ore was promptly sent to mill, and with the proceeds control of the Eureka mine was secured for a few thousand dollars, and it is commonly said that much of the money for this came from the Eureka ground, the Badger workings having extended over the line into the neighboring mine. There now being no further reason for secrecy, the ore was sent to both the Badger and Eureka mills, and to custom mills as well, and soon the Eureka Consolidated, which a short time before was one of the poor mines of the Lode, was making an output of over $30,000 a month. Chamberlain, seeing his fortune was now made, did not care to further follow the business of practical mining and sold his interest to Hayward for $500,000, being well satisfied with his investment of $6000, and retired from the mining regions to lead a life of luxury.

The richness of the great Eureka-Badger vein is still one of the favorite topics of conversation among old timers. One miner told me a few days ago, that one day in the stopes he hammered a boulder of hard rock for nearly half an hour, and being unable to break it, finally managed to send it up in the bucket. In a few minutes the superintendent came hastily to where he was at work and excitedly inquired where the boulder came from. The cause of his excitement was in the fact that the quartz was matted with gold to such an extent that it was with greatest difficulty it could be broken, which fact, curiously, the usually astute miner had failed to notice, the rock being covered with the coal-black gouge of the vein. Some of the less scrupulous miners used to add to their wages by occasionally appropriating small pieces of quartz containing gold. It need not be said that modesty was not always a feature of these appropriations; in fact, some of these men actually amassed fortunes by crushing the loot of the mines in their little private mills, consisting of a cast-iron mortar and pestle, which they employed industriously in their cellars or in small drifts leading from them. Several years ago, a boy at play on the hillside near the Eureka mine observed what appeared to be an old pair of overalls lying beneath a bush. He gave it a pull and the rotten cloth was torn, having lain there evidently many years. When the cloth was torn away, a quantity of rock was exposed. The lad was raised in a mining town, and his eye quickly caught the glint of gold. Examination revealed gold in every piece. This find is said to have netted $6000. Some miner had cached his spoil where it was found, doubtless hoping to remove it later.

Most miners, like sailors, are superstitious. Of course, intelligent people generally have little sympathy with these ideas; nevertheless, the following strange story is absolutely true, and will be vouched for by some who are still living at Sutter Creek: One morning at breakfast in the company boarding house, a miner named Wilson White said that during the night he had had a vivid dream that depressed him somewhat. He dreamed, he said, that three men were climbing out of the mine on the ladders when the one nearest the surface lost his hold and fell, knocking the two men beneath from the ladder. Two were killed and the third seriously injured. His friends, more superstitious than White, declared his dream a bad omen and urged him not to go into the mine that day, particularly as it was the last shift he expected to put in there, but he refused to give heed to their well-meant remonstrances and went to his work as usual, laughingly saying he was not in the least superstitious. That evening Wilson White, a man named Joseph McDaniels, but who was generally known as 'Joe Kentuck', and a third miner whose name is now unknown, were climbing the ladders of the inclined shaft on their way to the surface. For some reason which can never be known, Wilson White, who was ahead and nearing the surface, lost his hold and fell backward headlong down the shaft, bounding from place to place among the timbers. His falling body struck the man who had followed him a few feet below, and he, too, fell from the ladder. Joe Kentuck was on the ladder, but not, as yet, a great way from the bottom. He apparently received some intimation, possibly from an outcry of one or both of the unfortunate men, and clung desperately to the ladder. One of his falling companions struck him, but so tenaciously did he grip the ladder that he maintained his position. Wilson White and the man first below him fell to the bottom of the shaft and both were instantly killed.

The great mine daily grew greater and richer and soon became the then most valuable gold mine in the world. Larger and better mills were now built, and the famous Consolidated Eureka mine continued to output gold at the rate of more than a million dollars annually until its total production exceeded $20,000,000.

It was in the Consolidated Eureka mine that giant powder was first introduced. A man named Birdsall, formerly employed there, took the agency for the powder company, but so great was the prejudice against it that it was with great difficulty that the miners could be persuaded to use it. Nevertheless they quickly recognized its superiority over black powder, particularly its convenience in wet holes, and stole it for use on contract work whenever opportunity offered.

In some respects, the Eureka-Badger vein was geologically unlike most of the other mines of the Mother Lode. The vein occurred at the contact of a greenstone (diabase tuff) hanging wall and clay slate foot-wall. It is said the hanging wall continued unbroken from the surface downward with wonderful regularity to a depth of 1750 ft., where it appeared much broken and disturbed. The mine has now been closed for many years, and geologists of this day have had no opportunity to study its structure, except at the surface, so the cause of the reported disturbance about the 1750-ft. level, I am unable to explain. The great Eureka mine has for many years been the property of Hetty Green, of New York, and she seems disposed to allow it to remain idle, although many overtures looking to its purchase have been made by California mining men and others.

Crushing Efficiency of Fine-Grinding Machines

By H. Stadler

*Crushing means reduction in size, consequently in volume, and the possibility of an exact size measurement of the materials dealt with before and after passing a machine is, therefore, the primary factor upon which the reliability of the computation of crushing efficiency of grinding appliances depends. The classification of the sizes obtained by sets of screens into series of standard grades, may be based on the largest diameter, on the volume (or weight), or on the surfaces (or fractures) exposed. It does not matter which of these functions of the particles be taken as a base for the classification into grades, as the final results of the calculations are bound to be the same for all classes, but once a system has been adopted it is necessary to stick to it by reducing all other fuuctions to the same standard of measurement. It would, for instance, be utterly wrong to base calculations of crushing efficiency on the surface, and at the same time measure them by quite another rule based on the reduction in volume. Volume and surfaces vary with the coarseness of the particles at quite a different ratio, and without converting the one into the other they cannot be measured by the same rule any more than the pressure in a steam boiler can be measured directly by degrees of temperature without conversion. Considering that after crushing, the further or-treatment by amalgamation or by cyanidation has to act through the surfaces, it has been suggested that the exposure of these surfaces, representing the 'metallurgical efficiency', should be taken as a criterion of the useful work done in crushing. Under the condition that the work done represented by the exposure of surfaces is also measured by a standard of grades, based on equality of steps in regard to these surfaces, no other objections than those of practical inconvenience can be raised against this suggestion. However, as cyanide managers do not trouble about the surfaces exposed, and as also the assayers give the percentages of gold extraction per weight (volume) and not per fractures exposed, there is no reason why, in computing crushing efficiency, the reduction in volume should not also be accepted as representative for the metallurgical efficiency.

The most rational and logical system of classification for mining purposes is, therefore, undoubtedly to base it on the reduction of the volume of the particles. It appears that the standard screens of the Institution of Mining and Metallurgy follow, in regard to the mesh-apertures, a curve of seriation based on a successive reduction in volume of one-half from grade to grade, but unfortunately, in consequence of unreasonable concessions made to the accustomed number of meshes and to the maintaining of the uniformity of the screen-discharge area—the distance between the screens, or, better, the decrease of the grades in regard to volume, is very irregular and not based on any principle. By chance, however, it was possible to select from the large number of these standard screens a restricted set with apertures corresponding fairly well to the mathematically correct scale, and complying, at the same time, with the requirements of equality of steps from grade to grade in regard to a reduction in volume of 1 to 4.

The possibility of an accurate measurement of grinding products being ascertained, the next question arises of establishing from the gradings taken at the inlet and at the discharge of the machine a workable and reliable formula for the computation of the useful work done in crushing by the machine. It has been shown that the amount of work required to reduce the equivalent of 1 cu. in. from one grade to the next following is constant, and the ordinal numbers of the grades represent, therefore, at the same time the relative values of the energy which had to be spent in reducing the unit of 1 cu. in. to the respective grade. To obtain the mechanical value of mixed sands, multiply the percentages of the gradings with the number of these energy or crushing units of the respective grade, and add the products. The relative value of the work done by any crushing machine is naturally determined by the difference between the mechanical values of the pulps at the inlet and discharge of the machine, and the relative mechanical efficiency is then the product of this value into the tonnage dealt with, divided by the value of the energy-consumption.

In practice this method, based on Kick's law, has given great satisfaction, and all through the research work which I had to execute on behalf of the Mines Trials Committee, in tube-milling, it was seen that this method is for coarse as well as for fine crushing, correct and reliable, and in accordance with the results of experience. Based on this fact, I have no hesitation in stating that with this method it is now possible to determine, with a high degree of accuracy, the relative merits of different crushing appliances or the mechanical efficiency of one and the same machine working under varying conditions.

*Abstract from Jour. S. African Ass'n. of Engrs.

Plans for geological surveys in Alaska this season include a continuation of the work done in the Innoko field in 1908, the results of which have been published in Bulletin 410 of the Geological Survey. It is now proposed to make a geologic and topographic reconnaissance survey of the more important part of this placer district, including the northern part of the Iditarod basin. This work will be done by A. G. Maddren, geologist, and C. G. Anderson, topographer. The party will make its way inland by way of the Yukon river, and one section, with seven horses, will be landed at the mouth of Ruby creek. This section will travel overland to the Innoko and on the way will undertake such surveys as can be made without delaying the party. In the Innoko placer district an areal survey will be begun and carried southward as far as conditions permit. A second section of the party will continue down the Yukon and up the Innoko, bringing supplies to meet the first section on Ophir creek. The water resources available for placer mining in the Yukon-Tanana region will be further determined by C. E. Ellsworth and G. L. Parker, who began work in the Fairbanks district in April and later extended it to Circle.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Classification of Igneous Rocks

The Editor:

Sir—I send you with this an abbreviated tabular classification of igneous rocks which may prove of interest to some of your readers.

E. R. RICE.

Wickenburg, Arizona, May 23.

	Chief Feldspar Orthoclase			Chief Feldspar Plagioclase				Leucite (and/or) Nepheline	No Feldspar	
Texture	+ Quartz	− Quartz	Nepheline (and/or) Leucite	+ Quartz	− Quartz	+ Olivine	− Olivine	+(or)−Olivine Little(or)No Feldspar	+ Olivine	− Olivine
	Hornblende (and/or) Biotite (and/or) Augite			Biotite (and/or) Hornblende		Pyroxenes				(and/or) Amphibole
Glassy	Acid Glasses Obsidian, Perlite, Pumice, Pitchstone			Andesite-Obsidian			Basic Glasses Basalt-Obsidian Scoria, Tachylyte			
Felsitic	Quartz Syenite and Rhyolite Felsite		Felsite Phonolite (Rare)	Aphanitic Diorites		Aphanitic Basalts			Augitite	Limburgite
Porphyritic	Rhyolite and Quartz Porphyry	Trachyte	Phonolite Porphyry	Dacite	Andesite	Olivine Basalt	Basalt	An indefinite group classed as Nephilite or Leucite Basalt	Augitite Porphyry	Limburgite Porphyry
Phenocrystalline	Granite Porphyry	Syenite Porphyry	Nepheline Syenite Porphyry	Quartz Diorite Porphyrite	Diorite Porphyrite	Olivine Gabbro or Diabase Porphyrite	Gabbro or Diabase Porphyrite	Includes Tephrite, Basanite Nephelinites Leucitite Generally require microscope for identification VERY RARE IN AMERICA		
Granatoid	Granite	Syenite	Nepheline Syenite etc. Monzonite	Quartz Diorite	Diorite	Olivine Gabbro	Gabbro		Peridotite	Pyroxenite and Amphibolite
Diabasic	Quartz and Orthoclase Quartz and Muscovite					Olivine Diabase	Diabase	ALASKITE = General Name for all rocks consisting of quartz and alkali feldspar		
Pegmatic	Pegmatite	Greisen	APLITE = Fine grained Muscovite Granite BINARY GRANITE = Granite with two Micas. GRANO-DIORITE = Granite with Ortho & Plag					TRAP = Field name for any dark, finely crystalline, igneous		
Structure Fragmental	Rhyolite	Trachyte	Phonolite TUFF IS FINE AND BRECCIA IS COARSE	Dacite	Andesite	BASALTIC TUFF and BRECCIA			Peridotite	Py(or)Am
SiO_2	80–65	65–55	60–50	70–60	65–50	55–45	65–50	50 – 40	55–30	

Classification of Igneous Rocks, by E. R. Rice.

Richard Gird and His Work

The Editor:

Sir—Richard Gird, who died in Los Angeles on May 29, was a fine type of the men, now mostly passed away, who did much to open the mining interests of the Pacific Coast. A morning paper, in a fine editorial notice, said "he was a man who did things." "Any community in which he lived was better because of his presence." I remember that while standing under a cluster of great walnut trees in Sonoma county once he said he had planted them over fifty years ago knowing someone would be benefited later. Another time, going by rail from the Kern to the Coalinga oilfields, he looked out at one point, saying he once owned a section of land there, and put hundreds of hogs on it because Mussel Slough settlers were then poor and harrassed and needed an object lesson in what might be done. Many of the hogs were given away, some disappeared, and the rest were disposed of.

He made the first map of Arizona; laid out the city of Prescott, took the first irrigating ditch from the Colorado river, and early erected a matting furnace at the Planet mines. While engaged continuously in mining, his principal fame came from discovering, with E. L. and A. E. Scheffelin, the lodes worked by the Tombstone Mill & Mining Co. He assayed and tested the ores himself and built the first mill in the district, while other companies waited until the 'Gird mill' successfully turned out Doré bars. He made a fortune out of these mines, and coming to California, purchased the Chino ranch of 42,000 acres, fenced and stocked it, steadily improving the breeds. Then he erected a laboratory and systematically analyzed the soils, with the result that he became the 'father of the beet sugar industry of the State.' Meantime he helped many men and put them on the road to prosperity. He sunk artesian wells on his ranch, and when an acquaintance came to him saying that if he could get the use of a string of tools he thought he might strike oil in Kern county, the tools were furnished, and this was the beginning of one of the largest oil fortunes of the State. Other acquaintances had borrowed a large sum from an Eastern financier to equip their gold mine, and came near losing their property in consequence, whereupon they applied to Mr. Gird; the finances were adjusted, the debt paid, and the original owners are still operating their property.

Up to the end he was interested in mines in Mexico, Arizona, and California, using his own funds in development. He was the kind of conservationist who made two blades of grass grow where was but one before. " 'Tis true 'tis pity and pity 'tis 'tis true" that in the great mining operations of today conducted on a scale impossible for any individual to undertake, and with an efficiency and economy unknown in pioneer days, there seems little place for a man like Richard Gird.

F.

San Francisco, California, June 6.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Copper deposits near Yerington are of three kinds. (1) Irregular bodies formed by metasomatic replacement of limestone and genetically associated with metamorphism of a kind usually attributed to the contact action of intrusive rock; (2) metasomatic vein deposits in altered limestone; and (3) metasomatic vein deposits in granodiorite.

Specular hematite in Virginia occurs inter-layered with the Lower Cambrian quartzite and shale as a bed of varying thickness. Workable portions outcrop along the Blue Ridge in Botetourt, Bedford, and Roanoke counties, from Buchanan on the north to a point about five miles south of Roanoke. The ore-bed has been worked at eight localities along its principal outcrops.

A treaty has been signed by Great Britain and the United States in which provision is made for regulating the use of water for power purposes at Niagara Falls. By the terms of the treaty the Canadians are to be permitted the use of 36,000 cu. ft. per second, while on the New York side 20,000 cu. ft. per second may be used. The amount allotted to the Canadian side will make possible a much larger development than is now in use, but as the developing companies are permitted by the Canadian, as well as by the United States authorities, to transmit and sell on the south side at least half of the power generated in Canada, the New York side is benefited by the Canadian development.

Graphite is used for the manufacture of crucibles, as a lubricant, in the manufacture of pencils, as a pigment, for coating foundry castings, in the manufacture of electrodes, and for numerous minor purposes. The grades are: amorphous, crystalline, and artificial. In 1908, 11,456 tons valued at $762,367 were imported; 1443 tons of amorphous, valued at $75,250, and 1144 tons of crystalline, valued at $132,840, were produced in the United States. It is now quoted in New York at 5 to 10c. per lb., depending on purity, size, and character of crystallization. Graphite occurs usually irregularly disseminated through schists and the process of treatment is one of crushing, sizing, and close concentration. A market should be sought according to the purity and particular adaptability of the grade found.

The weight of the dry matter in a cubic foot of wet mud of the density to be expected at the bottom of a reservoir was determined by the engineers of the Tallahatchie drainage district, Mississippi, in connection with their investigations of the probable sedimentation in the reservoirs that may be constructed in the district. Two sections, 8 in. long, of 3½-in. wrought-iron pipe, were turned on a lathe to a cylinder bore inside, were milled at the ends, beveled outside at one end, and carefully measured with calipers and scale. Each tube was pushed down into typical submerged mud, struck at the ends, and the contents then washed out into an iron vessel, which had been first heated to drive off moisture, and then weighed. The vessel was then heated until all moisture had been driven off, and again weighed. By several such determinations it was ascertained that 1 cu. ft. of wet mud such as was tested contains 60 lb. of dry matter.

Manganese ores in the United States generally occur in small discontinuous pockets, few of which contain more than 25,000 tons, and most of them much less. A large proportion of the ore is low grade, containing considerable iron, silica, and phosphorus. The Eastern ores are embedded in clay and must be washed and sorted before becoming fit for the market. The limited extent of the deposits discourages the erection of expensive concentration plants; hence mining is carried on only in a small way.

A reinforced concrete building in course of construction in Mexico City was subjected to the earthquake shock of July 30, 1909. The second floor was less than two days old when the shock occurred. The projecting rods at the column points and in the outside wall swayed violently, this being noted by the architect and the superintendent of construction, who were on the building when the second of two rather heavy shocks occurred. As in the case of a number of structures built in Mexico City during the past few years, the entire building is carried upon a heavy reinforced concrete raft, which reduced the pressure on the soil to about 800 lb. per square foot. Examination of the building after the shocks failed to disclose any cracks even in the green concrete.

Manganiferous silver ores occur at Leadville, Colorado, in large deposits at or near the contact of porphyry and limestone, replacing the latter. These deposits consist of a black mixture of manganese and iron oxides with lead carbonate and silver. The manganese content varies from 10 to 40%, being high where the iron is low, and conversely. Manganese and iron oxides are associated only with the oxidized portions of the Leadville deposits. In the lower unoxidized portions the minerals are mainly pyrite, sphalerite, and galena. Manganese minerals are conspicuously absent, and it is believed that the large quantity of manganese oxide in the oxidized ore is due to infiltration from the porphyry. The ore is used both in the steel industry and for fluxing.

The Mexican Government has signed the concession for the construction of a railroad from the Isthmus of Tehuantepec to connect with the United Railroads of Yucatan at the city of Campeche. The road is to be built by the Vera Cruz, Tabasco & Campeche Railway Construction Co. The location of the proposed road is not complete, but the company expects to send out an engineering party at once and have the route completed and agreed on before the expiration of the six months' time limit. Two routes have been suggested, the first for the road to keep close to the foothills, thus avoiding much of the lowlands to the north, at the turn of the Yucatan peninsula. The other is to penetrate the lowlands farther to the north, the road thus passing through some of the biggest and most important cities in the hot country, between the isthmus and the peninsula.

Special Correspondence

DENVER, COLORADO

Favorable Season — Labor Troubles — The Coal Industry. — Clear Creek Companies.—Cripple Creek News.

Mining throughout the State is in a flourishing condition, as the season is one of the earliest in the history of the snow bound camps. Leadville mines are now more active than at any time in the last three years. The cheap power furnished by the Central Colorado Power Co. and the draining of many of the former producers by the Yak tunnel promises a most prosperous season for the mines in this district. In the San Juan district, the prospectors have already started out on their annual pleasure trips. The railroads are now open and doing a heavy business in supplies and ore shipments. Roads are even now in fair condition, so that freight teams are hauling ore from many of the mines not on the railroads. The strike of the coal miners in the northern coalfield is dragging along in a sort of hopeless way, with no prospects of an early settlement.

Idaho Springs, Colorado.

The position of the miners has been much weakened by the failure of the national organization to provide the benefit funds promised at the beginning of the strike. On May 28 the laborers, tappers, and furnace men employed at the Globe plant of the A. S. & R. Co. went out on a strike suddenly. They demand more wages. There seems to be no organization and no demands had been previously presented. Considerable damage will result by reason of their sudden leaving. An important transfer of property has been recorded at Durango by which the Southern Pacific railway has acquired the holdings of the Porter Fuel Co. The price said to have been paid is $1,250,000. This property will be remembered as the one on which Joseph Walker, United States Civil Service Agent, was working at the time he was murdered. The transfers made during the past year indicate that the titles to the land have been cleared. The Yankee Fuel Co. of Trinidad is in financial difficulties again, as shown by the filing of a suit by the United States Mortgage & Trust Co. of New York. The latter asks that a receiver be appointed and alleges that the company is insolvent. It is claimed that attempts are being made to dispose of the properties without the sanction of the New York company, which holds a mortgage of $2,500,000 on properties located in Las Animas county, Colorado, and in Colfax county, New Mexico. A new company, known as the Continental Coal & Coke Co., was incorporated here on May 24, with a capitalization of $3,000,000. It has extensive holdings of coal land in Routt county and controls the rights for the Lowe coking process in Colorado. The company plans to establish small coking plants in different cities throughout the State where it can dispose of the gas produced in making coke by this by-product coking process for domestic use. Unusual activity is manifest in the Clear Creek district. Many transfers of property and reorganizations of old companies are being brought about. One of the largest of these reorganizations is that of the Consolidated Vindicator Mines Co. of Idaho Springs. The company has acquired 27 claims on the ridge between Chicago and Soda creeks. Most of these claims were formerly owned by the Gold Leaf, Grass Roots, and Gold Hill companies. The promoters of these companies got into the Federal courts some years ago because of their alleged fraudulent methods, and, as a result, good prospects have lain idle for a long time. Many of those interested in the new company were stockholders in the old companies. The Golden smelter is again in operation after three years of idleness. The North American M. & S. Co. has re-equipped the entire plant and brought it thoroughly up to date. This plant has taken over the business of the Modern smelter near Denver, which plant has been closed indefinitely. The expected boom in Cripple Creek stocks has started on the Colorado Springs Mining Exchange. Rich discoveries in some of the deeper workings of the Elkton, Vindicator, and Golden Cycle started the excitement. A line for an aerial tram from Cripple Creek to the Golden Cycle mill in Colorado City has been surveyed, and estimates on the cost of such a project are being made. Many believe this to be part of the game to get more advantageous freight rates from the Colorado Springs & Cripple Creek District railway. The Deep Drainage tunnel advanced 393 ft. during May. It is still in Pikes Peak granite and making little water. During May, the production from the mines of the district was 57,105 tons with a gross value of $1,351,852. That high-grading is not entirely abandoned is evidenced by the arrest of four of the employees of the Golden Cycle mill at Colorado City recently. Their thieving had been going on for some four months. They will be punished under the recently enacted statute which makes high-grading in this State a penitentiary offence.

TORONTO, CANADA

Peterson Lake Changes Directors.— Cobalt Developments. — Gowganda Shipments. — Canadian Northern Coal.—Canadian Steel Corporation.— Industrial Training.

The most sensational event of an otherwise very dull season in connection with mining matters has been the end of the protracted struggle for control of the Peterson Lake Mining Co. For some time this company has been involved in a series of disputes, culminating in litigation with the Nova Scotia, which holds a lease of a portion of the Peterson Lake property. One of the suits was settled by arbitration, while another is still pending. There has been much dissatisfaction with the directorate, and shareholders have been deluged with circulars from the opposing factions. At the annual meeting on May 30, after a very exciting day, the insurgents won, and almost a clean sweep was made of the old board of directors, a slate headed by Sir Henry Pellatt being returned by a narrow majority. A resolution was adopted favoring the policy of extending the leases. So far the change has had no perceptible effect upon the stock. All expectation of any improvement in market conditions until next fall seems to have been abandoned. Midsummer is too near for anything like a boom. The Provincial mine on the Gillies Limit, sold by the Government for $113,000, is showing good results under the present management, two good veins having been cut in a drift and at the bottom of the shaft. A discovery of high-grade ore has been made on the large vein of the Wyandoh, and another of ore running 2000 oz. per ton. The McKinley-Darragh has declared its regular quarterly dividend of 3%, with the addition, for the first time, of a 2% bonus. A new vein, known as the Victoria, was recently found on the Crown Reserve, 63 ft. south of the Carson vein on the 100-ft. level. It is 2 to 6 in. wide and assays 6000 oz. per ton. The O'Brien has made another shipment of silver bars to England, containing 18,250 oz. fine silver valued at $9675. The Temiskaming has two drills in operation putting the main shaft down to 500 ft., which will make it the deepest mine at Cobalt. The shaft at present is down below 450 ft. The Trethewey has opened new territory at the

150-ft. level of No. 2 shaft. The new vein cut at the 75-ft. level has been struck again at the 150-ft. A drift driven on a stringer ran into 2 in. of high-grade ore with good milling ore for several feet. Skips from No. 2 shaft are now running regularly up the 650-ft. tramway to the mill, which is running nearly to full capacity. The Cobalt Central is in liquidation, but mining is being carried on actively and the mill is in operation. A considerable amount of ore is blocked between the third and fourth levels. There is a 3-in. vein of high grade for about 100 ft. on the fourth level. At the Hudson Bay mine a new vein carrying smaltite and native silver has been found in a cross-cut running southeast of the drift on No. 6 vein. It will assay 2000 to 3000 oz. silver per ton, with leaf silver in the wall-rock. Shipments from the Gowganda district to date for this year total 334 tons, of which the Millerett has sent 218 tons, Reeve-Dobie 42, and Boyd-Gordon 30. The latest addition to the list is the Bonsall of Miller Lake, which last week sent 10 tons to the Deloro smelter.

William Mackenzie, of the Canadian Northern railway, who has just returned from England, has secured loans amounting to $41,700,000 for various undertakings in which the railway is interested, including $14,000,000 for the Dunsmuir collieries, British Columbia, and $6,000,000 for the development of the Brazeau coalfields, Alberta. The subscriptions for the bonds issued in connection with the latter enterprise were taken up in Belgium. D. D. Mann, vice-president of the Northern, has left for the Pacific Coast. A long projected scheme for the merger of several steel and iron companies, chiefly in western Ontario, is being carried into effect. Application has been made for a charter for the new concern to be known as the Canadian Steel Corporation, and is capitalized at $25,000,000, with headquarters at Hamilton, Ontario. The companies embraced include the Hamilton Steel & Iron Co.; the Canada Screw Co., of Hamilton; the Canada Nut & Bolt Co., of Toronto, with works also at Brantford and Gananoque, Ontario, and the Montreal Rolling Mills Co. The scheme involves extensions to the plant of the Hamilton Steel & Iron Co., including another blast-furnace and a steel-rod mill requiring an expenditure of about $1,500,000. Rumor has it that this merger foreshadows an amalgamation of the newly organized corporation with the Dominion Steel & Coal Corporation, and perhaps other interests, and while this may be premature so far as any well defined scheme is concerned, it is certainly among the probabilities of the future. The Canadian Government has appointed a royal commission on industrial training and technical education, with James W. Robertson, of Montreal, as chairman, among the members being representatives of the Canadian Manufacturers' Association and the Dominion Labor Congress. They are first to investigate conditions in Canada and afterward to visit the United States, England, and the European continent to note the operation of the system in practice and compile information. The subject has been for some time urged on the attention of the Government both by the manufacturers and the labor bodies, but in view of past experience it may well be doubted whether the appointment of a commission is auspicious of the intention of the Government really to accomplish anything practical. Commissions in the past have usually been a convenient expedient to avoid taking action.

JOHANNESBURG, TRANSVAAL

Randfontein Estates Changes. — General M. & F. Corporation.—Cinderella Deep. — Roodepoort United.—Rhodesia.

Something of a sensation has been caused in local mining circles during the past week by the announcement that the services of two or three directors of the Randfontein Estates Co. have been terminated. It was at first reported that all the directors had resigned, but this statement has been proved to be an exaggeration. The resignation of a portion of the Board is believed to signify a development of much importance and far reaching effect. For some time past it has been persistently rumored that another and more important firm has been acquiring a large interest in the Randfontein Estates Co., and it is stated (with what degree of truth I cannot at present say) that this firm is about to appoint its own representatives on the Board of the Randfontein Estates. The General Mining & Finance Corporation (more popularly known as 'Albus') announces that its subsidiaries earned a total profit of £61,069 from 136,159 tons milled during the month of April, as compared with £65,720 and 139,602 tons in March. The companies contributing to the April return were as follows:

Company.	Stamps.	Tube-mills.	Tons crushed.	Revenue.	Profit.
Aurora West	60	..	11,053	£12,730	£2,442
Cinderella Deep	80	2	15,000	22,569	5,034
Meyer & Charlton...	75	2	12,302	21,555	9,074
New Goch	120	3	27,845	32,151	12,146
Roodepoort United...	110	2	18,259	20,177	2,858
Van Ryn	135	6	31,400	47,409	24,805
West Rand Con.....	100	3	20,300	24,135	4,710

The General Mining & Finance Corporation has recently engaged in two schemes for the expansion of the company's operations. The more important of these is the acquisition of 1803 claims by the Cinderella Deep company. A new company is about to be formed, called the Cinderella Consolidated Mines, which will have a total claim area of 2092 claims and will thus be one of the three or four largest operating on the Witwatersrand. The authorized capital of this company will be £1,500,000, of which £1,159,450 will for the present be in issue. A central plant of the latest design will be erected on a suitable site and this will at first be of 100,000 tons per month capacity. The site for this plant will be so selected and the various units so arranged that the plant may easily be extended to treat 200,000 tons per month. Two new shafts are to be laid out with this in view. The technical adviser of the General Mining & Finance Corporation expects that the average profit per ton milled will be not less than 10 shillings. The present Cinderella Deep shaft is fully equipped and will serve the western portion of the property. The second or 'Central' shaft will be sunk on the old 'Rand Central'

claims, and the eastern section of the property will be served by a third shaft about 6000 ft. southeast of the Central shaft. The second important plan concerns the Roodepoort United Main Reef G. M. Co. (which now includes the Kimberley Roodepoort mines). At this property a new reduction and treatment plant is being erected. One hundred stamps are to be installed on the back to back design. They will be 1900 lb. weight each, and will be operated by electricity. The stamps will be driven in sets of ten by separate motors. The stamp duty is expected to be about 12 tons per day at the commencement of operations, and this will eventually be raised to 18 tons or more. Five tube-mills (each 16 ft. 5 in. by 5 ft. 19 in.) are being installed, and a sand and slime plant of latest design is being put in. The whole equipment is laid out with a view to expansion, and the ultimate capacity will probably be in the neighborhood of 100,000 tons per month.

The mineral output of South Rhodesia for the month of March was £241,325. Gold mines, as usual, contribute the bulk of the return, the March yield being 54,277 oz., as compared with 48,442 oz. produced in the preceding month. The rest of the output is made up of contributions from coal, chrome iron, silver lead, and copper mines. Recent developments in both the Matabeleland and Mashonaland have been of a highly satisfactory nature, and both in Johannesburg and London Rhodesian developments and new flotations are attracting as much attention as is the Rand. Perhaps a word of warning regarding new Rhodesian flotations will here be not out of place. A few years ago mining affairs in the British South Africa Co.'s dominions were stagnant and depression was most acute. Such a condition of things was brought about by gross over-capitalization of small rich quartz veins, the erection of machinery on these ventures regardless of potential value, and the utter neglect of development. Lately Rhodesia has, through sheer hard work, diligent prospecting, and more discriminating methods, come forward as a mineral State, and it would be a pity to see the country fall back into its old paths of depression through a repetition of the errors of fifteen years ago. That there are large auriferous formations in South Rhodesia has been conclusively proved by the discovery of the Shamva mine and the exploitation of the Eldorado, Giant, Globe & Phoenix, and Falcon mines. At the same time it must be remembered that many of the mines of the country are situated on rich quartz veins with no great length of ore-shoot, and to capitalize and equip such ventures on a 100-stamp basis before any exhaustive development has been done is bound to be highly prejudicial to the country.

MEXICO

Panuco.—Guadalupe de los Reyes. — San Fernando, Durango.—Real del Monte.

The Compañia Minera de Pánuco, one of the most important mining concerns of the State of Sinaloa, has just issued its annual report for 1909, the thirty-third year of its existence. This shows that the total revenue for the year was ₱884,182.53, and the total expenses ₱407,344.18, leaving a profit of ₱476,838.35. Out of this, dividends to the amount of ₱425,000 were paid. Since its organization the company has paid ₱7,465,000 in dividends. The Pánuco mines yield silver-gold ores, and are equipped with a 40-stamp mill, concentrating plant, and cyanide annex, the latter of late installation. Some ore assaying from 23 to 24 kg. silver and over 200 gm. gold per metric ton is shipped to the Selby smelter at San Francisco. The ore treated amounted to 13,411 tons, and this produced 15,325 kg. silver and 102 kg. gold. The treatment-cost per ton was ₱8.31, which is a much better showing than is made by several of the other big Sinaloa concerns, due to the fact that direct water-power is used for the operation of the mining and milling machinery. The Pánuca company is controlled by Spanish capitalists of Mazatlán, the men at the head being Genaro García, Victor Patrón, and Juan Escutia. Recently negotiations were opened with Los Angeles men for the sale of the properties. The price asked is ₱6,000,000.

The Compañia Minera Guadalupe de los Reyes, another big Sinaloa producer, which is also controlled by Spanish interests of Mazatlan, failed to make as good a showing as usual last year. The production amounted to ₱1,425,000, but the expenses were high, and dividends of only ₱200,000 were paid. The company has paid as high a ₱1,000,000 in annual dividends but for several years the distribution has been less. The concern has a power problem to solve, as adjacent fuel supplies are giving out, and plans are now being considered for the installation of charcoal gas engines at a point where an abundance of charcoal can be had, and the generation and transmission of electric energy to the mines and reduction plant. Luis Basave, a young mining engineer, is in charge of the company's affairs. J. S. Johnston, of Los Angeles, California, representing a group of Los Angeles men, has just purchased the properties of the Metates Mining Co., in the State of Sinaloa, two days by road and trail from Mazatlán. Maximiliano Lopez Portillo was the principal owner. The price is $125,000 gold, and a payment of $31,000 has been made.

The San Fernando mine in the municipality of Juarez, State of Durango, which was abandoned by the Fernando Mining Co., a Calumet & Hecla concern, a few years ago, is now under option to American interests for ₱800,000. When the Boston men abandoned the properties they are reported to have turned over the titles as gifts to John T. Canfield, an American resident of Culiacán, the Sinaloa capital, and

San Rafael Mill, Pachuca.

a former employee of the company. He has given an option to Los Angeles men, who in turn are dealing with New York parties. The mines were purchased fourteen years ago by Alexander Agassiz and associates on the strength of a report by James E. Mills. The Fernando Mining Co. was organized to carry out extensive development and milling plans. Several shafts were put down on the Fortuna, a big gold-copper vein, and fully $1,000,000 gold was spent in the erection of a mill, concentrating plant, and smelter, the installation of a hydro-electric plant, and the construction of six miles of electric railroad. At a depth of 600 ft. the profitable ore gave out, and the company's engineers reached the conclusion that the mine was bottomed. As a result it was decided to abandon the enterprise, and Mr. Canfield was given a commission to remove and sell the machinery and supplies on hand. At a cost of ₱35,000 he had the mining, milling, and electrical equipment freighted to Culiacán, and since that time he has realized about ₱90,000 from sales. The greater part of the equipment is still in his hands. Mr. Canfield is working the Tocalla, a gold vein on which some work was done by the Fernando Mining Co., and is treating a small amount of ore in arrastres. During the period of its operation the old company took out ore worth ₱7,000,000, and since the abandonment of the mines several engineers have reported favorably on the possibilities of further development. The surface holdings consist of 197 pertenencias (486.59 acres).

The old Rosario mine of the Real del Monte y Pachuca company, which gave the great bonanza that was opened just after the transfer of the properties from English to Mexican interests, is to be again worked on an extensive scale. Electric hoists have been ordered, and development will be with a view to a production of from 200 to 300 tons per day. The present American company, which is controlled by the U. S. Smelting, Refining & Mining Co., is

planning a number of extensions, and will enlarge its Guerrero and Loreto reduction plants. The production of the Real del Monte y Pachuca mines in 1909 was 213,630 tons of milling ore and 1579 tons of shipping ore.

BUTTE, MONTANA

Georgetown District, Southern Cross, and Oro Fino. — Ophir.— Washoe Smelter.—Butte & Superior.—Keating.

The Georgetown district, which gives promise of being one of the richest gold camps ever located, is now receiving attention. It is but a short distance from Anaconda. The mine attracting most attention at present is the Southern Cross. Experts representing the A. S. & R. Co. have visited the property for the purpose of making an examination. The shaft is now down 326 ft., and there are three station levels. Samples show that more than 300,000 tons of ore are in sight and will assay about $15 in gold. The Southern Cross was discovered by Lucien Eaves when he was taking out a wagon load of ore from a neighboring property. A snowstorm had raised the road so that his team could not get under a trestle and he had to lower the road. In doing so he cut an immense body of gold ore. With the proceeds he constructed a mill, put the property in good shape, and had enough left to become independent. The story of the discovery of the Oro Fino claim, a few hundred feet east of the Southern Cross, is also interesting. Charles Bostrom two years ago was a barber in Anaconda and after making a study of mining from books, decided to go to the Georgetown district and work in the Southern Cross. While there he spent his spare time in prospecting and soon decided to secure a lease on the claim known as the Oro Fino. He engaged the services of an old time prospector and the pair started to work on shares. Almost from the start the claim has more than paid for the work done. The owners found one body of ore which ran as high as $1000 to the ton. While the one time barber is decidedly adverse to talking about his business, it is quite well known that during the past 12 months he has taken out more than $100,000 and recently he opened an orebody more than 35 ft. wide of a much higher grade than is found in the Southern Cross.

The Ophir mine of the Butte Central Copper Co. should be in operation by the last of the present month. It was not anticipated that the work would be completed before the middle of July, but all calculations have been upset by rapid work. The extent to which the Butte mines are being worked at the present time may be imagined from the fact that the Washoe smelter at Anaconda is receiving from 11,000 to 11,300 tons of ore daily. Inasmuch as the supposed capacity of the smelter is but 10,000 tons daily, it will be seen that the Anaconda plant is being crowded to its utmost capacity. Since the merger the position of manager of mines has been abolished and now the properties are in charge of superintendents grouped in much the same way as under the old management. This policy not only abolishes an office and saves money, but it places the various superintendents more directly in a position to handle the mines as they desire without having to consult with managers. The Butte & Superior company is still keeping up its shipments of ore to the Basin concentrator. Those who have been down in the mine unhesitatingly assert that there is ore sufficient to allow shipping to continue for five years at double the present output, and further that the ore is high-grade. Many wonder why things are not running along more smoothly and why the new concentrator, which was started some time ago, is not being pushed to completion. As yet nothing is definitely known whether the minority holders of the Parrot are to push their suit for an appraisement of the stock, but to make sure that everything will be safe guarded so far as the company is concerned, the Parrot special meeting which had been adjourned until June 7 has been further adjourned until June 21, by which time the protestants will have appeared in court and made their formal demand for the appraisement if they propose carrying out the notice served on the company. The Keating Gold Mining Co., in the Radersburg district, is now in charge of R. G. Goodell, of Duluth, who takes the place of Jesse B. Roote, who has been at the head of the company. At the annual meeting held in this city a few days ago it is stated that the men from Duluth who are heavy stockholders expressed dissatisfaction with the way matters were being conducted and decided to take the affairs of the company into their own hands, so they not only elected a president, but a vice-president and secretary-treasurer from their own ranks. The directors elected were: R. G. Goodell, A. G. Agatin, J. H. Barnes, Charles Newton, and Jesse B. Roote. The latter is the only real Butte man on the board as the three first named are Duluth men, and Mr. Newton, while residing in Butte at present in his capacity as superintendent of the Butte-Ballaklava, is from Duluth. Mr. Agatin is vice-president and Mr. Barnes is secretary-treasurer. No report was submitted at the meeting so far as the public knows, but one of the officers stated afterward that the property had just been fully equipped with electricity, and that the first shipment of ten cars of ore had been made to the Pittsmont smelter in this city. It is intended to continue for the present weekly shipments of ten carloads of ore. In order that an office may be maintained in this city an assistant secretary, A. C. McDaniels, has been appointed.

SALT LAKE, UTAH

International Report. — Ohio Copper. — Bingham Shipments.— Tintic News.—Boston Sunshine Closes.

The completion of the temporary line of the San Pedro, Los Angeles & Salt Lake railway will mean much to Salt Lake and the mining industry. The branch road to Pioche will be repaired in a few days, allowing all-rail communication with that camp, and the Los Vegas & Tonopah road can be reached from this city, besides a number of smaller districts that have been cut off by the washout, which was the most disastrous in the history of railroading. The first annual report of the International S. & R. Co., covering the year 1909, shows income of $2,586,543, expenses of $1,450,830, dividends of $300,000, and surplus of $935,000. During the year the company expended $1,578,628 in the construction of the Tooele smelter, which is expected to be ready for operation by August 1. About 15,000 tons of ore will be stored during July, so that, once started, the plant may have an uninterrupted run. The report states that favorable results are expected from the operations during the last half of the year, but owing to the difficulties which always attend the starting of a new plant the manager does not make any prophecies as to earnings. J. B. Risque, for the past three years general manager of the Utah Con., has tendered his resignation, to take effect September 1. Mr. Risque has many private interests to which, as well as consulting work, he will devote his time. The Centennial Eureka has declared a dividend of $3 per share, the first since 1908, bringing the total to $24 since the company passed into the hands of the United States S. R. & M. Co. This company owns all but 136 of the 100,000 shares of capital stock. The annual election of the Ohio Copper Co. resulted in returning all of the old directors except Russell Hopkins, who resigned recently. The report of the first quarter shows receipts of $112,972 and expenditures of $91,302, leaving a net profit of $21,670 for the quarter. As there has been no construction carried on during the quarter covered by the report, it is assumed that the expenses were wholly for operation, which does not tally with the newspaper statements that the company has been earning $1000 per day since the mill went into commission. At a special meeting of the Con. Mercur, George E. Airis was elected a director to succeed his father, the late E. H. Airis. Resolutions of respect were adopted for Mr. Airis, who has been a director of the company since its organization and was secretary of the predecessor, the Mercur Gold Mining Co. Colorado, once one of the strongest stocks on the local exchange, is selling at the lowest price since 1907. No definite reason can be assigned, but it is generally supposed that the single orebody that has furnished all of the ore has been exhausted and the future of the mine is in doubt until it has been prospected at depth.

The month of May was the largest in point of tonnage that Bingham has had. The official figures are not yet avail-

able, but they are known to be in excess of previous records, and the production for the month will be 8,000,000 to 9,000,000 lb. In one day recently 402 carloads were shipped, Utah Copper alone sending out 378. The work of making the changes which are expected to increase the capacity of the Utah Copper plants is going on steadily, the new machinery being all in, in three of the units of the Magna mill. It is generally supposed that the delay in the financing of the Ohio Copper Co necessary to enable it to finish its mill is due to the fact that as yet no satisfactory contract has been made for the use of the Mascotte tunnel. This tunnel is the property of F. Augustus Heinze, and the company has only a short time contract for its use. The proposed backers are loath to put up the money unless a long-time contract can be made for the use of the tunnel, as without it the Ohio would be at heavy expense in the matter of shipping ore, and Mr. Heinze seems to hesitate about entering into a contract covering any length of time. The tunnel of the Bingham Metals Co. is now in 3400 ft., and a vein of milling ore has been opened. This vein has been penetrated for 70 ft. without encountering the opposite wall and proves the mineralization of the west side of the mountain. The company will make no effort to develop any of the ore except by leasing until the tunnel has been entirely completed. Work has been resumed in the Bingham Copper property in which the North Utah recently bought an interest. Rumors of a discovery sent the stock up on the local exchange, but the management positively denies that any ore has been found except a body of milling grade which was opened before the old management ceased operations. The Utah Mines Coalition has filed suit against the City Rocks Mining Co., claiming illegal extraction of ore to the amount of $500,000, which, according to the Utah laws, renders them liable for three times that amount. A court order permitting the complainant to make a survey of the defendant's property is asked. The Carbonate, which was recently taken over by New Yorkers, is about to commence shipments, the mine having about 4000 tons of shipping ore blocked when the transfer was made.

The Grand Central at Tintic is now shipping somewhat more than a carload per day, recent developments having opened orebodies both east and west of the shaft. The directors of the May Day have levied an assessment of 2c. which will be delinquent July 15. The money will be used to install equipment which can be used at greater depth than that at present in place, and the shaft will be pushed to the 1000-ft. level with the hope that the ore may be found with depth. The assessment has been delayed, as 400,000 shares of May Day are held by the Uncle Sam and the officers of the two companies are very much the same. The Uncle Sam did not wish to stand the expense out of its treasury, so has distributed the May Day stock as a dividend, on the basis of eight shares of May Day for ten of Uncle Sam. The Uncle Sam has also declared a cash dividend of 2c. per share, which will a little more than offset the May Day assessment. The Eagle and Blue Bell has opened a new orebody within 250 ft. of the shaft that is being sent down to the lowest levels as the main opening of the mine. The new ore nets about $12 to $25 per ton. Under present conditions the ore must be trammed about half a mile to get it out, so it will be seen that the sinking of the new shaft will be a wise move.

The Boston Sunshine has been closed and the final clean-up of the mill is being made. When the property was purchased fourteen months ago there was a year's supply of ore in sight, but extensive prospecting has failed to develop any more, and the management decided it was advisable to shut down before any further loss. The stock was floated at 30c. per share and the stockholders will receive, with the proceeds of the clean-up, 13c. per share. The mill has been a great success and the news of the shutdown has occasioned considerable surprise. In Beaver county the Hub has opened a 42-ft. body of ore that will average $26 per ton, with an excess of copper over silica of 20%. The principal content of the ore is copper. The Utah Gold & Copper Co. has commenced work on its concentrating mill and a new hoist. The hoist is to be for an incline raised from the tunnel to the surface on the vein. The mill is to have a capacity of 100 tons per day.

Utah Copper Mill, Garfield, Utah.

NEW YORK

Railway Injunction. — Copper Production. — Mexican Notes.— Canadian Mines. – Utah Copper Bonds.—Phelps-Dodge.—Granby.

The injunction obtained by the Federal Department of Justice restraining some twenty-five Western railroads from charging increased freight rates, and the later conference between the railroad officials and Mr. Taft and his cabinet, have formed a chain of events sufficiently important to keep our financial centres in anxious expectancy. The market has been swamped with selling orders; and it was said that "Wall Street is making the market an object lesson." When the outcome of the Washington conference is analyzed, however, there is really little to substantiate this theory. The railroads have yielded gracefully and completely, but in so doing have absolved themselves from responsibility. The real question now is not corporate regulation, but the competency of the present governmental authorities to regulate wisely.

The copper situation has perforce been adversely affected. The most disappointing feature of the statement of the Producers' Association for May is the dwindling of the domestic demand which absorbed 59,305,222 lb., the lightest consumption since last September, and a decrease of 8,680,000 as compared with April. Transportation companies being among the largest users of copper, any condition causing cancellation of construction contracts and the holding up of work on extensions and replacements would be directly felt at once in the metal market. Deliveries abroad show some improvement. Exports increased 14,-

163,037, and amounted to 45,495,440 lb. The production for May was 123,242,476 lb., an increase over April of 5,764,837, a greater production than any month since October last. The increase in the surplus was 18,441,814 lb., while the total on June 1 was 160,425,973; European stocks on hand are estimated at 239,142,400, giving a world's visible supply of practically 400,000,000 lb. of copper. The decrease in the European visible supply has been offset by the increase in American surplus and the present conditions emphasize the statement made a few weeks ago by the management of the Rio Tinto of Spain, that the control of the copper situation lay with the low-grade, low-cost producers of the United States. Curtailment is the remedy, but some of the principal factors are evidently marshaling forces for a battle for supremacy. On the one hand is the new smelter at Tooele, just being completed, backed by the International. It is to handle the ores of the Utah Consolidated, the Giroux, and any other Cole-Ryan properties within its territory. This side of the line of battle includes the Cole-Ryan coterie, with Amalgamated-Anaconda, Standard Oil affiliations, including the Lewisohns and the United Metal Selling Co. Against these are arrayed Utah Copper, Nevada Con., Ray Con., and the A. S. & R. Co., with the Guggenheim-J. P. Morgan alliance in the circles of high finance. On both sides there is the evident determination to dominate in the smelting and refining industry. It may be taken for granted that both know their allies; the Lake mines and the Phelps-Dodge properties are huge factors in copper, and where such weight is to be thrown in case of struggle is undoubtedly already known. The situation is a most interesting one, but by no means encouraging for the red metal market.

A short time ago, when a story of a break in the ranks of the Copper Producers' Association first appeared, there came to light about the same time a story to the effect that the Tanganyika Concessions, Ltd., a British company operating in the Congo Free State under a charter obtained from the late King Leopold, had an accumulated surplus of 200,000,000 lb. of copper ready to be thrown upon the market at any time its absorption could be deemed possible. Investigation now shows that this story was evidently circulated purely for market effect. 'Tanks', as the company is known on the London Stock Exchange, is developing a copper production of some considerable importance from three mines. The Star of the Congo is said to have large reserves of ore blocked and to have a mineralized deposit of 4000 ft. in length and some 500 ft. in width, the main vein portion being some 28 ft. in width and running 14 to 18% copper. The second property in magnitude is the Kambove, the third is the Kansanshi, which is producing in a small way. The properties are being connected by rail and in the course of two or three years are expected to output five to seven million pounds of copper per month.

One of the most active of the development companies in New York at present is the Proprietary Mines Company of America. It is building a 250-ton cyanide mill at the Tajo de Dolores mine at Guanajuato, Mexico, sinking a deep shaft on the dip of the ore-shoot of the famous old Valenciana mine at Guanajuato, and re-opening the Yellow Jacket Gold mine in Idaho. The Tajo mill will be completed by November 1; it is being equipped with Schmidt tube-mills and Sweetland filter-presses. The machinery has all been purchased. The Nueva Luz shaft was 1890 ft. deep on June 3, and will go to 1966 ft. (600 metres) before a cross-cut is run out to the Veta Madre. This cross-cut is to be begun before August 1; the sinking of the shaft is subsidized by the Mexican National Government. At the Yellow Jacket, John B. Hastings is in charge of the work of overhauling the mill and re-opening the mine.

Aside from the coppers the mining markets are very quiet. The distribution of a 5% interim dividend by the Nipissing Mines Co. is of some encouragement to the holders of Cobalt shares. The showing made by the Goldfield Con. is turning the attention of the mining investors to this issue, and the comparisons between the dividend returns on these shares and those of some of the leading coppers are beginning to tell in favor of the precious metal mines. Porcupine remains something of a riddle, some eminent engineers having recently visited the district and reported most unfavorably. Other visitors have returned filled with enthusiasm. Some of the figures at which claims are reported to have changed hands recently would presage a boom, but as yet there has not been enough development to really prove any of the territory. The Utah Copper Co. is considering a $2,500,000 bond issue, to finance the railroad which is to connect the mines at Bingham with the smelter at Garfield. At present the ore is handled by the Denver & Rio Grande, and is carried 27 miles; the company's engineers are expecting to approve a new route of 17 miles. The new bond issue is to be secured by a first lien upon the railroad, and, while definite announcement has not been made as yet, it is expected that the bonds will be offered at par and will carry some attractive privilege of conversion into stock. Utah Copper has a cash balance of some five and a half millions on hand, and at the moment is an important factor in Wall Street loans. It is barely possible that the two and a half millions necessary for the road may be taken from the cash surplus. Phelps, Dodge & Co., Inc., is paying its regular quarterly dividend of $250 per share. This concern has been recently credited in some quarters with an ambition for a more dominant position among copper producers, the theory being that by building a railroad from its smelters to the Pacific, Phelps-Dodge ores and matte could be sent to the Isthmus of Tehuantepec, thence across east by water to the Perth Amboy refineries, so cheaply that the company would have the lowest cost copper on the Atlantic seaboard, and so absolutely dominate the copper market. The price paid to W. A. Clarke by the Amalgamated is still unknown, and as Amalgamated holds a rather precarious position at the moment the question is of some importance. Amalgamated pays $2 per year and sells at a price which could only be justified by highly speculative possibilities, or the possession of a large surplus, neither of which Amalgamated can be said to possess. There is much analyzing of the reports of Amalgamated and Anaconda, but the ratio of return remains the same, and while Amalgamated holds a recognized place as a speculative issue it is weak under present conditions. The rehabilitation of the Granby Consolidated seems to have been indefinitely postponed. When the report of Otto Sussman was made last April, the collapse followed and the public and the shareholders were asked to suspend judgment until another report could be had, and the conditions thoroughly investigated. Jay P. Graves, vice-president of the company, recently submitted a report made after a detailed investigation; since which the board of directors has held two meetings, without giving out any information as to Mr. Graves' findings, and the inference is that the directors think it best to keep the report secret. The disappointing surprises in Granby and in North Butte are unanswerable arguments in behalf of systematic mine reports and publicity in regard to mine conditions. The new Federal Bureau of Mines just established, which is to be headed probably either by J. A. Holmes, of the Technologic Division of the Geological Survey, or by Edward W. Parker, also of the Geological Survey, being chief of the Department of Mineral Resources, can, if given legal authority, accomplish much toward the upbuilding of the mining industry by work along this line. The California-Nevada Copper Co., headed by F. L. Underwood, formerly of the British Columbia Copper Co., has arranged for the erection of a 200-stamp mill on its Ebner property near the Treadwell mine in Alaska. The property is a large milling proposition of the same class as the Alaska Treadwell, the Alaska Mexican, and the Alaska Perseverance. The present stamp-mill is to be built as the first unit of a larger plant. The engineers estimate a potential earning capacity for the mine, when fully equipped, of more than three quarters of a million annual net profit. A party of New York engineers and capitalists have left New York to visit the properties of the Radersburg Consolidated Mining Co. in Montana. The trip is to include visits to the Ohio-Keating mine at Radersburg. At Placerville, Montana, the Manhattan California mine is to be inspected, and from there the party will go to Elk City, Idaho, where another property controlled by the same people is situated. W. Murdoch

Wiley and R B Lamb, the latter being formerly connected with the Marcus Daly mines at Butte. Lawrence B Adams and B Binnard are of the party

ELY, NEVADA

Nevada Con. Reduces Output.—Giroux Cuts Station.—Tungsten Mill.—Ely Tonopah Railroad.

During the past two weeks the Nevada Consolidated has shown a disposition to reduce its output of copper It has recently adopted a policy of having one section of its concentrator closed for repairs all of the time, and now two are down the greater portion of the time As there is no shortage of ore, this is taken to mean that the company is not anxious for a large output during the present era of low prices. The company's output for last month was five and a half million pounds, but from present indications it will not reach five million pounds for June. Several thousand tons of ore per day in excess of the capacity of the concentrator could be produced by two steam shovels operating on ore. At the present time only one shovel is working on ore, and it is easily supplying about 7000 tons per day. Four steam-shovels and seven churn drills are at work in removing the overburden from all sides of the Copper Pit. A railroad track has been laid to the Liberty claim a half mile west of Copper Pit, where another steam-shovel mine will be opened during the present summer. Three steam-shovels are now on the road from the East which will be put to work there as soon as they arrive. The sulphides come near to the surface in that locality, in fact it is stated that the overburden will not exceed 60 ft. The cutting of a pumping station 20 by 40 by 125 ft. in solid limestone on the 1200-ft. level of the Giroux was finished June 12, and as soon as the large chamber can be cemented, two pumps of a capacity of 600 and 1200 gallons per minute will be installed, after which the cross-cut will be started to connect with the lower levels of the Alpha shaft, where a large tonnage of high-grade smelting ore has been developed. Steel structural material for the head-frame for the big shaft has arrived, and will soon be put in place. Excavating for the foundations for the engines and boilers for the permanent hoisting plant is proceeding rapidly and will be completed within six weeks. Eight of the boilers have arrived and parts of the engine are now coming in. Thomas F. Cole, president of the company, will arrive in a few days, when it is expected that orders will be issued to commence the sinking of a permanent working shaft on the Rickard Ely ground, recently purchased by the company, which will be the same in dimensions as the Giroux shaft, 12 by 19 ft. It is also expected that concentrating plant of 500 tons capacity will soon go into commission. Dr. Nehrbas, L. C. Hendrickson, and Theodore Burkhart, of Portland, Oregon, who are officers of the Kohinur M. & M. Co., operating properties at Piermont, arrived from the mines today, and state that the company has in contemplation the installation of a 10-stamp mill during the present year. Lane C. Gilliam, a mining engineer of Los Angeles, has just finished an examination of the property, and his report was highly satisfactory to the officers of the company. E. L. Fletcher, manager of the Tungsten properties, forty miles east of Ely, has just returned from Denver, where he purchased a complete concentrating plant which will be installed on the property within the next four months. The plant comprises a battery of Nissen stamps and necessary jigs. The company already has its boilers and engines installed. About twenty-five men have been employed in developing the property for the past year, and will soon largely increase the force. O. W. Turner, who promoted the Butler mines of Tonopah, is president of the company. From general report it now seems definitely settled that construction work will soon commence on the Ely Tonopah railroad, which will be a connecting link between the Western Pacific at Shafter on the Nevada Northern and the Tonopah & Tidewater railroad at Goldfield. A permanent survey for the road was made last year by way of Currant creek, but it now seems probable that the route will be changed to one by way of Hamilton, from near which point a branch will be extended into Eureka. This town has been cut off from railroad communication since the washing away of the Palisade & Eureka railroad in March The principal mines of Eureka are owned by the United States Smelting Co of Salt Lake and from them it drew from two to three hundred tons of ore per day It is said that the company is much in need of the ores, which are used as a fluxing base. It is probable that the road will run from Hamilton to Cherry creek on the Nevada Northern, fifty miles north of Ely, which would give it almost a direct line between Goldfield and the Western Pacific at Shafter. This would be a more direct line than the one heretofore surveyed through Ely All of the machinery for the 10-stamp mill under construction by the Amalgamated Nevada Mining Co has arrived at San Pedro, and the heavy timbers for the plant are being cut in the mountains near by. It is expected that the plant will be erected and in operation some time during the coming fall. It will treat custom ores. A 3 ft. vein of $50 ore has been uncovered on the Ely Calumet property by lessees. It is understood that Thomas F. Cole has an option on a majority of the stock of the company. The Eureka shaft of the Ely Central has reached a depth of 515 ft., while the Clipper shaft is down 230 ft. The work is progressing steadily.

WASHINGTON, D. C.

Land Withdrawal Bills in Senate and House.

The bill permitting the President to withdraw from public entry any of the undisposed of public lands is having a most difficult time in the Senate. This is the bill that passed the House several weeks ago and which was so objectionable to the oil men of California. It has been amended in the Senate to suit the ideas of the oil men, but still does not seem to be satisfactory to a number of Western Senators. There is really a three-cornered fight on over the measure. Some Senators believe that the President now has the right to withdraw the public lands from entry. Others, mainly from the West, are against the legislation on the theory that it would confer altogether too much power in the President. Still others are of the opinion that it is a wise measure and should pass. W. B. Heyburn is decidedly against this administration measure. After denouncing the bill in scathing terms, he sarcastically remarked that the people of the East get their ideas of the West from the romance writers witn whom 'Long-Haired Dick' or 'Six-Shooter Joe' were of more consequence than the men who opened mines and built up the agriculture of the region. C. D. Clark, of Wyoming, declared that the bill placed absolutely in the hands of the President the disposition of practically every acre of public land. "That," said he, "is not a safe proposition in a Republican form of government. I am unwilling to place in the hands of any man, I care not how virtuous he may be, the power to deal with hundreds of millions of acres of land as he may see fit." Mr. Clark offered an amendment to the effect that if Congress failed to take affirmative action upon the report of the President withdrawing lands at the same session in which the report is made, the withdrawals should be inoperative and the lands should be restored to the public domain and be subject to sale and entry under the general land laws. The amendment was defeated, after Knute Nelson, Senator from Minnesota, had made the statement that it would be utterly destructive of the entire bill. "It would repeal a power that now exists in the President," said Mr. Nelson. "There are some withdrawals which I have no doubt all men will agree the President can make, and under existing law such withdrawals remain in force until revoked by the Executive or by act of Congress. This amendment revolutionizes all that." The Senators got into such a tangle over the bill that they laid it aside for a future hearing, but was passed without amendment June 15. Gifford Pinchot issued a statement as to what he believed to be a joker in this bill. He declared that it contains one wholly indefensible provision. Section 2 provides that if minerals other than coal, oil, gas, or phosphate can be found on any land withdrawn for public uses, the land shall be open to private appropriation. Mr. Pinchot says that section, if passed, will operate directly for the benefit of the water-power interests and directly against the interests of the people.

General Mining News

ALASKA

(Special Correspondence).—The Northland Development Co. is operating near Big Harbor and expects to have a cargo of high-grade ore ready for shipment before fall.——Sinking on the Goodroe property is progressing with favorable results. Rich bornite with some gold and silver is being developed. Returns from the last 400 tons shipped to the Tyee smelter are said to be very satisfactory to the owners.——The Mount Andrew, It, and Sulzer mines are steadily shipping and blocking out large quantities of ore. ——Over 20 different prospects are being developed in this district, most of them with encouraging results.

Ketchikan, June 4.

ARIZONA

COCHISE COUNTY

The recent survey of the Holbrook shaft at the Copper Queen showed it to be three feet out of line between the 300-ft. level and the surface. Arrangements have been made to stop work at this point till the shaft can be retimbered from this level to the surface. During the temporary shutdown the Czar and Spray shafts will be used as a traveling way and for the handling of timbers. The company has installed two new storage battery motors for hauling in the mine.——Preparations have been made at the Denn-Arizona Copper Co.'s property to resume sinking. One of the heavy pumps has been placed on the south station of the 1350-ft. level and room for an additional pump has been cut on the north side. The ore recently opened by the drift toward the Briggs on the 1350-ft. level has averaged 9% copper.——Development has been stopped temporarily at the Bisbee Extension while changes in the power-plant are made to permit the using of oil for fuel instead of coal. New pumps are being placed in the mine and new water and steam columns in the shaft.——Three Prescott sinking pumps have been installed in the Tombstone Consolidated below the 800-ft. level.

GILA COUNTY

(Special Correspondence).—The Venture Exploration Co., a syndicate of Duluth capitalists headed by W. A. Eaton, president of the Cactus Copper Co., is to acquire 70% of the stock of the Gibson Copper Co., whose property, consisting of 15 claims 18 miles west of Globe, has produced over $1,250,000 worth of high-grade copper sulphide in the past six years. The option on 70% of the stock is for $400,000, the payments being distributed over four years. Plans for development and installation of concentrating equipment are being made.——Grading is under way at the Inspiration for an experimental mill capable of treating 75 tons of ore per day. The plant will be completed in two months.——The Miami Copper Co. will establish its own medical and surgical department beginning July 1. Plans for a new and fully equipped infirmary are being prepared.——Driving westward for 150 ft. on the 660-ft. level of the National Mining Exploration Co.'s Williams shaft has developed an ore-stringer 36 in. wide. Samples taken across the vein show the copper content to be 30%. The copper occurs as both carbonate and glance. H. W. Woodward is superintendent. ——The cross-cut being driven to open the Old Dominion vein on the 500-ft. level of the Telfair shaft on the Arizona-Michigan property is 963 ft. long. The vein is estimated to be 137 ft. from the face of the cross-cut.——Churn-drill hole No. 6 on the Live Oak property has struck disseminated ore 250 ft. from the surface.

Globe, June 11.

GRAHAM COUNTY

The Gold Belt Consolidated Mining Co. has stopped operations on its property ten miles from Clifton. A mill has been installed on the claims by the stockholders who are largely local operators.

MOHAVE COUNTY

Four feet of high-grade shipping ore and nine feet of milling ore have been cut on the 150-ft. level in the old Keystone mine at Mineral Park. The ore is rich in native and ruby silver, and assays made from samples of the 100 tons already broken, run from $250 to $2400 per ton. The Keystone, owned by Tom McNeely and James Uncapher, of Mineral Park, was bonded last December by S. R. Porter, of Los Angeles, who re-opened it after it had lain idle thirty-five years. There is about 25,000 tons of ore in the old stopes that will be shipped to the Needles plant.——The C. O. D. mine, whose history is similar to that of the Keystone, made its first shipment since operations were resumed there several months ago. It is expected that the ore just shipped, about 30 tons, will net over $6000. The second station has been cut in the new shaft and another level started.——The Gold Road and Tom Reed mines, at Goldroad, shipped gold bullion to Kingman a few days ago valued at $55,000, representing about a two weeks' run of the mills. The automatic-pouring furnaces installed at both plants a few weeks ago are proving very satisfactory. A good body of milling ore was cut recently on the east 700-ft. level, about 100 ft. from the shaft in the Gold Road mine.

PIMA COUNTY

A good body of ore is being opened in the Trece de Mayo mine in the Patagonia mountains by the owners, A. L. Peck and J. Saldamando. The shaft is down 150 ft. on the vein which is about 6 ft. wide with an 18-in. pay-shoot.——The Mansfield Mining Co. is reported to have cut a rich shoot of copper-gold ore in the Black mine.

YAVAPAI COUNTY

The 2-stamp mill at the Monte Carlo property is being run on ore that averages $50 per ton, the mill crushing about 1200 lb. per day.——At the Commercial Mining Co. group, in Copper basin, 12 miles west of Prescott, the shaft is down 140 ft. in ore. There are several other bodies of ore that the shaft will open at depth for the mineralized zone is from 300 to 600 ft. wide.

CALIFORNIA

AMADOR COUNTY

(Special Correspondence).—The Dane-Mitchell Mining Co., which recently purchased the Dane and Mitchell groups near Pine Grove, has installed a 25-drill, two-stage, Sullivan air-compressor, the power for which is furnished by a 5-ft. Pelton wheel. Water is obtained under a 255-ft. head from the Volcano Mining & Ditch Co., at the rate of 12½c. per miners inch per day. There was a light 10-stamp mill on the property when the company acquired the ground but this has been torn down and a new one erected to which the company will probably add more stamps in the near future. The mill is also driven by water power. The vein has been opened to a depth of 200 ft. by two levels, one driven from the 135 the other from the 200-ft. station in the shaft. The vein dips 45° toward the east and is about 20 ft. in width, the shoot assaying from $1 to $10 per ton. The company plans eventually to sink a new shaft in the foot-wall and keep the drifts parallel to the vein. The chutes will then be driven to the vein every 30 or 40 ft., and the ore worked by the shrinkage system. Edwin A. O'Donnell is manager. ——The Craymer Brothers, who sold the Mitchell property, have secured a lease on the Reward mine in the same district and erected a 2-stamp mill to test the ore. A shoot over 100 ft. long has been opened, portions of which will plate as high as $50 per ton.——The Little Climax mine, between Pine Grove and Jackson, has been examined in the interest of F. A. Stokes, and it is probable that operations will be resumed on the property which has been idle for some time on account of the death of one of the owners.—— The Ferry Brothers are sinking an incline shaft at their property near Volcano and expect to tap the channel this season.——Several men have been put to work at the Lincoln mine, near Sutter Creek, and the property will be unwatered and thoroughly prospected. The property has produced considerable good ore in the past, but lost the shoot and was shut down. Later it was re-opened and over $150,000 is reported to have been spent in trying to find the ore without success. The work in the adjoining properties has led the present operators to believe that the previous management followed the wrong direction and a strong effort is to be made to recover the shoot.——The South Eureka is to shut down temporarily for a few months while

a new head-frame and electric hoist are installed. The shaft will be aligned and retimbered where necessary.

Jackson, June 13.

MODOC COUNTY

The 50-ton custom mill which is being erected in the Hoag mining district will be completed by July 1, when it will commence work on custom ores. The mill will be under the supervision of J. T. Wall. The Hoag district has produced considerable rich ore in the past few years but has been held back by lack of milling facilities. The east drift of the Consolidated, on the Mountain View claim, has opened three feet of ore, and the Big Four which is under lease to Bashler, Brown & Trendt, has blocked out a considerable tonnage ready for stoping.

NEVADA COUNTY

A shoot of high grade ore has been opened in the Red Ledge mine near Washington.——Work has been started on the re-opening of the Wisconsin mine, at Graniteville, which has been idle for the past 40 years. The shaft, which is down 110 ft., is being cleaned out and retimbered, and arrangements have been made for the installation of additional machinery. Fred Medlin is superintendent.——Ore has been opened by both north and south drifts on the 1100-ft. level of the Pittsburg mine, between Nevada City and Grass Valley, showing the shoots to be from 16 to 18 in. wide.

PLUMAS COUNTY

The buildings near the shaft of the '76' mine of the Plumas Eureka Mining Co. were destroyed a few days ago by fire, resulting in the loss of several thousand dollars. A

Bully Hill Smelter.

portion of the aerial tramway was destroyed, though the timbers of the shaft and the hoist were but little hurt. Julian McCarty Little is superintendent of the property.——There are 15 men working in the Del Monte mine, near Seneca, which was recently bonded to J. J. Reilley.——C. L. Burt and S. A. Bretherton have secured a bond on the Salmon Falls placer mine on the north fork of the Feather river. The group covers one of the ancient river channels and is owned by G. H. Goodhue and associates.——Harry Merrill, who has a lease on the Dutch Hill gravel mine, one of the old time producers, is driving an incline to tap the channel.——Considerable work is being done on the properties in the Portola district. Arrangements have been made to ship four or five tons of ore from the Miller claims to the smelter, and the shaft on the Brooklin is down 50 ft. with cross-cuts started to the vein.——Joseph Young and H. J. Langhorst are preparing to commence work on the claim on Poplar creek which they bonded recently from O. W. Wall.

SHASTA COUNTY

The French Gulch Mining Co., which owns the Milkmaid mine at French Gulch, has secured a two years' bond on the Sibyl group and will commence the exploration of the property.——Lessees at the Green mine are driving on a vein that varies from a few inches to 3 ft. in width.——At the Centennial the lessees are opening a 4-ft. vein.——J. B. Keating, manager for the Bully Hill company which operates the smelter at Kennett, is authority for the statement that the company will not build a bag-house. No attempt will be made to resist the Government if the officials of the Forest Service insist that the plant close down or install some smoke-consuming device.——The machinery for the Nissen mill which the Victor Mining & Power Co. is to erect at its property in Harrison gulch has been shipped from Red Bluff, and it is thought that the plant will be in operation by August.

SIERRA COUNTY

(Special Correspondence.) The lower adit has cut the vein at the Tightner mine, about 1700 ft. from the portal, and at a depth of 640 ft. below the upper workings. At the point of intersection six feet of high grade ore is disclosed. The driving of this adit has been in progress about five years, the hard formation and use of hand drills explaining the slow work. H. L. Johnson is the owner of the property.——The winze at the Sixteen to One is expected to cut the vein at an early date.——Within a few days the Middle Yuba Hydro Electric Co. expects to commence the placing of poles for its transmission line to Alleghany, to supply the town and mines with light and power. E. H. Steels is in charge of the work.——The Rio Antigua Mining Co. is developing the recently opened Bald mountain channel in the South Yuba mine at Forest. F. H. Kuhfeld is manager.——A shoot of rich ore has been opened in the Lee mine, situated in Ladies canyon, three miles from the Sierra Butte mine. Rich ore is being taken out, but developments have not progressed sufficiently to determine the extent of the discovery.——At the Sovereign eight men are employed and an adit is being driven 1600 ft. to tap the shoot of ore opened in the Discovery shaft.——The Young America quartz mine, near Sierra City, is being examined for San Francisco interests.——Operations will be resumed at the Phoenix next week. It is planned to install an electric power-plant.——The Gunn Mining Co. is completing a boarding house and bunk houses, and plans to erect a small mill. T. Elgie is superintendent.——Operations on the Colombo mine will be shortly resumed.

Alleghany, June 13.

A rich shoot has been cut by the drift at the Rose Quartz mine near Sierra City and a 500-lb. lot has been shipped to test the value.——A new mine-car has been packed from Downieville to the Sierra-Poorman mine.——F. H. Davis has secured a bond on the Oxford ground north of Downieville on the east side of the serpentine belt. Some excellent ore has been taken from the vein on the group and crushed in the mill that was destroyed by fire some time ago.——A. C. Wilkinson and S. P. Fellman have secured a bond on the Amethyst claim on Oregon creek near Forest.

SISKIYOU COUNTY

The Scott River Dredger Co., which has a bond on about four miles of Scott river, at Callahan, has stopped operations and will not continue the work of exploring the ground this year. The action of the company throws about 25 men out of work.

TRINITY COUNTY

B. E. Stevenson and J. A. Manaudas have taken a bond on the holdings of D. B. Fields, on Indian creek, for a company of French capitalists. The properties include both placer and quartz claims and cover 1552 acres of mineral land. There are several water rights that are included in the bond which carry over 500 inches of water the driest seasons of the year. The placer claims have been equipped with 4000 ft. of pipe to carry the water for washing the gravel, which has averaged between 11 and 14c. per cubic yard.——In the Yellow Jacket district William McLaren is taking a good grade of tellurium ore from his claims.——J. L. Johnston is opening a 5-ft. vein in the Bonanza.——The Trinity River Dredger Co.'s pony dredge was started at Poker Bar, two miles below Lewiston, on the Trinity river last week. The dredge will handle about 1000 cu. yd. per 10 hours, but the company will have another machine completed this fall that will have nearly double this capacity.

TUOLUMNE COUNTY

(Special Correspondence).—A small crew of men has been put to work at the Longfellow mine, preparatory to the resumption of mining operations. Fred Meyer is in charge.

——Bernard Brothers have let a contract for sinking the shaft at the Karnac an additional 50 ft.——According to a report the shaft at the App mine, now 1300 ft. deep, is to be sunk an additional 300 ft.——Work is soon to be commenced at what are known as the Oneto and Rosasco gravel mines, situated near Phoenix lake, by the Tuolumne Consolidated of California, recently organized. S. A. Knapp will be superintendent.——A company has been formed to drive an adit under the limestone belt at Columbia, in search of gold-bearing gravel in paying quantity. It is said that the preliminary work will be commenced within a few weeks.

Tuolumne, June 13.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence).—Development is in progress at the Standard property on Fall river and reserves of ore are now being blocked preparatory to the starting of the 50-ton mill. W. T. Chapple is manager.——A body of ore two feet wide has been cut in the west drift on the Magnolia vein run from the Rockford adit. Tests show values of 3.8 oz. gold and 2.6 oz. silver per ton.——The German mine in Virginia canyon, has been entered among the list of shippers. During the last week a test run on three tons brought a settlement of $190 per ton in gold and silver.——From 4 to 6 carloads of ore per week are being shipped from the Santiago mine in East Argentine. The product is brought to the independent sampler in Georgetown over the Argentine Central railroad. William Rogers is manager.——A heavy tonnage of ore is being marketed by the Waldorf Consolidated Mining Co. The 250-ton mill is running steadily and a fine quality of concentrate is resulting. It is estimated that there is ready for delivery over 2000 tons of smelting ore that will average $50 per ton.

Idaho Springs, June 11.

GILPIN COUNTY

(Special Correspondence).—The Brooklyn mine, in Lake gulch, has been taken under bond and lease by E. O. Fairchild and O. Q. Beckwith, of Denver. The machinery is being overhauled and placed in condition. The shaft is down 500 ft., and work of retimbering is now in order.——Shipments are in order from the Chicago-Carr mine, in Gregory district. All work is being carried forward under the leasing system.——The Ashtabula mine, in Perigo district, is to be equipped with a boiler, while the other machinery is being placed in condition. T. W. Wells is manager.——The old Pewabic dump has been leased by Charles Niccum, of Black Hawk. From four to five carloads per week will be shipped to the Hidden Treasure mill.

Central City, June 10.

GUNNISON COUNTY

Work at Gothic has been considerably retarded by the late snows this season and operations have only been started a short time in the Mountain King property which is being developed by the Elk Mountain Mining Co. Drifts have been started from the face of the cross-cut which opened the vein last year, and it is expected that one of the shoots will be found within the next 75 ft. The company is to install a water wheel and compressor in the canyon below the mine to furnish power for the drills. J. T. Bennett is superintendent.——Operations for the season have been started on the property of the Maroon Mountain Mining Co.——A force of men is at work grading for the foundation of the new 10-stamp mill which C. M. Carter is erecting at his claims on Ohio creek. A new bunk house for the accommodation of 30 men has been finished.

LAKE COUNTY

There has been considerable high-grade ore taken from the third level of the St. Louis property at Leadville. A 34-lb. brick was shipped to the Denver mint a few days ago that was made by melting picked specimens. The same streak has been found on the fifth level and an effort is now being made to catch it on the fourth.——Work has been started in the unwatering of the Helena shaft in Iowa gulch, and the ground will be ready to open in a few weeks.——A 500-ft. shaft is to be sunk on the Little Mary claim in Big Evans gulch and the ore which is supposed to be the extension of the Famous opened. The Yak tunnel passes a short distance from the proposed shaft and no trouble with water is anticipated as it is thought the tunnel will carry off any seepage.——Brown Brothers, who are operating the Ibex claim under a lease, recently shipped 18 sacks of ore to the smelter that was reported to assay several thousand dollers per ton.——The Colonel Sellers is to commence sinking in a short time.

OURAY COUNTY

The mill at the Thistledown mine near Ouray has been running steadily the past week effecting a saving of 72% of the lead in the ore.——The Camp Bird management is planning extensive development for this season and has increased the force at the mine. The production is keeping up to that of last year which averaged $225,000 per month.——F. M. Jackson, who has been operating the Wedge property for some time, has given a bond on it to a company with which John B. Farish is prominently identified.——The mill at the Revenue has been started and the company will put on an additional 100 men in the course of the next few weeks.——The development which has been carried forward for the past six months at the Atlas has reached a stage where enough ore can be mined to supply the mill continuously. The mill is making a good grade of concentrate and will soon be handling 100 tons of ore per day.——The San Pedro Mining & Milling Co. has let a contract to drive the main development adit 800 ft. from its present face which will complete the work. Eight veins have been cut during the progress and it is expected to open at least three more.——The old Poughkeepsie mine, in the Poughkeepsie district, has been taken over by an Ohio company which is to erect a mill and do considerable development work the coming season.——The development adit, nearly 1400 ft. long, at the Calliope, has been completed and the old workings are being re-opened.

SAN JUAN COUNTY

George Fisher has begun work for the season on his Big Ten group on Greene mountain, five miles southeast of Howardsville. A drift has been run on the Golden Egg claim of this group for over 600 ft. opening ore that assayed about $75 per ton with some that ran as high as $500 per ton. On the main group about 1000 ft. of development work has been done opening a large body of ore ready for stoping.——Work is soon to be started on the Russell group at Animas Forks in the face of the cross-cut that opened a 26-in. vein of ore last season.——The plant has been put in order at the Kankanee and a train of burros is packing in supplies. Some very high-grade ore has been opened in the underground work and the property should make a good showing this year.

TELLER COUNTY

High assays continue as development progresses on the orebody cut on the 1300-ft. level in the Vindicator property on Bull hill, and the vein is showing up strong as followed from this depth. The shoot is opened to the entire width of the drift, and as it contains small seams of high-grade, will average over three ounces gold per ton all the way across. The vein in the 1300-ft. level was cut at a point 400 ft. north of the shaft and lies 1200 ft. from the find made in the same mine two weeks ago. The No. 3 south vein, cut recently at a depth of 1400 ft. in the Vindicator, is appearing stronger than ever before and now measures over 15 ft. from wall to wall. Some of the ore exposed in this shoot assays several thousand dollars per ton, while the entire vein will at this time average more than $110 gold per ton. Samples taken from the new vein recently cut in the Jerry Johnson property on Ironclad hill returned assays as high as $1700 gold per ton. This vein is under development at a depth of 450 ft.——June 10 was pay day in the Cripple Creek district and over $315,000 was distributed for May wages.——The find made several days ago by Fred Johnson, lessee operating on the Pride of Cripple Creek, on Ironclad hill, is said to be improving as development work is carried on and the orebody opened now measures four feet from wall to wall. This vein lies at a depth of 630 ft. and assay returns show from 1 to 5 oz. gold per ton.——A number of leases have been granted on the Blue Bird mine, on Bull hill, and the mine will shortly be back on the ship-

ping list. The Gold Dollar property on Beacon hill, operated by the Union Leasing Co. is making a fairly good production, the output averaging over 25 cars per month. Development work upon a large scale is being done on this ground and it is believed that before the closing of the present month the mine will be in shape to double the tonnage going out at this time. Two ore-shoots are opened and operations are conducted through the Mabel M. and Husted shafts. The ore shipped from the property is averaging $25 per ton.

IDAHO

IDAHO COUNTY

Joe Sugars, of Orogrande, and M. L. Derrigg, of Grangeville, have bought the 2-stamp mill on the Gold Dove claims and will move it to their Iola group near Orogrande. A cross-cut adit on the claims opened an 8-ft. vein at a depth of 60 ft. from which assays have been obtained as high as $125 per ton.——The adit at the Buckhorn claims on Four Mile creek is reported to have opened a shoot of high grade ore, cutting the vein at a depth of 140 ft. The property is owned by C. E. Sample, J. H. Kingsley, and J. D. Wooden, of Spokane.——J. Asher Cowan, who recently secured a bond on the Center Star mine, north of Elk City, has commenced work. The adit will be driven ahead on the vein and a shaft sunk, while later construction on a road to bring in machinery will be started if the present development warrents it.——The re-adjustment of the American

Bunker Hill & Sullivan New Mill.

Eagle mill, on Seigle creek, was completed a few days ago and the 10 stamps are now dropping on ore. It is estimated that there are 500 tons of ore ready for the mill that will average $54 per ton.——Work has been started at the Jumbo mine in the Buffalo Hump district. The mill and machinery will be repaired and the mine thoroughly tested.——There are 11 men working in the Lone Pine claim which is under bond to F. W. Bradley, and it is reported that the entire face of the drift is in high-grade ore.

SHOSHONE COUNTY

The directors of the Federal Mining & Smelting Co. have declared a dividend of $210,000, at the rate of $1.75 per share on preferred stock, payable on June 15 to stockholders on record May 27. This is the second dividend paid this year and brings the total to $420,000 for the year. With the payment of this dividend the Federal Mining & Smelting Co. will have disbursed $8,090,000 since its organization a few years ago. Of this total $5,381,250 has been paid on the preferred and $2,708,750 on common stock. The company has 60,000 shares of common stock issued and 120,000 shares of preferred, the par value of each being $100.——The Caledonia Mining Co., owning the newest of the bonanzas in the Coeur d'Alene district, has increased its shipments to 40 tons per day. Some of the latest assays show 1200 oz. silver, and as high as 38% copper per ton. The ore is among the richest ever uncovered in the Coeur d'Alene. Seventy-five men are employed in the development of the property. The company has paid two dividends, amounting to $39,000 in two months and the third of $13,000 at the rate of 1c. per share is due.——The Gold Hunter Mining Co. is planning to drive an adit of two miles on its property near Mullan, making it the longest in the Coeur d'Alene. The adit will be driven from the Bell Mining company's old adit at Gem, and run through the Bell, Elvan, Wonder, and Star claims before tapping the Gold Hunter. The property is one of the largest shippers in the Mullan district.

MONTANA

BROADWATER COUNTY

B. Binnard, the president, and officers of the Radersburg Consolidated Mining Co., controlling the Ohio Keating mine and the Manhattan California mine, have left on a tour of inspection of its properties. The electric power line has been completed to Radersburg and active operations are about to be resumed. It is the intention of the company to commence active development on the Manhattan California property and it is expected that the equipment will be placed during the fall.

NEVADA

ESMERALDA COUNTY

The Goldfield Consolidated Mines Co. had another big month in May, according to the official figures just given out by J. R. Finlay. The figures for the month fall but a trifle short of those for April. The gross production for the month was $1,021,656, and the net profit $723,396. Mr. Finlay's report follows:

TONNAGE PRODUCED.

	Dry tons.	Assay oz.
Combination	4,656	1.18
Mohawk	6,549	1.32
Red Top	4,409	1.31
Clermont	4,204	2.63
Shipping ore from Clermont	691	25.88
Total	20,509	2.41

The gross value to be credited to the various mines are as follows:

Combination	$ 114,742
Mohawk	180,472
Red Top	121,136
Clermont	605,306
Total	$1,021,656

The performance of the mill was as follows:

Dry tons milled	19,818
Average value per ton	$ 32.89
Total value	$651,868
Loss in tailing	$ 31,260
Value realized	$620,628
Percentage extracted	95.20

EXPENSES.

General—	Amount.	Av. Per Ton.
Bullion tax and marketing bullion	$ 22,000	
Administration, etc.	21,000	
	43,000	$2.10
Mining	81,000	3.95
Transportation	3,000	0.15
Milling—		
Milling and cyaniding	$51,000	
Marketing concentrate residues	16,000	
	67,000	3.27
Construction	40,000	1.95
Cost of marketing high-grade ore	33,000	1.61
Net cost	267,000	13.03
Loss in tailing	31,260	1.52
Total costs and losses	$298,260	$14.55
Profit per ton	$35.26	
Total value of ore	$49.81	
Total profit for month	$723,396.00	
Percentage of profit	70.81	

The Codd lease on St. Ives is to resume operations and will sink to a depth of 1500 ft.——The Combination Fraction has a force of men at work in the mill of the Nevada-Goldfield Reduction Co., and will commence milling as soon as the machinery is in good running order.

HUMBOLDT COUNTY

(Special Correspondence).—E. A. Montgomery and associates have decided to hurry the work on their property, adjoining the National mines.——W. L. O'Connell and associates are conducting developments on the Radiator and Auto Hill claims.——The Stahl lease on the National is extracting the richest ore in the district. A recent shipment of 1000 lb. netted $35,000, while a previous shipment of 800 lb. brought $25,000.——At Seven Troughs activities are pronounced and several leases are opening excellent ore.——The Seven Troughs Co. is operating the Kindergarten, Therien, and other properties. On the 400-ft. level oreshoots have been developed for 600 ft. These, save for a barren zone of about 50 ft., are continuous and range in width from three or four inches to three feet. The ore assays well with an average about $30 per ton. On the 500-ft. level, which is being opened, the shoot has been driven on for a short distance.. The Kindergarten shaft, sunk to a vertical depth of 300 ft., is the main working avenue. The mill is running with one shift, but as soon as the new pump has been installed two shifts will be employed. L. A. Friedman is manager.——The company has a force of 85 men on its payroll.——The Engineers', Merger, and other leases are developing blocks of ground with satisfactory results. On the Merger lease ore assaying $50 to $100 per ton has been intersected.——The Chicago lease has secured a block of ground on the west ore-zone and will commence activities within a few weeks.——It is reported that negotiations are pending for the consolidation of the Seven Troughs Co. and the Florence Leasing Company.

Winnemucca, June 11.

LINCOLN COUNTY

Orders have been received at Pioche to start work on the Consolidated Pioche and the mine has been gotten in shape for extensive work.——After a brief shut-down the Gold Chief, in the Chief district, has resumed operations. A supply of distillate has been obtained at Caliente and work can be carried on without stopping till the railroad is repaired. The Gold Chief shaft is now down 400 ft. in ore that assays from $6 to $17 per ton.

NYE COUNTY

(Special Correspondence).—A movement is under way to organize a new company, known as the Dexter-Jumping Jack Consolidated Mines Co. to take over the Union No. 9 claim of Dexter and the Jumping Jack claim of this company, in order to avoid further apex litigation. The new corporation will have 1,250,000 shares, and will be controlled by the two parent companies.——The Rescue-Eola Co. has filed articles of incorporation with the county clerk. The company, composed of San Francisco capitalists, plans to assume the debts of the Rescue Consolidated Mining Co., and resume operations on the property.——The Flemming lease on National Bank is driving the east cross-cut at a depth of 300 ft. A gasoline hoist has been installed and the compressor moved to the lease from the main workings.

Tonopah, June 10.

OREGON

BAKER COUNTY

The White Points Gold Mining Co. is opening a group of five claims east of Sumpter with good results. A 400-ft. adit has been driven that tapped the vein at a depth of 300 ft., and drifts are now being run on the ore.——Mikle & Gleason have been prospecting the Mero group, near Bourne, this season with good results. The vein has been opened in several places, the assays from which averaged about $10 per ton.——Work has been resumed on the Mammoth property near Sumpter which has been operated by A. Bodleson for several years. The property is equipped with a mill and it is understood that work will be continued on a larger scale than before.

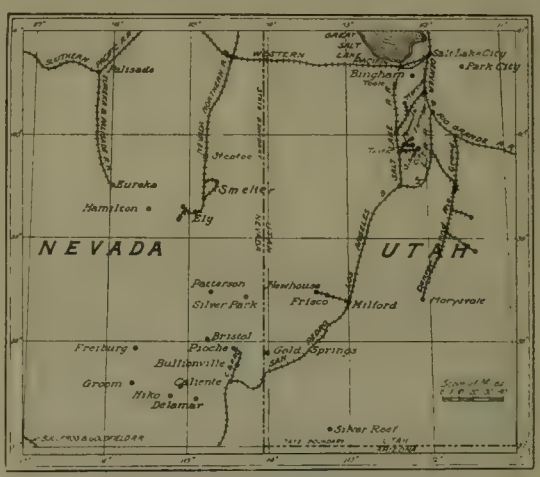
GRANT COUNTY

The Virginia mine on the head of Olive creek in the Greenhorn district is being unwatered and will be thoroughly sampled. Several portions of the mine have been very rich, one pocket having been opened that produced $50,000 worth of ore.——At the Ophir mine, in the Susanville district, the operators are stoping on a 5-ft. vein at a depth of 300 ft., on which level drifts have opened the shoot a distance of 75 ft. The 10-stamp mill is kept running night and day showing a good value on the plates and shipping concentrate to the Sumpter smelter that assays well.

UTAH

JUAB COUNTY

Some of the best ore that has ever been shipped from the Iron Blossom property is now being mined on the 500-ft. level of the No. 1 workings, the average being about $65 per ton though portions are much higher. Twenty tons per day of this grade of ore is being shipped. The board of directors has declared a dividend of 6c. per share, payable June 25.——The work of developing the Governor property through the Star Consolidated shaft has been started. The Star is now part of the Black Jack group and it is



Eastern Nevada and Western Utah.

through the 300-ft. level that the Governor ground will be reached.——Operations are to be resumed at the Crown Point.——The Lehi-Tintic Mining Co. has let a contract for 300 ft. of cross-cutting on its ground in the North Tintic district.——At the meeting of the directors held in Provo recently the Colorado Mining Co. declared a dividend of 8c. per share to be paid June 20.——Sinking is to be resumed at the Sioux Consolidated in the 450-ft. shaft. The drift, which is being driven toward the old workings is now out over 1100 ft., and is expected to open the ore any time.

PHILIPPINE ISLANDS

The Bua mine, in the Benguet district, recently shipped a $5000 bar of gold, the result of the mill-run during April. There are nearly 100,000 tons of ore blocked out in the mine which assays from $5 to $10 per ton. The company is to move the present plant to a more favorable site some time soon, and add another battery to the mill.——The dredge of the Philippine Gold Dredging Co. is to be started on a strip of ground on the Malaguit river, the owners of the dredge to receive 40% of the net profit.——The Syndicate Mining Co., operating in the Masbate district, is to issue ₱25,000 of its treasury stock to continue development. Some fair ore has been opened and the company will erect a mill if the results of the planned work are as satisfactory as the ground now opened.——The Colorado Mining Co., of Masbate, has completed the grading for the foundation of a 20-stamp mill and will have the plant completed late this fall. There are several veins on the property one of which is 16 ft. wide, the ore assaying about $10 per ton.——The Mayot Mining Co. is developing a group of claims on Gold creek in the Benguet district. Over 3600 ft. of work has been done on the property opening ore that averages $8 per ton.——The Headquarters Mining Co. is preparing to install its new mill which was ordered a short time ago. The company has purchased a cyanide plant from the Atlantic Gulf & Pacific Co. which will be erected with the mill.

BUTTE MINE PRODUCTION

Production cost and earnings of the Butte companies for the year ended June 1, 1910, are given below

ANACONDA

Tons of ore mined		1,[illegible]
Gross value of ore		$11,[illegible]
Cost of mining	$[illegible]	
Freight on ore	16,[illegible]	
Cost of production	1,[illegible]	
Marketing charges	1,[illegible]	
		$[illegible]
Net proceeds		$1,[illegible]

BOSTON & MONTANA

Tons of ore mined		1,291,343
Gross value of ore		$17,127,551.43
Cost of mining	$4,761,[illegible]	
Freight on ore	81[illegible]	
Cost of reduction	3,579,[illegible]	
Marketing charges	1,911,614.87	
		10,168,761.58
Net proceeds		$2,956,792.93

BUTTE & BOSTON

Tons of ore mined		377,106
Gross value of ore		$3,707,261.79
Cost of mining	$1,265,916.21	
Freight on ore	72,669.96	
Cost of reduction	918,921.62	
Marketing charges	380,153.62	
		2,667,991.13
Net proceeds		$1,039,270.31

WASHOE

Tons of ore mined		203,508
Gross value of ore		$1,549,640.58
Cost of mining	$785,728.29	
Freight on ore	21,516.00	
Cost of reduction	116,290.97	
Marketing charges	151,000.05	
		1,377,535.31
Net proceeds		$172,105.27

TRENTON

Tons of ore mined		150,867
Gross value of ore		$1,331,221.71
Cost of mining	$649,896.89	
Freight on ore	18,328.03	
Cost of reduction	301,692.01	
Marketing charges	129,214.91	
		1,099,132.34
Net proceeds		$236,092.37

PARROT

Tons of ore mined		88,416
Gross value of ore		$652,093.36
Cost of mining	$532,962.16	
Freight on ore	12,161.25	
Cost of reduction	180,505.25	
Marketing charges	74,958.24	
		800,589.90
Net proceeds		$148,496.54

NORTH BUTTE

Tons of ore mined		430,121
Gross value of ore		$4,217,604.82
Cost of mining	$1,612,921.73	
Freight on ore	51,614.30	
Cost of reduction	1,798,407.12	
		3,462,943.15
Net proceeds		$754,661.67

RED METAL

Tons of ore mined		517,463.43
Gross value of ore		$4,839,126.31
Cost of mining	$2,007,771.81	
Freight on ore	101,355.34	
Cost of reduction	2,034,616.25	
		4,143,743.47
Net proceeds		$695,382.87

ALICE GOLD & SILVER

Tons of ore mined	1,415
Gross value of ore	$17,319.60
Total cost of production	20,701.45
Net loss	$3,381.85

The net earnings of the same companies for 1909 were: Anaconda, $2,079,891.28; Boston & Montana, $1,404,783.09; Butte & Boston, $616,198.24; Trenton, $136,898.40; Parrot (loss), $12,220.83; Washoe, $153,441.43; North Butte, $1,839,442.78; Butte Coalition, $459,160.86; Alice, $3,810.01. The total increase for the year was $316,090.94.

COPPER PRODUCERS' ASSOCIATION figures made public June 8, show an increase of stocks on hand June 1 of 18,441,814 lb. over May 1. Stock on hand June 1 was 160,425,973 lb., an increase of 18,441,814 lb. over May 1; May production, 123,242,476 lb., an increase of 5,764,837 lb. over April. Total deliveries during May, 104,800,662 lb., an increase of 5,482,308 lb. over April. Of the deliveries 45,495,440 lb. were for export, an increase over April of 14,167,037 lb., while 59,305,222 were delivered to domestic consumption, a decrease from April of 8,680,729 pounds.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

EDGAR COLLINS is in San Francisco.

FRANK M. WATTS is now at Los Angeles.

E. A. SPERRY has returned to Sacramento.

COURTENAY DE KALB has gone to New York.

J. W. D. MOODIE has returned to Los Angeles.

L. A. GREENE has returned from Los Angeles.

E. B. KIRBY was in San Francisco Wednesday.

J. MORGAN CLEMENTS was at Los Angeles recently.

MARK B. KERR has gone to Trinity county, California.

GELASIO CARLANI and LIONEL LINDSAY are at Austin, Nevada.

E. H. MESSITER has removed his office to 25 Broadway, New York.

S. H. WIMBERLEY is with the Homestake company at Lead, South Dakota.

G. LAVAGNINO, of Pasadena, California, is spending some time at Salt Lake.

CHARLES KIRCHHOFF is attending the International Congress at Düsseldorf.

FRANK W. ROYER was in San Francisco last week on his way to Mexico City.

JOHN A. ROOK is mining engineer for the Atlas Mining Co., at Whitehorse, Yukon Territory.

O. H. PACKER has returned from examining and locating placer ground on Middle Fork of Feather river.

CHARLES M. MULLEN, now of Portland, Oregon, but long connected with mining in Colorado, is visiting San Francisco.

J. B. TYRRELL has been elected a Fellow of the Royal Society of Canada.

H. F. LEFEVRE has returned to New York after an absence of ten months spent in Guatamala, Salvador, Nicaragua, and Costa Rica.

PHILIP WISEMAN has left Los Angeles for New York by way of Portland and Butte. He will sail for Europe on the *Lusitania* June 29.

HOWLAND BANCROFT, of the United States Geological Survey, has resumed field work on the ore deposits of northeastern Washington.

LAWRENCE ADAMS, late vice-president and general manager for the Guanajuato Amalgamated, is leaving New York for Montana and California.

CARL F. DIETZ and DYKE V. KEEDY, of the firm of DIETZ & KEEDY, metallurgical engineers, of Boston, have gone to Nova Scotia for Boston clients.

S. F. SHAW, general manager and consulting engineer for the Montezuma Mines of Costa Rica, has gone to Montezuma, Costa Rica, where he will be engaged for several months.

W. MURDOCH WILEY and R. B. LAMB, of New York City, have left for Montana to examine the Ohio-Keating mine. They will also make mine investigations in Idaho and California.

R. L. BARTLETT, recent graduate of the course of mining geology of the Mass. Inst. Technology, has accepted a position with FREDERICK G. CLAPP, geological engineer, Pittsburg, Pennsylvania.

L. Vogelstein & Co. give the following figures of German consumption of foreign copper for the months January to April, 1910:

Imports of copper	57,322 tons
Exports of copper	2,658 tons
Consumption of copper	54,664 tons

as compared with consumption during the same period in 1909 of 46,619 tons. Of the above quantity 50,784 tons were imported from the United States.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

LOCATION OF CLAIM—ASSESSMENT WORK

Where a junior locator contended that annual assessment work was insufficient because the work was done for the purpose of representing several claims, a court, in determining the sufficiency of the work, will apply the labor shown to have been done to the particular claims upon which the work was in fact done.

Swanson *v.* Kettler, (Idaho) 105 Pac., 1059, Jan. '10.

LOCATION OF CLAIM—ABANDONMENT

A senior locator, possessed of a paramount right in mineral lands for which a patent is sought, may abandon such right and thereby render the ground covered by such location subject to re-location before the expiration of the statute of limitations within which the annual labor must be performed. And upon application for a patent a junior locator may show, as against the senior location, that the ground covered by such senior location had become a part of the public domain so as to be subject to re-location even before the expiration of the statutory period for performing the annual labor, by showing that there had been an actual abandonment of the claim by the first locator.

Swanson *v.* Kettler, (Idaho) 105 Pac. 1059. Jan. '10.

LOCATION OF MINING CLAIM—RIGHT TO PATENT

A person who has initiated a right to a mining claim, recording his location notice, and performed the other acts made necessary by law, will be entitled to a patent on application, unless adverse rights are set up in the mode provided by the statute. And in an application for a patent by a junior locator, upon the failure of the senior locator to adverse, it will be presumed that there was no senior location, and that at the time the junior location was made the ground was open to entry under the mineral laws of the United States, but where it is made to appear that there is a third location made subsequent to such junior location, such third or subsequent locator may adverse the application for patent by the junior locator, and show that the junior location was void, because when made the ground was not open to location under the mineral laws.

Swanson *v.* Kettler, (Idaho) 105 Pac. 1059. Jan. '10.

LOCATION OF CLAIM—AMENDMENT OF CERTIFICATE

If the certificate of the original location of a mining claim was insufficient because so defective as to prevent identification or designation of the claim on the ground, an amended certificate cannot be filed curing the defect where it includes other or different territory so as to injure intervening rights.

Washington Gold M. & M. Co. *v.* Olaughlin, (Colo.) 105 Pac. 1092, Dec. '09.

PRIORITY OF LOCATION—FRACTIONS OF A DAY

Where the relative priority of conflicting mining locations depends on the exact hour of the day of the filing of a location certificate, fractions of a day must be taken into account; and where a location certificate, not filed within the statutory time was filed in advance of the filing, on the same day, of a junior location certificate, in a controversy as to the pirority, the former was held to be prior in time.

Washington Gold M. & M. Co. *v.* Olaughlin, (Colo.) 105 Pac. 1092, Dec. '09.

CONVEYANCE OF COAL LANDS—RELEASE OF DAMAGE FROM WORK

Where the grantors of coal under land released all claims for damages by the working of the mines in a proper manner, the removal of all the coal was not an improper working; and where a subsidence of the surface was caused thereby, the owner of the surface under such release had no right of action for damages.

Kellert *v.* Rochester & Pittsburg Coal & Iron Co., (Pa.) 74 Atlant. 789, Oct. '09.

Publications Received

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1907-8. PART V. UPPER MISSISSIPPI RIVER AND HUDSON BAY BASINS. By A. H. Horton, E. F. Chandler, and R. H. Bolster. U. S. Geol. Surv., Water-Supply Paper 245. Pp. 133, ill., index. Washington, 1910.

MODERN ASSAYING. By J. Reginald Smith. Pp. 145. Ill. J. B. Lippincott & Co., Philadelphia and London. Price $1.50.

This little book is the latest on the assaying of ores, and is direct, comprehensive, and plain, a book that is both technical and practical. It is profusely illustrated and likely to become popular with those who wish a knowledge of assaying without the expense and time of a special course in a technical school. Considerable space is devoted to the assaying of ores by wet, as well as fire methods.

A HISTORY OF THE LOGARITHMIC SLIDE RULE AND ALLIED INSTRUMENTS. By Florian Cajori. Pp. 125. The Engineering News Pub. Co., New York. Price $1.

This volume is one of the most complete treatises of the many thus far published on the subject of the slide rule and its uses. In these days, when 'time is money', the engineer employes the slide rule to reduce the mental labor of mathematical computation, and this book gives a history of this valuable type of instrument, and explains its varied uses, so that anyone may employ it to advantage.

THE CORROSION AND PRESERVATION OF IRON AND STEEL. By Allerton S. Cushman and Henry A. Gardner. Pp. 373, ill. McGraw-Hill Book Co., New York. Price $4.

This is a treatise on a subject which cannot fail to be of interest and value to all who are using iron and steel for structural purposes. It goes thoroughly into the problem, and various expedients are suggested to prevent, or lessen, the destruction of iron and steel by corrosion due to electric currents or to other causes. The book will be of particular usefulness and value to architects and engineers whose work deals largely with structural steel.

THE CYANIDE HANDBOOK. By J. E. Clennell. Pp. 520, ill. McGraw-Hill Book Co., New York. Price $5.

This is the latest addition to the extensive literature descriptive of the cyanide process, and one of the best. The history of the process and its chemistry, is reviewed at length. The chapter devoted to the preparatory treatment of ore for cyaniding, is of peculiar value, as it describes in detail the various types of machinery employed in crushing and grinding the ore; the mechanical contrivances for handling the material, both direct and old accumulations of tailing. Hydraulic classification, and the various metallurgical processes which commonly precede cyanidation are treated at length and considerable space is devoted to special modifications of the cyanide process; to testing as to adaptability and other essential features of the treatment of ores by the process.

New Oilfields Map

William Forstner is preparing a map covering the oilfields of the west side of the San Joaquin valley from Coalinga to Sunset, including the Carizo valley in the eastern part of San Luis Obispo county. This map will give the names of owners and claimants to the parcels of land, with the character of the ownership or claim; whether agricultural patents and mineral entry, pending homestead entry, lieu selection, desert-land entry, State selection, mineral application, or mineral location; giving the exact status of all ownership and claimants, as gathered from the public records. The map will be on the scale of one inch to the mile, and about 10 ft. long by 3½ wide. As only a restricted number will be published, orders should be sent to Mr. Forstner in advance.

Market Reports

LOCAL METAL PRICES

San Francisco, June 16.

Antimony	12–12½c	Quicksilver (flask)	47½–48
Electrolytic Copper	14½–15¼c	Spelter	7–7¼c
Pig Lead	4.70–5.65c	Tin	36¼–36½c

METAL PRICES

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper.	Lead.	Spelter.	Silver per oz
June 9	12.50	4.34	4.98	53⅝
" 10	12.43	4.34	4.98	53⅜
" 11	12.37	4.34	4.98	53⅜
" 12	Sunday.	No market.		
" 14	12.31	4.34	4.95	53⅛
" 14	12.31	4.34	4.95	53⅝
" 15	12.31	4.34	4.94	53⅝

ANGLO-AMERICAN SHARES.

Cabled from London.

	June 9. £ s. d.	June 16. £ s. d.
Camp Bird	1 8 0	1 8 6
El Oro	1 7 0	1 6 6
Esperanza	2 13 9	2 15 6
Dolores	1 8 9	1 8 9
Oroville Dredging	0 7 6	0 7 6
Mexico Mines	8 12 6	8 10 0
Tomboy	1 0 0	1 0 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, June 16.		Closing prices June 16.
Adventure	5¼	Mohawk	47⅛
Allouez	38	North Butte	25¾
Atlantic	7	Old Dominion	31⅝
Calumet & Arizona	63¾	Osceola	130
Calumet & Hecla	645	Parrot	13
Centennial	16	Santa Fe	1½
Copper Range	60	Shannon	10¼
Daly West	8	Superior & Pittsburg	10¼
Franklin	11	Tamarack	46
Granby	38½	Trinity	5½
Greene-Cananea, ctf	7⅛	Utah Con	20½
Isle Royale	6¼	Victoria	3
La Salle	11¼	Winona	7
Mass Copper	8	Wolverine	110½

(By courtesy of J. C. Wilson, Mills Building.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, June 16.		Closing prices June 16.
Amalgamated Copper	62⅛	Miami Copper	19⅜
A. S. & R. Co.	74¼	Mines Co. of America	⅝
Boston Copper	18⅜	Montgomery-Shoshone	⅝
B. C. Copper Co.	5⅝	Nevada Con.	18¾
Butte Coalition	18⅜	Nevada Utah	⅜
Chino	10⅞	Nipissing	11¼
Davis-Daly	1¼	Ohio Copper	2
Dolores	6⅜	Ray Central	2⅛
El Rayo	4¼	Ray Con.	16⅝
Ely Central	1¾	South Utah	1⅛
First National	3½	Superior & Pittsburg	10¾
Giroux	7	Tenn. Copper	24¾
Guanajuato Con	¾	Trinity	5⅝
Inspiration	7½	Tuolumne Copper	3⅝
Kerr Lake	8⅛	United Copper	5¾
La Rose	4¾	Utah Copper	43½
Mason Valley	7¼	Yukon Gold	4⅜

SOUTHERN NEVADA STOCKS.

San Francisco, June 16.

Atlanta	$ 12	Mayflower	$ 3
Belmont	3.70	Midway	26
Booth	15	Montana Tonopah	95
Columbia Mtn	6	Nevada Hills	1.12
Combination Fraction	49	Pittsburg Silver Peak	68
Daisy	6	Rawhide Coalition	24
Fairview Eagle	20	Rawhide Queen	25
Florence	2.70	Round Mountain	45
Goldfield Con	9.00	Sandstorm	3
Gold Kewenas	6	Silver Pick	7
Great Bend	3	St. Ives	11
Jim Butler	28	Tonopah Extension	85
Jumbo Extension	20	Tonopah of Nevada	8 60
MacNamara	28	West End	58

(By courtesy of San Francisco Stock Exchange.)

Drilling 'Man Size' Holes

Work recently performed by the War Department through the corps of engineers with a Terry core drill has established beyond doubt the practicability of drilling bore holes 30 or 40 in. diam., vertically or at an angle, and to any reasonable depth. The drill used was of the class D type and equipped with tools for boring a 29-in. hole. The work was in New York, and the material bored through was a trap concrete embankment. Some of the drilling was done in places where the bore holes penetrated cement reinforced by steel beams, and elsewhere iron drain pipes and the like intersected the line of the bore hole. All of the holes drilled were at an angle, and the average cutting rate was 2 ft. per hour. In the illustration below are shown parts

Drill Cores Made With Terry Drill.

of some of the core removed from a hole drilled at an angle of 55° from the vertical. In one of these cores there is embedded a section of an 8-in. eye-beam, and in another an iron pipe 2 in. diam. Both the steel beam and iron pipe were severed without any appreciable reduction in the speed of cutting. The wear on the bit was one-quarter of an inch per foot cut and ten pounds of shot was used in drilling the same distance. Numerous seams and openings caused by imperfect setting of the cement, as well as severed pipes large enough to drain in a few minutes the water from an ordinary bore-hole, offered not the slightest hindrance to the work. Irregular and broken formations are of no consequence in drilling large holes, as has been demonstrated in similar operations. The detritus or sludge from the kerf is sufficient to close all save large seams or crevices and through them the heavy tools under a high momentum advance with remarkable rapidity.

Details regarding the work are given by Captain H. L. Wigmore, as follows:

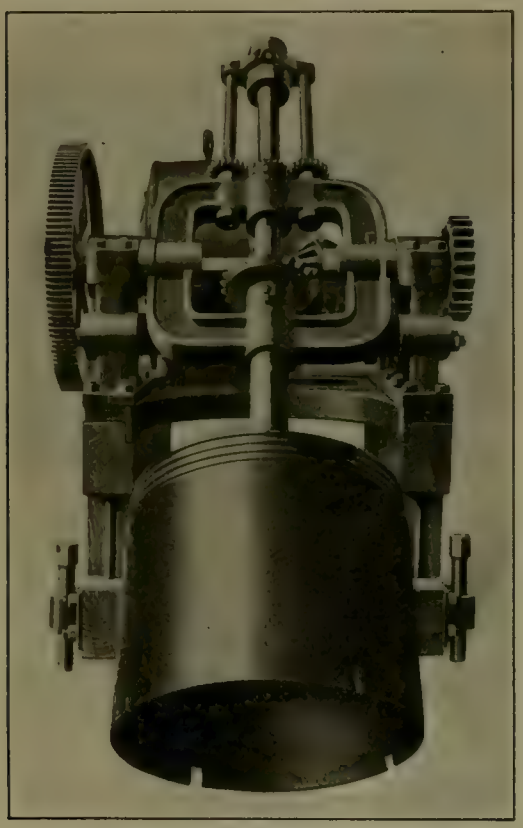
(1) April 18: a 28-in. diam. bit, inclination of shaft 54° 22′ with the vertical, cut 37 in. through concrete in 2 hours and 40 minutes, actual running time. (2) April 19: 36 in. cut through the same class of material in one hour, actual running time. (3) April 20: 31 in. cut through concrete and 8-in. steel beam in 2 hours, actual running time. (4) April 22: 33½ in. cut through concrete and 2 in. wrought-iron pipe in 1 hour and 15 minutes, actual running time.

In making the above statement it is understood that the total time consumed in drilling the lengths stated was considerable more than the time given, as many delays for different reasons are continually occurring in work of this nature. The space available where this drill was used was exceedingly limited and the work was much slower than would have been possible with longer runs. In three days, April 18, 19, and 20, counting all delays, a total progress was made of 104 in. In cutting a total of 14 ft. of hole a wear on the bit valued at $5.25 was reported. Consumption of oil, waste, grease, and shot for drilling the above 14 ft. is reported at $2. In a similar hole of only 6 ft. in length, a wear on the bit valued at $6 was reported, and consumption of shot, oil, waste, etc., valued at $1.

This statement shows that in drilling 29-in. holes through

trap concrete, steel beams, and iron pipes, 138 in. was cut in 414 minutes, or 1 in. every 3 minutes; this is equivalent to 20 in. drilled per hour. In drilling 20 ft. through the same material the cost of wear on the shot-bit was 56c. for each foot drilled.

In mining operations, where the head room will permit, these drills can be profitably employed for sinking winzes or boring holes for use as ore-chutes. Such operations are now being conducted with a Terry drill in a large mine in northern New York. It is, however, to those concerned in the ventilating of mines, and of coal mines in particular, that this subject should be of the greatest interest, both



Terry Core Drill.

from an economic and humanitarian point of view. Several holes 30 in. or more in diameter can be drilled for the cost of sinking a single shaft, and if properly placed they would supply a circulation of air to the workings much better than that obtained through a single shaft. The size of these holes would be ample for the installation of permanent ladder, and they would serve as exits in case of accident, and as such they would be of the greatest assistance in rescue work. There would be much less difficulty in reaching and extinguishing mine fires, which under present conditions are oftentimes so situated as to be inaccessible, and therefore continue unmolested until checked at some place remote from their origin. To be able to reach a fire quickly, and while still in the incipient stage, would save enormous sums hitherto wasted for lack of a vantage point from which to begin the attack. Apart from providing a means of ingress and egress for miners, these large bore-holes would supply to the workers a wholesome atmosphere under more natural conditions than at present. At each opening could be installed an electrically driven fan which would force air into the workings or exhaust the air from the mine as needed. Ventilation is not the only purpose for which these bore-holes could be advantageously used, for they could serve as conductors for pipes and cables, and would in many cases shorten the distance to which such lines must be carried. To some these suggestions may seem impracticable, or the cost prohibitive. As a matter of fact such is not the case, but even if the actual cost were high, it would appear that any cost would be reasonable which would provide a method whereby life and property would be conserved. To the mine owner this method of ventilation offers the cheapest insurance he can procure, and the improved working conditions it would afford within the mine would stimulate those of a higher order of intelligence to seek therein employment where hitherto they would not venture.

CATALOGUES RECEIVED

THE DEISTER CONCENTRATOR CO., Fort Wayne, Indiana. 'Deister Ore Concentrator No. 2'. Illustrated. 12 pages. 5½ by 8½ inches. 'The Improved No. 3 Deister Slime Concentrator'. Illustrated. 16 pages. 9 by 6 inches.

GALIGHER MACHINERY CO., Salt Lake City, Utah. Catalogue B, showing complete line of mining machinery and supplies including everything from blasting fuse, hand-hammers, up to rock-drills, compressors, hoists, vanners, and the like. An unusually complete index adds materially to the usefulness of the volume. Fully illustrated. 520 pages. 5^1_2 by 8^1_2 inches.

COMMERCIAL PARAGRAPHS

The Chicago office of the POWER SPECIALTY CO. has been moved to the Peoples' Gas building. The business in that territory is in charge of R. B. Nutting.

The NATIONAL ORE CONCENTRATION CO., Chicago, has recently shipped an order of Woodbury jigs to the Braden Copper Co., of Valparaiso, Chile.

The HARBISON-WALKER REFRACTORIES CO., Pittsburg, advises that J. J. Brooks, Jr., its general sales manager, has recently been elected to the directorate of the company.

WARREN C. BOGUE has organized the BOGUE SUPPLY CO., and has established office and yards at Seventh West and Third South streets, Salt Lake City, to buy and sell mine and mill equipment.

THE DORR CYANIDE MACHINERY CO., Denver, Colorado, advises that among its recent orders is one for 10 Dorr classifiers and 8 large thickeners for the Santa Gertrúdis company, at Pachuca, Mexico.

EDWIN H. MESSITER has opened an office as a consulting engineer at 25 Broad street, New York City, and will make a specialty of problems connected with handling of materials in metallurgical plants.

The DODGE MFG. CO., Mishawaka, Indiana, is distributing a chart showing, by a four-color half-tone, the action of the Eureka water softener and purifier. As an example of the best in mechanical illustrations this chart is pre-eminent and deserves careful study of the process which it illustrates.

THE DENVER ROCK DRILL & MACHINERY CO., Denver, Colorado, is now associated with the International Steam Pump Co., of New York, and will handle all the business of the latter firm in the Denver, Salt Lake, and El Paso territories. A large stock of machinery will be carried at each of these three points.

The Cananea Consolidated Copper Co. is increasing its roasting plant and has placed an order with ALLIS-CHALMERS Co. for six McDougall furnaces. These are exactly like the four furnaces which they now have in service. The furnaces have an outside diameter of 18 ft. 6 in. and are 32 ft. high. They are the six-hearth type.

THE C. O. BARTLETT & SNOW CO., Cleveland, Ohio, reports the following recent sales: Grasselli Chemical Co., three sets of heavy crushing rolls, and elevating and conveying machinery; Jacobs Asbestos Mining Co., Thetford Mines, W. P. Q., Canada, one special Common Sense pan conveyor, 250 ft. centres; capacity 150 tons of asbestos rock per hour; National Carbon Co., Cleveland, Ohio, elevating and conveying machinery; Pennsylvania Salt Co., Philadelphia, Pa., elevating and conveying machinery; Diamond Rubber Co., Akron, Ohio, two drop forge chain conveyors for conveying tire core, 120 ft. centres.

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EDITORIAL

THE Congress of Inventors set for June and to be held at Rochester, New York, has been postponed till October. It will be held then unless new cause for delay be invented.

GOLD from the spring clean-up at Fairbanks has begun to arrive at Seattle. A shipment of $305,000 was received June 18, and $1,000,000 in addition is known to be on the way.

ST. MICHAEL harbor is at last open, steamers having been able to land June 19. It is reported that ten ocean-going vessels and fifteen river steamers were waiting for the break-up of the ice.

STATEHOOD is at last to be the portion of Arizona and New Mexico, though under the act just signed we shall probably not be permitted immediately to extend the welcome mining men in particular have long had waiting. In the meantime, don't crowd, gentlemen. There can only be four Senators.

PUEBLO, Colorado, is making extensive preparations to entertain the National Irrigation Congress, September 26 to 30. Irrigation and mining, the peculiar interests of the Western States, have much in common, and it is significant of their close relations that the Irrigation Congress will assemble in the Mineral Palace.

SEISMOLOGICAL studies are not as yet to be taken up by the United States Government. Mr. Hale, the venerable senator from Maine, characterized the project as 'absurd and sentimental' and the appropriation was accordingly refused. The narrowly circumscribed outlook illustrated by the remark is perhaps one reason why Mr. Hale is serving his last term.

PROGRESS in ore treatment at Kalgoorlie has not been made except through expenditure of much good money and hard work, as is shown elsewhere in this issue by Mr. M. W. von Bernewitz, the accomplished metallurgist of the Associated Northern Blocks (W. A.), Ltd. The account is taken from an unusually good illustrated description of the gold mines of the State, edited by Mr. H. V. Courtayne of the *West Australian Mining, Building & Engineering Journal.*

THE SUMMER SCHOOL is a well recognized institution in America. The mining colleges have generally conducted their summer courses in the field. The Missouri School of Mines is, however, to try this year a summer course in assaying, metallurgy, and related subjects carried on in the labora-

tories at Rolla. It has often seemed to us that there was an especial field for summer courses devoted to coal mining since, in general, the coal mines are less active during that season and an opportunity would be afforded the more ambitious workmen to prepare themselves for advancement.

WET METHODS of assaying have never been successfully applied to gold ores. The portability of apparatus suitable for such a method has led to many attempts to develop one that would be reliable. In our issue of last week we publish a scheme recommended by Mr. Robert DeLuce, and this week we give the results of a series of careful tests of the method made by Mr. James W. Howson. Evidently, as Mr. Howson concludes, this particular method while imperfect warrants further investigation. We shall be glad to hear from others.

STEWART and the Portland Canal district of British Columbia have led to much speculation this year. There seems to be no doubt as to the presence of good veins and the probability of important production. All this may be conceded and yet a word of caution be in order. Shares in the three leading companies, the Red Cliff, Portland Canal, and Stewart, have reached prices indicating a popular estimate of the combined value of the properties amounting to over seven million dollars.

BOTH coal miners and coal operators in Illinois seem to have settled down for a long and bitter contest. A number of operators have broken away from the association and signed the new scale but on the whole these defections have been few; much fewer probably than were anticipated by both miners and operators. The United Mine Workers withdrew the pumpmen and emergency workers, and the operators retaliated by announcing that they would recognize a separate engineers' and pumpmens' union if formed, which was promptly undertaken. There has been little disturbance of the peace and, while feeling is bitter at many points, so far there has been no rioting. The men insist that the operators shall pay for the short-firers, which the companies maintain is impossible in view of the competition they must meet.

Inspection of Mines

Mine inspection and various other means of increasing safety in the mines are now, fortunately, attracting much attention. We are glad to note especially that the interest is not confined to the coal mines. The program of the Mine Inspectors Institute, which has been meeting at Chicago, included such subjects as 'Timbering in Metal Mines', discussed by Mr. F. Cushing Moore, State Mine Inspector of Idaho, and 'The Education of Mine Employees' by Mr. H. H. Stoek, of the University of Illinois. The American Mining Congress has been attempting for some years to frame a model law which might be recommended to the various mining States. The committee having the matter in charge, consisting of W. R. Ingalls, J. Parke Channing, James Douglas, John Hays Hammond, and J. R. Finlay, have worked with unusual care and will probably be ready to report at Los Angeles this fall. The report is sure to be a notable one and ought to be productive of much good. In the meantime Mr. Finlay is showing what the companies themselves can do in advance of legislation. A department of inspection has been organized at the Goldfield Consolidated, with Mr. Heath Steele in charge. The men have been invited to make suggestions with regard to anything that may be done to make safer any machinery or equipment in any part of the property of the company. Many changes have been made already and more improvements in plant and methods are in view. Mr. Finlay feels that while the Goldfield mine is one in which work is less dangerous than usual rather than the reverse, that is no excuse against taking every reasonable precaution and the details given on another page indicate that the aim is at a practice as exceptional as is the production of the great mine that he manages.

Prospectors and Geologists

Idaho's senior Senator, Mr. W. D. Heyburn, is a forceful man with a cutting tongue. Under the rule of Senatorial courtesy, he makes, uncontradicted, a good many statements that in the expressive language of the mining camp are 'bunk'. In the course of a recent speech he said, for example, that "no geological expert ever discovered coal." This will be news to the officers of the Colorado Fuel & Iron Company, which for many years employed Mr. R. C. Hills as geologist for the express purpose of discovering coal, and which in some fashion as a result of his work found and acquired large tracts of ground containing a black material that burns and otherwise fulfills all the purposes of coal. Mr. Robert Forrester, who performed a similar service for the Utah Fuel Company, is proud of the title of geologist and is certainly expert. Mr. E. T. Dumble, so well known as State Geologist of Texas, did such excellent work for the Southern Pacific in the coalfields of Coahuila, that he and a whole corps of geologists are now employed by that corporation. It would probably be hard to convince Mr. Julius Kruttschnitt that Mr. Dumble never 'discovered' any coal.

It will not do to argue that these men and others of their like, merely examined and reported on discoveries already made by some 'poor prospector'. A case falling within the experience of Mr. Bailey Willis while employed by the Northern Pacific, more nearly illustrates the true relation. In the heavily timbered and drift-covered coalfields of Washington, outcrops of any sort are rare. Mr. Willis, finding coal on a certain Section 18 and determining from the dip of the rocks a synclinal structure should bring the same bed near the surface in Section 13, sent his foreman and drill crew to the centre of that section with instructions to drill. They found coal within a few feet and thereafter had a great respect for the knowledge of Mr. Willis since they knew he had never been on the land nor had probably any other white man. The prospector has much to his credit. His intelligence, optimism, and patience have worked wonders in the development of the West but in giving him full credit it is not necessary to deny alto-

gether the efficiency of other men's work. To do so argues the limitations of the speaker's mind or a deliberate desire to mislead by an appeal to the gallery.

Americans and Chinese Railways

Since the Brice syndicate died an unlamented death Chinese railways have not been favorably considered by American investors, and American participation in railway building has been even less favored by the Chinese. Our initial effort gave an unfortunate introduction. The Brice fiasco was the most ordinary of promotion enterprises. As little as possible was given and as much as might be was exacted, with a view to quick profits rather than sound railway building. Ultimately, it will be recalled, the Chinese bought back the concession for $6,750,000, borrowing the money from the British. The price covered 32 miles of road and 50 miles of earthwork, and $3,500,000 of the amount was figured as a compounding of future profits. The transaction was finally closed, to the great relief of all concerned, through the good offices of J. P. Morgan & Company. Since then Americans have been in disfavor at Pekin, so far as railway concessions were concerned, and, on this side, popular interest in Chinese railway building has languished. This condition is unfortunate, since in many ways American experience and practice in railway building is eminently suited to Chinese conditions. Much of the present unrest in China over foreign loans for railways has risen from the English and continental plan of making the initial outlay on the basis of a road to last all time and to be capable of handling at once all of its ultimate traffic. European engineers spend more than we do on permanent improvements and as a result start with a heavier initial capitalization. In America roads have been built on the basis of the least possible first expenditure and of making betterments from earnings. It was on this basis that the great system of American railways was built, and it is because of the flexibility of the plan that the system grew so rapidly. A not less important consequence is that the railways belong in the main to our own people. In a broad sense, despite being at the time a poor people, we paid for our roads as they were built.

The Chinese would do well to follow our example. So far as concerns capital available for railway building, they are, as we were, poor. They have greatly the advantage in that the potential earnings from their lines are larger and traffic will in most cases develop more quickly. Indeed, at many points it merely waits the coming of the rails. In the Pekin-Kalgan line they have shown their ability to build substantially at low cost, and in the Imperial Railways of North China, to operate with an unusually favorable ratio of net to gross earnings. They should not hesitate to borrow the amount necessary to build the needed lines, but they may well hold out for better terms than they have been generally granted, and particularly for full control over the property.

At present there are two lines under consideration, in which Americans are interested. The Hankow-Sze Chuan railway has been much discussed and it is again announced that negotiations for its building have been completed. English, German, French, and American bankers are to participate in a loan of $30,000,000 to finance it. The line is a most important one, extending from the great interior seaport of Hankow at the head of deep-water navigation, westward through a populous country and along a line where a rich trade already exists. Some of the construction work will be heavy owing to mountain grades. The second line, and in many particulars the more significant one, is that from Chinchow on the Imperial Railways of North China, to Aigun on the Amur river. The distance is about 750 miles and the situation corresponds roughly to a proposal to build from Chicago to Winnipeg, supposing no lines were in operation save the Northern Pacific from Duluth west through St. Paul, to which Tsitsihar, near which the new line will cross the Chinese Eastern, may be taken to correspond. The country is a broad valley or great open plain across which construction will be cheap and easy. It is only sparsely inhabited and constitutes, with Mongolia, the natural area into which the Chinese surplus population should flow. The soil is good and the climate favorable. Much of the territory is not greatly different from Iowa and southern Minnesota. It is corn land, and even as far north as the Amur river a deciduous palm is present. At Blagoveschenk, apposite Aigun, the summers are positively hot and the winters not colder than in the Mississippi Valley. It is China's most available unoccupied territory, and economic as well as strategic reasons demand that the road be built. American and British firms have undertaken to supply the capital, to the amount of $30,000,000, at a rate of 5 per cent interest, leaving full control of the line in Chinese hands. The requirement of foreign engineers and payment of commissions on purchases has been waived, and, in short, the terms are the most liberal that have been given to the Chinese. The proposal is backed by American banking firms abundantly able to carry the matter through without outside appeals, and is not therefore a promotion matter, but a sound business enterprise. Difficulties have been raised by both Russia and Japan, but essentially they rest on strategic grounds. In the long run economic conditions are bound to control, and the right of China to build roads where she pleases in her own territory can hardly be permanently contested. In the meantime the suggestion has been made that Japan and Russia join in the enterprise, and this is a sound suggestion, since everything which makes toward the neutralization of Chinese railways in their political aspects, makes toward peace. The more the Chinese can be led to develop their own resources, the less danger there is of conflict, and the further the world moves from the old 'spheres of influence' notion, the better. America has been the historic friend of China, and in the new phase of development of the ancient Empire America has everything to gain and nothing to lose by continuing that attitude. No special privileges are desired or desirable. From the Brice syndicate to the Chinchow-Aigun terms, marks progress in America as well as in China.

BY THE WAY

The relations between the work of the geologist and of the prospector have been discussed recently in a *Press Bulletin* circulated by the United States Geological Survey. From it the following is abstracted:

The question is often asked by those who have made only superficial observations of geological work on mineral or ore deposits: "Why does the prospector discover a greater number of valuable mineral deposits than the mining geologist?" The answer might be "Because there are more prospectors than geologists," but a better answer is that the geologist usually devotes his attention not to the discovery of individual deposits but to the determination of broad structural features and of the general relation of these features to the occurrence of the ores or minerals. He attempts to interpret the geologic history and structure of a region and to suggest where certain ores or minerals may or may not be found, but the details of the search for commercially valuable deposits are left for the man who is willing to spend time and labor in patient exploration at one spot.

Pioneer work on mineral deposits in a new field is as a rule done by the prospector. The geologist does not pose as a pioneer; he is not looking for bonanzas; he is in search of information that may be of wide general use and in the search he merely takes the larger ascertainable facts, studies their significance, and in his report groups them in an orderly way, so that even in his reconnaissance work he lays the foundation for thorough scientific study of the region he explores. For some of his purposes an old, abandoned mine without economic value may be of great service; it may show the manner in which valuable ores occur typically; it may show their mineral associations and mode of origin; it may indicate the kind of country rock that will probably contain deposits of a particular nature. On the other hand, his work may develop facts that seem to have no immediate practical application but that may in time—in a very short time perhaps—become of great economic importance.

An example of work of this class may be seen in some of the Geological Survey's explorations in Alaska. Most of the gold mining thus far done in that region has been confined to work in the placers. In the course of their explorations in this rough region the Government geologists have not only determined the geology of large areas and examined the streams or localities in which valuable placers are found or are likely to be found, but have endeavored to fix the place of origin of the placer gold. Many of the rocks from which the gold was derived will doubtless remain untouched until the placers have been exhausted, but when the placer deposits are gone the miner must necessarily turn to the original sources of the gold. Some lode mining has indeed already begun in Alaska and, in spite of the difficulty of access to the interior, there is no doubt that it can be carried on profitably. On the other hand, much of the geological work in Alaska has been of immediate practical value. The map work is of prime importance, and many of the geologists' judgments as to the probable location of rich placers have been borne out by subsequent mining.

The determination of the character of the rocks and of the geologic structure of a region may afford a means of indicating places or zones in which valuable orebodies occur—places that the ordinary prospector would not at first consider favorable. An example of this form of geologic inference is seen in a Government report on the Bisbee district of Arizona. In this district the explorations of the prospector confirmed at once the geologist's prediction that valuable ore would be found in a certain locality.

It must be acknowledged that the prospector of earlier days—the man of pick, shovel, and pan—had little help from the geologist, and that much prospecting in out-of-the-way corners of the earth must still be done in advance of geologic study. Yet the modern prospector fully appreciates the value of geologic work as enabling him to plan his search intelligently, to avoid wasting his efforts in unfavorable localities, and to begin his work where he has the best chance of success. Many a prospector who plods behind his laden burros over the desert carries a well-worn geologic map in his pocket. Much modern prospecting, moreover, is carried on by machinery and involves the expenditure of large sums with no certainty of return. It is in directing prospecting of this essentially modern character that the mining geologist has applied his knowledge with greatest success, for few such enterprises are now undertaken without his advice. It may be said, however, that chance will always remain a large factor in the search for some minerals and for some kinds of ore and this factor will always insure work for the prospector as well as for the geologist.

In his search the prospector naturally enough collects specimens of any odd-looking or uncommon mineral that he may be able to find and submits them to the geologist or mineralogist for examination. The miner, too, in his daily operations not only strikes new mineral deposits but discloses geologic facts and relations that were before unknown, and these the geologist gratefully notes and interprets. The geologist is not equipped with diamond-drill or steam-shovel, and in many regions he can observe only the natural exposures of the rocks; but the operations of the drill and shovel serve to increase his means of observation and to give his work greater value.

Notwithstanding the fact that prospecting is a distinct art, the special knowledge of the geologist and his habit of trained observation enable him at times to recognize the presence of valuable mineral deposits without going through the ordinary steps of prospecting. A geologist of the United States Geological Survey, for example, recently discovered and called attention to a valuable deposit of monazite in Idaho, which is now being exploited. Another discovered tin-bearing veins in Alaska. The Government geologist, of course, can reap no pecuniary benefit from such discoveries, for he is prohibited by law from acquiring any interest in mines or mineral deposits. During the last few years many geologists have left the Survey to accept positions with mining and exploring companies or firms at higher salaries than those paid by the Government.

Gold Deposits of Georgia

By E. K. Soper

Gold has long been known to exist in the Appalachian Mountains in a belt more or less continuous from Maine to Alabama, but only in the southern end of the belt, in Virginia, the Carolinas, Georgia, and Alabama have deposits of workable size been found. Probably the first important discovery of gold in the South was about 1799, when a nugget reported as weighing 17 pounds was discovered on the Reed plantation in Cabarrus county, North Caroline. Other large nuggets were found in the State about this time, and soon North Carolina became a regular producer, and for twenty-seven years yielded all the native gold coined in the United States. The total production up to 1827 was about $110,000.[1] In 1828 discoveries were reported from Georgia, and the year following South Carolina made its first shipment to the mint. Gold was first produced in Alabama in 1830. From this time on until late in the forties the output rapidly increased in all of these States, and they ranked as the greatest gold producers in the United States. The most active mining carried on in this region during these years was at Dahlonega in Lumpkin county, in the northeast corner of Georgia. By 1838 this district had attained such importance that the Government established a branch mint in the town of Dahlonega, and during the twenty-three years that elapsed between 1838 and 1861 (when the mint was closed) it coined gold to the value of $6,115,569. When the Civil War broke out mining in the South was generally abandoned, and since that period none of the districts have ever attained their former prosperity.

The principal gold deposits in Georgia occur in what is known as the Dahlonega gold belt, extending from the extreme northeastern corner of Georgia southwest to Haralson county in a fairly straight line. This belt varies between one and thirty miles in width and is about 150 miles long. That portion of the belt lying in Lumpkin and White counties, comprising the Dahlonega district, is the most important. The nearest railroad point is Gainsville, situated about twenty-one miles from Dahlonega on the main line of the Southern railroad. The topography of the district is typically that of the foothills on the eastern slopes of the southern Appalachians. Low rounded hills and broad gentle valleys are characteristic and the absence of sharp angles or ridges is striking. To the north, some fifteen miles, the Blue Ridge rises in striking contrast to the smooth and eroded hills below. The region is well watered and covered with a heavy growth of Georgia pine, chestnut, hickory, oak, and underbrush. The pines afford abundant and cheap timber for mining operations, while numerous streams or 'branches' furnish the power for the mines and mills. The Chestatee and Etowah rivers and their tributaries constitute the drainage system of the region.

The rocks of the Dahlonega region are Archean mica and hornblende gneisses and schists. The prevailing dip varies from 30 to 60 S. E., while the strike is about N. 20 to 30 E. The gneisses and schists shade imperceptibly into each other, even in the same mass, and everywhere there is abundant evidence of intimate relationship between the two. The rocks are generally much contorted and banding in layers varying in width from 2 to 20 ft. is common. The formations are overlain by a mantle of saprolite derived from the weathering of the Archean crystallines themselves. This saprolite varies in thickness from 50 to 100 ft. and is of a red, yellow, or brown color, according to the degree of oxidation of the iron by which the color is imparted. While the saprolite usually retains the form and structure of its parent rocks as to contortion, banding, and folding, yet it is quite soft, and in places of cheese-like consistence. This fact has an important bearing on the original method of mining adopted throughout the district, as will be shown later. The gneisses and schists are rarely cut by granitic and dioritic intrusions, but very few granite dikes exist in the vicinity of Dahlonega. Pegmatite dikes occasionally occur. Northeast of Dahlonega, about one mile, is an outcrop of a quartzose foliated rock, different from the usual schists of the region and resembling more closely quartzose slate. The mica schists are sometimes garnetiferous and often enclose more or less well defined quartz veins. The various kinds of rock weather to different varieties of saprolite of characteristic colors. These are spoken of by the miners as the 'yellow' and 'black' belts. The yellow saprolite is probably derived from a pearl gray hydro-mica schist, and the black variety seems to be the weathering product of the dark hornblende schist and quartzose slate.

The gold deposits belong to a rather unusual type to which G. F. Becker[2] has given the name of 'stringer lead'. They consist of more or less parallel bands of gneisses and schists fissured and filled with gold-bearing quartz and sulphides. The small quartz bands are not true veins, but may be better described as an aggregate of numerous narrow and discontinuous quartz lenses and stringers, occuring in a zone, and which taken altogether form a 'vein'. The thickness of the veins varies from a few inches up to twenty feet. They pitch usually to the northeast. In addition to these belts of discontinuous quartz lenses, the schist within the zone of fissuring is often itself auriferous. Especially is this true toward the surface in the saprolite belt, where the silica has been removed to a large extent in solution, leaving the gold behind. Among the miners there is the general opinion, based on observations and experience in the district, that in the yellow saprolite, gold may be present throughout the mass; while in the 'black belt' the gold is confined to the unaltered quartz stringers that are found to have resisted the agencies of weathering and decomposition. While this is not to be taken as an invariable rule, there is certainly a strong tendency for a more uniform distribution of the gold throughout the 'yellow belt'. Concerning the age of the veins, there is con-

[1] 'Gold Deposits of Georgia.' Yeates, McCallie, and King. Geol. Surv. of Georgia, 1896.

[2] 'Gold Fields of the Southern Appalachians'. U. S. Geol. Surv. 16th Ann. Rep., part III, pp. 251-331, 1895.

siderable doubt. Various geologists have reckoned their origin as dating from pre-Cambrian to late Cretaceous time. Evidence would seem to point toward an ancient origin. The rocks in which the veins occur are Archean; the entire region has suffered a tremendous amount of erosion and denudation, and we have only the roots of the original veins remaining. The eroded material has gone largely to make up the rich and extensive deposits of auriferous gravels which furnished the bulk of the gold in the early days of the district. One thing is certain; fissuring occurred subsequent to the shearing of the schists. The chief evidence supporting this conclusion is the inclusion of fragments of the schist within the quartz. The opinion is sometimes expressed regarding these deposits, that they may be expected to increase in value with depth. This is a risky statement to make regarding any gold-quartz vein, but from the evidence at hand, it is altogether unlikely in the Dahlonega region.

The character of the ore varies greatly, not only among the various deposits in the district, but within the same vein. The filling consists essentially of quartz, pyrite, some chalcopyrite, and free gold. Little pyrite occurs above water-level. The quartz, where not stained from the oxidation of the pyrite, is usually milky white in color. In the saprolite zone the gold is often rusty, and much was lost on this account during the early days of hydraulic operations. It is almost impossible to state an average value of the ore on account of the pockety nature of the deposits. Perhaps $1 to $5 per ton would cover the larger deposits as they exist today. While the deposits have not the form and well defined walls of 'true fissure' veins, their origin has been similar. Mineralization is probably due to heated ascending solution through zones or belts of fissuring in the schists. The impregnations in the schists are due probably to even shattering of the homogeneous rock, and subsequent leaching out of the quartz, for no evidence of replacement has been observed.

The early methods of mining in Georgia, as well as in the neighboring States in the Southern Appalachians, consisted of panning and sluicing with the aid of the long-tom and rocker. Gradually, as the large deposits of decomposed saprolite ores became recognized, hydraulic methods were applied with great success, and this led to a mining and milling system peculiar to the region. The belts of yellow saprolite in the Dahlonega region were hydraulicked in the same manner that gravel banks are mined today in many localities, and the auriferous material was conducted through ground and wooden sluices to the mill, where it passed over coarse grates or screens into a bin with a perforated bottom. The holes in the bottom of the bin were from ½ to 1 in. diam. All of the material passing through these holes was run to waste into the neighboring stream which usually supplied the power to run the mill. It has been estimated that 50% of the gold was lost in this way. Of the remaining 50%, one-third was caught in the sluices. The material in the bin was fed by hand into the mortars, as it was found that mechanical feeding was not successful on account of the extensive variation in the hardness of the ore with its soft saprolite and chunks of solid quartz. The stamps were designed for coarse rapid crushing, and from this crude but profitable practice was evolved the so-called 'Dahlonega type', or 'Hall type' battery.

A large number of mills were in operation up to as late as 1895, and a considerable number are working today, although practically all of the saprolite ore is now exhausted. The Hall type battery consists of five 450-lb. stamps with a 9-in. drop, averaging 90 drops per minute. Round-punched screens are used with 120 holes per square inch. The height of discharge is 2 in. when the dies are new. The cost of a 10-stamp battery of this type complete and set up at the mine near Dahlonega has been given as $2350.[3] They give an extreme of rapid crushing, but with the gradual exhaustion of the soft saprolite ores, and the finding of hard quartz-pyrite ores at depth, the Hall type batteries are no longer so efficient, and many have shut down. With the passing in depth to a hard ore, there is also usually a marked decrease in grade, so that the situation that now confronts many properties is serious. In the days when hydraulic operations were at their height, saprolites running as low as 40c. per ton were worked at a profit.

The total average cost of mining and milling under favorable conditions by the Dahlonega method varies from 18 to 25c. per ton. As to the grade of pyritiferous quartz ore that can be worked at a profit by underground methods, it is hard to say, for much depends on factors that are variable in the district, such as labor, water-power, and location. The cost of underground mining at the Lockhart mine on Yahoola creek is given at $1.35 per ton, including milling. Conditions here are more favorable than at many of the properties. Underhand stoping is in use, and the roof supported by stulls 6 ft. apart. Labor is almost entirely white, but is nevertheless very inefficient. Wages range at many of the smaller mines from 90c. to $1.75 per shift, with perhaps an average of $1.25. While the best ore of the district is certainly worked out, and little unworked saprolite ground remains, there are doubtless properties that can be made to pay good profits with economical management and suitable methods of milling. However, none of the Georgia ores are high grade, and it is to the larger low-grade deposits that the region must look in the future.

Nitrate produced in the different Chilean Pampas is given by the Asociación Salitrera de Propaganda, in quintals, as follows, during the eight months ended February 28, 1909 and 1910:

Place of production.	1909.	1910.
Tarapacu	13,033,790	16,756,891
Tocopilla	2,104,400	4,167,020
Antofagasta	5,407,899	6,843,385
Aguas Blancas	2,568,805	2,595,640
Taltal	3,838,832	4,349,547
Total	26,953,726	34,712,483

[3]'Present Conditions of Gold Mining in the Southern Appalachian States'. Nitze and Wilkins. Trans. A. I. M. E., Vol. XXV, pp. 661-796.

LAKE VIEW GUSHER

The great oil well shown in the accompanying picture is situated in the Midway field of the McKittrick-Sunset district, in Kern county, California. It is the property of the Lake View Oil Co., of which the Union Oil Co. owns 51% of the stock. The flow of oil was found March 15 at a depth of 2265 ft., and for a long time the well resisted all attempts at control. It began flowing at a rate estimated at 47,000 bbl. per day and is thought to have attained a maximum of 90,000 bbl. at one time. Its present flow is conservatively estimated at 25,000 bbl., and, as one of the illustrations show, even this amount of oil resembles more the flow of water in an irrigating ditch than an ordinary stream of oil. While there has been some waste, most of the oil has been caught in open reservoirs or ponds and is being saved. The total flow so far is something over 3,000,000 bbl., and the well has surpassed all known records for output in the same time. The Lucas well at Beaumont, Texas, produced more oil in a single day, but the life of the well was short. The production of the State for May has been unofficially estimated at 7,000,000 bbl., which is the highest since production began. The yield has reached proportions which are far in excess of the facilities for moving the oil to the markets, and there is such congestion at the wells and at storage and transporting points that either the production must be diminished or a larger movement and storing capacity be obtained. These matters are now interesting the operators and producers, and it is safe to say that before the end of this year the facilities for storing, piping, and financing the oil will have been vastly increased, although it will probably take several years before they will care for the output at its present rate of expansion, which will be heavily swelled by the bringing in of numerous new wells, including many big gushers. In April 6,580,510 bbl. were produced. Stocks on hand March 31, 1910, were 19,569,085 bbl. Consumption in April was 6,445,243 barrels.

Lake View Gusher, Soon After Coming in.

Oil from Lake View Gusher.

Lake View Gusher, May 28.

Pool of Oil from Lake View Gusher.

Progress in Ore Treatment at Kalgoorlie

By M. W. von Bernewitz

*The metallurgical practice at Kalgoorlie, though only extending over a period of sixteen years, has made great strides. In 1893, the only means of obtaining gold from the surface alluvium and quartz veins near Hannan's was by the aid of the 'shaker' and 'dolly pot'. Early in 1849 the MacClay brothers erected a unit mill at the Kalgurli mine, the tailing from which ore is said to have assayed £40 per ton. Then five stamps were erected at the Croesus mine. In 1895 the lode formations in which the prospectors had found 'mustard gold' on the Lake View Consols mine had been shown to be of sufficient value to warrant the erection of a plant. An Austral Otis ball-mill was put up, but, not proving a success, was replaced by 10 stamps, which were erected in the gully between the Lake View Consols and the Great Boulder Proprietary Co.'s mines. Although not actually the first mill here, it may be considered the starting point of the metallurgical practice at Kalgoorlie. The ore was hand-fed, amalgamated in the mortar and on copper plates, passed over blanket tables into pits, the slime overflowing and running into ponds, while the sand in the pits was dug out and wheeled away for future treatment. During this time good ore had been found in a number of other mines, and several 3 and 5-stamp batteries were erected, but with the same primitive arrangements.

The Huntington mill was introduced about this time, the Associated Gold Mines, Ltd., being the first, with three mills; then the Hannan's Oroya and Hannan's Proprietary built each a similar number. Over 100 tons per day was crushed by each plant of three mills. The sand and slime was stacked or run into ponds. The Oroya dump at present is being treated by a vacuum plant, while the treatment of that of the Proprietary is under consideration. A point worthy of note in the Huntington milling is the low percentage of gold in the slime, as compared with the sand. The high value of the tailing from the different mills was by this time worrying not only those who had plants at work, but also those who contemplated erecting them. The original dry-crushing plant was erected on the Brownhill, and an electro-amalgamation process, called the Haycraft, was put up near the Hannan's Lake; but neither of these was a success. The Great Boulder Proprietary G. M., Ltd., erected 30 light slow-running stamps, the tailing after passing over copper plates being treated in grinding pans, which increased the extraction, but still left considerable gold in the sand and slime. These were stacked and subsequently treated. The Ivanhoe increased its battery to 60 head of 950-lb. stamps, gear-driven cam-shafts with clutch arrangement.

One of the directors of the Lake View Consols visited Broken Hill about this time, and saw the work at the Broken Hill Proprietary mine, and, recognizing the advantage of having a trained metallurgical chemist and assayer, persuaded the chief assayer of the Proprietary company to come to Kalgoorlie. Experiments of treatment of tailing by cyanide were begun, and by the end of 1896 the accumulated dumps on the Lake View mine were being treated. The slime difficulty next arose. The gold in this product was found to dissolve in the cyanide when agitated, but the trouble was to get the gold solution out of the slime. After numerous experiments, the adapted sugar press was found to be the best filtering medium. Early in 1897 the satisfactory working of the filter-press made great advance in the treatment of Kalgoorlie ore possible. The method of treating the slime by cyanide in the press was found to be too slow, and agitation and subsequent filter-pressing was adopted. The Brown Hill Co., Ltd., erected its second dry-crushing plant for the treatment of its oxidized ore. This consisted of a rock breaker, two revolving dryers, several No. 5 Krupp ball-mills, the crushed ore being separated into fine and coarse products by an air current, the sand being elevated to steel vats for percolation treatment by cyanide, and the slime being mixed with solution, agitated in small vats in sieves—one slightly below the other; and finally treated in filter-presses. This process was not the success that was anticipated, and the residue has since been re-treated. The oxidized ores in the mines cut out at a comparatively shallow depth, and the sulphides made their appearance at this point, so there was more trouble ahead for the millmen.

Soon after the sulphides appeared, telluride of gold was identified on Block 45 lease. It was also found in all of the other mines, and bonanzas of exceedingly rich ore were struck. This ore could not be treated locally at that time, so it was shipped to the smelters at Dapto, Wallaroo, and Fremantle, by the Lake View Consols, Associated, Golden Horseshoe, Kalgurli, Perseverance, and Associated Northern mines. The freight and smelting charges were high, fully five times the present cost of mining and treating a ton of ore. The Golden Horseshoe Estates, Ltd., erected a small blast-furnace at the mine, and the smelting of rich ore was continued for some time.

Some time during 1897, a seven-hearth roasting furnace was erected on the Great Boulder Main Reef, this furnace being similar to those used at the Mt. Morgan mine in Queensland. It was rabbled by hand, but costs were high and the roasting poor. It may be mentioned here that the ores of most of the mines are practically dry, and suitable for dry crushing. The ore at the Main Reef was crushed by a Gates breaker followed by Krupp No. 5 mills, and then went to the furnace. Later on, the Lake View Consols and South Kalgurli erected 'Brown straight-line' furnaces, followed by the Kalgurli and Associated with the Ropp type. At these mills the partly roasted ore—for these furnaces did very poor work—was cooled in various ways, and then damped down with strong cyanide solution. This ore was then elevated to vats to be treated with solution by the percolation method. This process was a great failure, and metallurgists were at a loss to understand why this was so for some time, until the chemical

*Abstracted from 'The Gold Mines of Western Australia'.

reactions during roasting and cyaniding became fully understood. In roasting, the lime and magnesia in the ore are converted into sulphates, and these, on being wetted by the solution in the vats, set hard, so that in several instances the half-treated ore was removed from the vats by picks and bars. The ore was under treatment for periods up to a month with low extraction and high consumption of cyanide. This clearly would not do, so grinding pans were installed on the Great Boulder Main Reef, the idea being to slime all the ore. The process was to dry-crush, roast, mix the ore with salt water, grind, and amalgamate in pans, force the slime into presses and filter out the water, the slime being then mixed with cyanide solution and pressed again. This was probably the first time the press was used on roasted ore. The Lake View Consols and Associated companies remodelled their plants on these lines, their system being to break the ore in Gates crushers and Rodgers rolls, crush in Krupp mills, roast in Brown and Ropp furnaces, mix with cyanide, agitate, and then treat in the presses. The Kalgurli had a Ropp, the roasted product being separated, the slime being air agitated and pressed, while the sand was treated in vats for some weeks with cyanide solution circulated by means of small air-lifts. At the Associated mill, and possibly some of the others, Wilfley tables were being worked to catch the unroasted pyrite that came from the furnaces, this in itself showing what sort of work the furnaces were doing. The Kalgurli had Halley percussion tables for the same purpose, the concentrate being afterward ground in a pan. The rabble carriages in the Associated roasters used to carry raw ore from the feed to the discharge end and drop it there to mix with the roasted ore. This went on for some time.

The Great Boulder Perseverance had in the meantime erected a large dry-crushing plant, using Griffin mills and the Holtoff-Wethey furnace. This type was also a poor roaster. The Koneman de-sulphurizing process was tried on the Great Boulder. Roughly, it consisted of roasting the ore in lump form in a furnace of three compartments, the ore falling into an increasing heat to be thoroughly oxidized. The roasted ore was to be crushed in a machine patented by Mr. Koneman. The process was not a success.

In the dry-crushing mills it was apparent that something must be done to improve the roasting and subsequent treatment. In the case of the Lake View Consols, the plant was shut down, and the treatment of the ore was continued in a stamp battery. About this time the Edwards—and later on the Merton—furnace from Victoria was introduced, and the seven hearth at the Main Reef, the Brown at the South Kalgurli, the Ropps on the Kalgurli and Associated were thrown out, and the newest types of mechanical furnaces were erected. The Great Boulder and the Perseverance later on converted the Holtoff-Wetheys into the Edward type. From this time onward the roasting was good. The roasting problem being settled, the treatment of the roasted ore was the next question, and with few differences the treatment on the Associated, Associated Northern, Great Boulder, Kalgurli, Main Reef, Perseverance, and South Kalgurli settled down to the following: (1) breaking the ore in Gates or Blake crushers, (2) milling in Krupp or Griffin mills, (3) roasting in Edwards or Merton furnaces, (4) cooling the roasted ore, (5) mixing with weak cyanide solution, (6) classification, the sand being ground in pans and the coarse gold amalgamated, (7) thickening the slime from all sources and running it into agitators; (8) treating with cyanide from 2 to 12 hours; (9) finally filter-pressing, the residue being disposed of in various ways.

Before adopting this scheme, the South Kalgurli installed the Reicken process. Its principle was as follows: The roasted ore from the Brown furnace was cooled, mixed with cyanide and agitated. It was then run into Reicken vats, which had sloping sides and a curved bottom, a horizontal shaft with arms attached keeping the pulp in motion. The sides of the vat were lined with copper plates, which served as the cathode, and iron bars suspended in the vat acted as the anode. An electric current of low voltage was used. A constant stream of mercury was made to flow over the copper plates, thus keeping them bright. The gold from the cyanide solution was precipitated on the plates as amalgam, as was also coarse free gold in the pulp. When it had been treated for 12 hours it was discharged into agitators and filter-pressed. This process was also used by the Great Boulder No. 1 company for a time, but it was a failure at both mills, its weak point being very prominent.

In the wet-crushing mills the necessity of close concentration, in order to separate the pyrite from the ore, was early apparent. All kinds of concentrators were tried, but the Wilfley table did the best work, and is installed in all the wet mills now. Canvas was also used to recover the fine material, but still some got away with the pulp. It was found that the Wilfley tables did better work if given a certain feed, so the plan of preliminary separation of the stamp pulp into grades was adopted. In treatment of the concentrate attempts were made to cyanide this product direct in vats, but with poor results. Then it was shipped to smelters, but this was too expensive. Lastly, the roasting of concentrate in Edwards or Merton furnaces, fine grinding and amalgamating in pans, agitation with cyanide and filter-pressing was tried, and this is the treatment to this day. The pulp from the Wilfley tables was at first pumped up to collecting vats. Here, the sand settled, and was given a short cyanide treatment, then dropped into other vats for a few days' more treatment. The slime overflowing from the collecting vats was thickened, agitated with cyanide, and filter-pressed. This process was greatly in advance of previous efforts, but extraction was still only fair. Something was wanting. Very fine concentrate and telluride escaped with the pulp. The finer grinding of the pulp from the tables was then tried at the Hannan's Star in a tube-mill, this being the first tube-mill used in the world in grinding gold-bearing ores. At the same time bromo-cyanide was tried. In this chemical, tellurides are soluble, though not in plain cyanide; and there is no doubt that the tellurides escaping were partly responsible for the low results in the earlier treatment with cyanide. At the Han-

nan's Star, where bromo-cyanide was first used in 1899-1900, the plant had ball-mills, the dry-crushed ore being mixed with water or solution previous to rough classification and fine grinding.

The Lake View Consols followed in 1901 in using bromo-cyanide in its mill, after all the pulp had been ground fine, the agitated slime being filter-pressed. About the same time the Brown Hill followed with the same treatment. These were the first instances of all-sliming in wet mills. Later on the Golden Horseshoe and the Ivanhoe adopted finer grinding. In the new mill of the former the process was all-sliming with tube-mills, and at the latter partly sliming in pans, and treatment of sand and slime still continues. At the Hainault also the latter system is in vogue. At present the Lake View Consols uses tube-mills alone, and the Oroya-Brownhill and Golden Horseshoe use pans and tube-mills in series with subsequent treatment of the slime with bromo-cyanide. The Ivanhoe uses bromo on its slime only.

Improvements in the filter-press were rapid until 1899, and the press used now is practically as it was in that year. These were hand-screwed, the hydraulic closing type being worked later at the Great Boulder, Ivanhoe, and Brown Hill. The first little press experimented with is still at the Lake View. It should be preserved, and so that it may be shown to interested mining men and visitors as the forerunner of the machine that has done so much for ore treatment. The presses were first charged by pressure tanks; but pumps were afterward tried, and are now universially used. The vacuum process of treating slime became fashionable in America some five years ago and was tried here experimentally. The only serious competitor of the press up to 1908 was the mechanical vacuum plant on the Great Boulder, but in 1908 and 1909 vacuum plants were erected on the Lake View Consols and Oroya-Brownhill to retreat the residue from those mines. The vacuum plant is cheaper in first cost than the filter-press plant, but its efficiency has not been proved superior. Experiments are now underway with the press, the idea being the discharge of the slime by sluicing without opening up. It will be interesting to note the improvements effected in these two types of filters, and the survival of the fittest.

The disposal of residue has been an interesting subject from the start of milling on a big scale. The various systems may be put down as, hand and horse trucking, electric locomotives, belt conveyors, elevators and swinging booms, and, lastly, the sluicing away to ponds. The difference in the cost of each method is not much, and in this windy place high dumps have been a curse to the engineers, workers, and inhabitants of the belt. Of course, where the residue needed re-treatment it had to be stacked near the mills.

In the recovery of the gold from the cyanide solutions there has been a certain amount of trouble at times, but on the whole the precipitation on zinc shavings has been good. In the clean-up the lead-lined press for filtering the sludge from the acid tank was first used here, as was also the tilting furnace for the smelting of the roasted sludge with the usual fluxes.

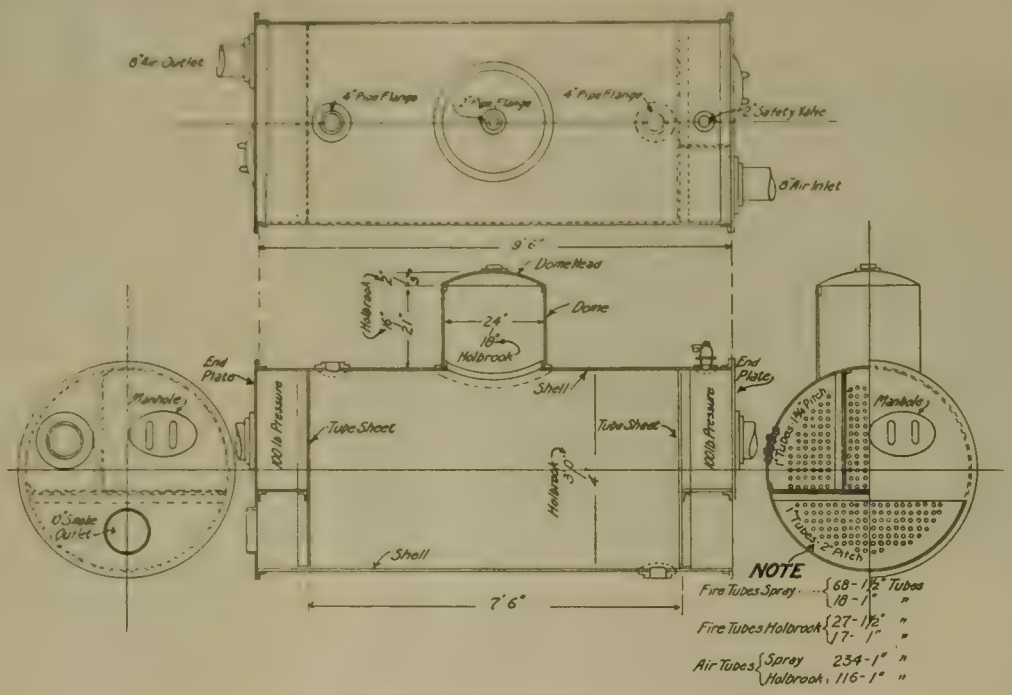
On thing not to be forgotten in this review is the water supply for the mills. Until 1903 the supply consisted of salt water procured from some of the mines. This was not good for general work, and it was very destructive to machinery. The Coolgardie Goldfields Water Scheme was completed in 1903, and since then an abundant supply has been available. There is no doubt that if the mines had to depend upon the salt and rain water couserved in ponds, mining and treatment would not be half as large. This is no place to go into details of cost of treatment, but it may be said that in the days of shipments of ore to smelters the cost was as high as £6 per ton, whereas the present cost, 10s. 6d. per ton, may be considered a fair average for wet and dry-crushing mills. It is probable that costs are on bedrock. Extraction varies, but may be averaged at 91% in both wet and dry mills. The following questions are still debatable on this field: breaking the ore in Gates or Blake crushers; milling in Krupp or Griffin mills; roasting in Edwards or Merton furnaces; fine grinding in pans or tube-mills; agitating in air, A. Z., or ordinary agitators; filtering the solutions from the pulp in presses or vacuum plants; disposal of residue by belts or sluicing; and, finally one that has lately been suggested, namely, the efficiency and economical working of the Krupp mill—wet crushing—as against the modern heavy stamp.

In the above review, necessarily somewhat incomplete, I had the assistance of C. M. Harris, manager of the Hannans Proprietary, Ltd., and local secretary of the Australasian Institute of Mining Engineers, who furnished the history of ore treatment from 1893 to 1897, and revised this article. My own observations and experience date from thence onward, especially in the latter part of 1899 and in 1900.

'Patents and Industrial Progress' was discussed trenchantly by William Macomber in the June number of *The North American Review*. He shows that there are two demands which our industrial and scientific interests make upon our patent system. These are: (1) The grant of a patent should afford substantial ground for assuming that the thing patented is novel and that the patent is valid. (2) The means for determining the novelty and validity of a patent—the final, judicial determination of these questions—should be certain, speedy and inexpensive. The remedies to meet the first demand are: (1) To allow the commissioner to use the surplus the Patent Office has earned to erect and equip a plant adequate to the needs of the business. (2) To co-operate with him in a revision of the fee schedule to materially increase the revenues without additional cost to the patentee. (3) To allow him to use the earnings of his department to make the work efficient. And the remedy for the second is the establishment of a Court of Patent Appeals, to which should be given final appellate jurisdiction. This court should be composed of five judges, all of them trained in the patent law. The method of appeal should be by case and exceptions; the record made by counsel and settled before the patent judge who heard the case, to the end that the present enormous cost of printing may be reduced and that the Appellate Court may not be burdened with a padded and cumbersome record.

OIL HEATER FOR COMPRESSED AIR

The efficiency obtained by re-heating compressed air is well understood. In re-heating, however, it is important to secure uniformity of temperature, and this is difficult to maintain when the heat is applied directly by passing the gases from the burning of fuel around coils or chambers through which the air circulates. The accompanying illustration shows a most efficient and economical heater, designed by Gerald Sherman, superintendent of the mining department of the Copper Queen Consolidated Co., at Bisbee, Arizona, and erected by him at the Holbrook shaft. In this heater a heavy oil is employed as a medium to transmit heat to the air-pipes, which latter pass through the oil-container. This oil is a residue from the partial distillation of the lighter compounds from crude petroleum, the residue having a gravity of about 12° Beaumé, and a flash-point of 700. The heater consists of a boiler 7 ft. 6 in. long by 4 ft. diam., provided with a dome which is open to the atmosphere. An 8-in. air-pipe admits the compressed air to a chamber at the rear lower side of the boiler, from which it is conducted through 1-in. tubes which make two turns within the boiler, causing the air to travel three times the length of the container in contact with the oil. One large flue, 10 in. diam., also passes through the lower part of the boiler for the heated gases. The boiler is set in brick-work in the ordinary way, the grate extending the full length from front to back. On this grate a coke fire is maintained, which raises the temperature of the oil to about 335°F., although it can be brought to 360°. Coke at Bisbee costs $10 per ton, and the amount consumed in re-heating the air does not exceed 400 lb. per day. The temperature of the air as delivered to the hoisting engine is usually about 315°F., and the temperature of the exhaust is from 32 to 40°. In a 27-minute test the consumption of free air per shaft horse-power was 24.4 cu. ft. Another test of 40 minutes' duration with air at a temperature of 455° showed a consumption of 28.7 cu. ft. of free air per shaft horse-power. The total work done in this test was 58,441,980 foot pounds, or a total shaft horse-power of 1771. Approximately 75 lb. of steam at the power-house equalled one shaft horse-power at the hoist. In this test the weight hoisted was weighed, and allowance was made for rope-friction and all losses. These re-heaters are being installed at the several subsidiary shafts of the Copper Queen, and hoisting by air will be used exclusively. It is found that the economy is greater than by transmitting electric current for this purpose.



Oil Heater for Compressed Air.

Land has been proclaimed by the President as available for settlement to the amount of 11,196 acres in the Gunnison forest, 5640 in the Cochetopa forest, and 45,489 in the Uncompahgre forest, in Colorado. The Secretary of the Interior has designated for homesteads 875,000 acres in Wyoming and nearly 4000 in Colorado. Thus land found available for settlement is being steadily taken out of the National Forests as fast as it is classified.

Chilean shipments of nitrate to the United States during 1909, according to the report of Alfred A. Winslow, United States Consul at Valparaiso, were valued at $18,769,236, against $14,765,250 in 1908, and $16,899,723 in 1907. The basic value of the importations of Chilean nitrate of soda into the United States last year, according to customs statistics, was about $31 per long ton, against $36.50 in 1908, and $40 in 1907.

The United States Government purchases annually from $6,500,000 to $7,000,000 worth of fuel. This sum includes the cost of delivery and stowage.

Atomic Weight of Chlorine

By F. H. Mason

Except in those few instances where the final weighing is made of the element itself, the accuracy of analytical chemistry depends upon the precise determination of the atomic weights of the elements, and, as the average analyst has neither the time nor the appliances to carry out these determinations himself, he must look to those savants who, from a pure love of science, and often aided by grants from governments and scientific societies, make these investigations for him. Each year a committee, consisting of eminent chemists from the principal commercial nations of the world, investigates researches that have been made during the year, and assign to each element the atomic weight that shall be used by analysts during the ensuing year, thus uniform results may be expected in all parts of the world. Notwithstanding this, should even a small error occur in the atomic weight of an expensive substance, it might cause an extensive loss to either the buyer or the seller.

In the October 1909 issue of *The Journal of the Chemical Society* there was an account of a most elaborate research, conducted by Robert Whytlaw Gray and Frank Playfair Burt, on the atomic weight of chlorine, and since the atomic weight of this element is the fundamental rock upon which the atomic weights of a large number of the other elements rest, it is highly important that it should be known with the greatest possible degree of precision. It was with this view that Gray and Burt, aided by a grant from the Royal Society, undertook the work. They attacked the problem from a physico-chemical standpoint that consisted of a detailed study of hydrogen chloride comprising: (1) A revision of the density of the gas. (2) Its volumetric analysis. (3) The determination of the form of the *pv* isothermal at 0 degree and between pressure limits of 780 and 150 mm. The hydrogen chloride used in the experiments was prepared by three methods: (1) From sulphuric acid and sodium chloride. (2) From sulphuric acid and ammonium chloride. (3) From silicon tetrachloride and water.

The following are the mean of the results obtained from determinations of density of the gas from three different sources:

Source of gas.	Weight of 1 litre of gas at 0 and 760 mm. in London corrected for compressibility of HCl.	Deviation from mean + or —
H_2SO_4 and NaCl	1.64016	0.00010
H_2SO_4 and NH_4Cl	1.64023	0.00008
$SiCl_4$ and H_2O	1.64016	0.00008

In the first series, four determinations were made, in the second, seven, and in the third, ten. The final mean calculated by the method of least squares is 1.64011 ± 0.00005, and the weight of a normal litre of gas is $\frac{1.64011}{1.000588} = 1.63915$ gram

where 1.000588 is the factor that expresses the difference in the value of *g* between London and Lat. 45 degrees.

In the tests based on determination of the volumetric analysis of hydrogen chloride, the mean result of eight experiments gave the figure 1.0079 with a probable error ± 0.000017.

If D(HCl) represents the weight of a litre of hydrogen chloride at 0 degree and 760 mm., Lat. 45 degrees, and D(H) represents the weight of a litre of hydrogen under the same conditions, and if the ratio of the volumes of hydrogen and hydrogen chloride, which at 0 degree and 760 mm. contain an equal number of molecules, is denoted by R, then the molecular weight of the gas in terms of O = 16 is given by the expression

$\left\{\frac{D(HCl)}{D(H)} \cdot \frac{2}{R}\right\}$ Atomic weight of hydrogen chloride.

Taking Morley's values for both standard litre of hydrogen and also for the atomic weight of that element the molecular weight of hydrogen chloride is

$$\frac{1.63915}{0.089873} \cdot \frac{2}{1.0079} \cdot 1.00762 = 36.467$$

and the atomic weight of chlorine 35.459.

In the method of determination of the form of the *pv* isothermal at 0 degree, and between the pressure limits 780 and 150 mm. it was found from a large number of experiments, in which every care was taken to eliminate errors and in which corrections were made that the limiting density of oxygen was 1.42762 and that of hydrogen chloride 1.62698, the molecular weight of hydrogen chloride, therefore, in terms of oxygen is:

$$\frac{\text{Limiting density HCl}}{\text{Limiting density O}} \cdot 32 = \frac{1.62698 \times 32}{1.42762} = 36.469$$

and the atomic weight of chlorine 36.469 – 1.0076 (atomic weight of hydrogen) = 35.461.

Gray and Burt finally take the figure 35.46, being the mean of the results they obtained by the two different methods, as the atomic weight of chlorine. The following are the results of recent researches on the atomic weight of chlorine, and the mean of them gives a figure that coincides with that obtained by Gray and Burt.

Dixon and Edgar	35.463
Edgar	35.461
Noyes and Weber	35.452
Richards	35.457
Guye and Ter-Gazarian	35.461
Guye and Fluss	35.466

Tennessee Copper Co. dividends are becoming more and more irregular. The current year is nearly half gone, and the stockholders have thus far received no income from their shares; neither is the management planning a disbursement in the near future. Last December the company paid $1.25 per share, which was the first distribution since September, 1908. The addition to the sulphuric acid plant is now about three-quarters completed at present. The company is producing sulphuric acid in the first unit of this plant at the rate of 75,000 tons per year; although its capacity is well over 100,000 tons. Last year there was derived a profit of $83,000 from acid sales. The mine is stated to have more ore in sight than at any previous time. The reserves at the end of its fiscal year were 4,172,311 tons. The yield of copper per ton, however, has not gained, but rather lost, the average being about 32 lb. as compared with 34 lb. in 1901; in 1903 the yield ran up to 37.61 lb., and dropped to 30.38 lb. in 1908.—*Boston News Bureau.*

Faulting in the Bullfrog District, Nevada

By W. H. Emmons and G. H. Garrey

*The displacement of strata on one side of a fissure with reference to those on the other side is called a fault. Most fault fissures are inclined and the vertical angle by which a fault-plane departs from a horizontal plane is called the dip. The direction of a horizontal line in the fault-plane is the 'strike' of the fault. When the hanging wall appears to have dropped with reference to the foot-wall the fault is a 'normal' fault, and when the foot-wall appears to have dropped with respect to the hanging wall the fault is 'reverse'. All the faults in the Bullfrog district, so far as known, may be classed as normal faults. Many faults are marked by slickensides, which are smooth polished surfaces resulting from movement along the fault-plane. The slickensided surfaces as a rule are scratched or striated by the grooving action of harder particles or projecting points as one wall moves upon the other. These striae show the direction of relative movement of the walls. A 'fault-zone' consists of two or more nearly parallel fault-fissures with thin sheets of country rock between them. In places intersecting fractures connect the main fissures and these cross-fractures may be so numerous that the rock in the fault-zone is much fractured or is crushed. As a rule the structure is expressed by vertical sections, taken where exposures are best and rarely at right angles to the strike of all the faults shown. Sections used in text-books to illustrate the elements of faulting are, as a rule, drawn at right angles to the strike of the fault-plane.

Fig. 1. Fault on South Side of Hill South of Sawtooth Mountain.

In the study of the structure of tilted beds that have been faulted three sets of planes are to be considered: (1) the top or base of a bed or some similar horizon; (2) the plane of the fault; and (3) the plane of the section under discussion. Where the bed is faulted by a straight fault-plane there are two lines of intersection formed by the fault-plane and the upper or lower surfaces of the separated portions of the bed. Ordinarily these two lines are approximately parallel. Unless the strike of the fault is the same as the strike of the beds the two lines of intersection between the upper or lower surface of the bed and the fault are inclined to a horizontal plane. Sections drawn across the strike of the fault cut these lines at two points which may be used as datum points from which the apparent horizontal, vertical, and inclined elements of a fault, as shown in the section, are calculated. The position of these two points with respect to each other is different in vertical sections drawn in different directions through the same fault. It is convenient to have terms that apply only to a given section under discussion, without reference to a plane at right angles to the fault-plane and without regard to the origin of the fault movement. This will be accomplished by prefixing the adjective 'apparent' to the names of various elements. Description of what may be called the geometry of faulting is thus kept distinct from inference as to the cause of the movements.

'Apparent vertical displacement' is used here to designate the vertical distance between or the difference in elevation of two points that are the intersections of the two separated portions of a bedding or similar datum plane with the fault and that are in the plane of a vertical section chosen at random. The term 'apparent horizontal displacement' is used to designate the horizontal distance between the intersections of two faulted parts of a bedding or similar plane with the fault-plane, in any vertical section. Similarly, the distance between the faulted edges of a datum plane, measured along the line common to the plane of the fault and the plane of a section under discussion, may be called the 'apparent throw' and will coincide with the real throw only when the section described makes a right angle with the fault-plane.

According to Spurr,[2] "offset may be used to designate the perpendicular distance between the intersection of corresponding planes in the two parts of any faulted body with a horizontal plane, such as the earth's surface may be considered to be, the planes being projected for the purpose of measurement if necessary." Where such a projection is necessary the parts of the planes are said to be offset with 'gap', and where a line representing the offset intersects a faulted stratum or other datum plane at two places without such projection of the bed the stratum is said to be offset with 'overlap'.

The original attitude of sedimentary rocks is hori-

*Abstract from Bull. 407, U. S. Geol. Surv.

[1]'Geology of Aspen Mining District, Calorado', Mon. U. S. Geol. Surv., vol. 31, 1898, p. 251.

[2]Op. cit., p. 162.

zontal or nearly so. If water-stratified rocks are laid down upon a steep slope the thickness of the bed will vary and the base may have a steep inclination, but the bedding planes will in most cases be approximately horizontal. Similarly, a molten lava flowing over a surface first fills the deepest places and consequently is thickest there. Most of the lava-flows here described are of nearly uniform thickness and hence flowed on a nearly level surface. Where a lava is highly viscous a considerable initial inclination of the upper surface of the flow may also result, and, consequently, this surface may dip steeply even when it has not been deformed by movement; but in that case the thickness of the flow usually varies greatly. Lava moves while it is cooling, and before it solidifies may become highly viscous and thus develop flow-lines which are steeply inclined when solidification takes place. Accordingly, flow-lines do not show the original attitude of the lava beds and cannot be depended on for measurement of dip and strike, but the dip and strike may be safely measured on the bedding planes of water-laid tuffs between the flows, or along contacts between basalts and rhyolites of comparatively uniform thickness or between rhyolites of different color or composition. The occurrence of the brown contact glass at the base of several of the rhyolites in the area here discussed is of great assistance in determining the attitude of the flows.

In many of the mountains of the Bullfrog district, especially when viewed from the south, the flows may be observed dipping below the surface at steep angles. Owing to the rugged character of the topography, the absence of vegetation, and the abundance of prospect pits in this district, exposures are unusually good and many of the faults may be traced without interruption for considerable distances. Where associated flows contrast strongly in color, as the basalt or the dark-glass flows with the light-colored rhyolites, faults may be recognized a mile or more away. The faults on the south side of the mountain south of Sawtooth mountain are among the most conspicuous features of the near landscape around Rhyolite (Fig. 1).

Nearly 100 faults have been recognized in the area mapped. Some extend almost across the area, and others are short. There are two fairly well defined fault systems, one striking nearly north and south and the other striking N.30° to 50°E. (Fig. 2.) A number of faults, however, do not fall into either system. All of the faults for which sufficient data for classification are at hand are normal, that is, the hanging wall appears in every case to have been depressed. The vertical displacement of the faults, measured in a plane at right angles to the strike, varies from two or three feet to more than a mile. The accompanying figure (Fig. 3) shows by diagram the apparent vertical displacement of the faults. The sum of the apparent vertical displacements of all west-dipping faults which this section crosses is 12,500 ft., and the sum of the apparent vertical displacements of the east-dipping faults is 1250 ft. The difference is 11,250 ft., and from inspection of this figure it appears that this amount of depression toward the west has resulted from faulting.

Fig. 2. Plan of the Principal Faults in the Bullfrog District.

Striations or grooves on slickensided surfaces along fault-planes are made by hard particles or hard projecting points of rock rubbing against softer rock. They show that one or the other wall has moved in one of two opposite directions. Where there has been more than one movement along a fault-plane the striae formed by the first are likely to be erased by the last, and so those remaining, as a rule, record only the latest movement. Where hard particles formerly projected from one of the walls these are likely to have been worn symmetrically, and the most worn side in this case should be the side representing the direction from which the opposite wall moved with respect to the wall in which the worn particle is embedded. The amount of crushing and slickensiding along a fissure is not always proportional to the amount of displacement which has occurred between the separated ends of a formation. It is not uncommon to find smooth, well defined slickensides and one or both of the walls greatly crushed where the displacement has been very slight. On the other hand, great movement may take place along a plane no thicker than a knife blade and the rocks be not greatly shattered.

The attitude of the flows and tuffs in nearly every block of the fault mosaic is known through the presence of basal contact facies or of thin layers that

contrast sharply with layers above or below them. The position and dip of the fault-planes between the individual blocks are known from exceptionally good exposures on the surface and underground. In Fig. 3 rhyolite No. 7 has been projected under later strata of known position and above older ones, its position being determined from the thickness of associated beds near by or from the average section. Most of the dips of flows as platted were observed near the plane of the section, but where the rocks are concealed by wash their dip was assumed. Fig. 3 represents a length of eight miles. Rhyolite No. 7 is represented in each fault-block as extended to the next fault west, and if necessary is projected upward with the dip observed or assumed at the surface. In the fifteen fault-blocks in which rhyolite No. 1 appears in this section the total downward depression due to tilting (the sum of the vertical legs of the right triangles shown in Fig. 3) is about 13,000 ft., the projection of the flow (the sum of the horizontal legs of the triangles) is 30,000 ft., and the extent of rhyolite No. 7 in the plane of the section (approximately the sum of the hypotenuses of the triangles) is 33,600 ft. The figure shows a slope to the east, due to tilting, that averages about 39 ft. in 100 along the flows and corresponds to an average dip of about 23°E. in the plane of the section. This, however, does not represent the actual dip of the flows, but only their apparent dip in the section of Fig. 3. Since the strikes of the flows are not exactly at right angles to the plane of the section, the actual dip is greater than the apparent dip. Sixteen field measurements of dip near the plane of the section average 27°, which may be taken as a very close approximation to the average actual dip of the flows. The sum of the apparent horizontal displacements of all faults as shown on this section is 12,240 ft., which, added to the projection of rhyolite No. 7 on a horizontal line, equals the total length of the section, or 42,240 ft. (8 miles).

There are nineteen faults in all represented in Fig. 3 and of these all but two dip west. According to the interpretation made, rhyolite No. 7 is displaced by fourteen of the faults, of which two have a downthrow to the west. Measurements of these blocks, as shown in the figure, give for the sum of the apparent vertical displacements of the faults 13,750 ft.; for the sum of the apparent vertical displacements of the faults which depress rhyolite No. 7 to the west, 12,500 ft.; for the sum of the apparent vertical displacements of the two faults which depress rhyolite No. 7 to the east, 1250 ft. Thus the apparent net depression of rhyolite No. 7 toward the west, resulting from all faults, is 11,250 ft. Tilting depresses this same rhyolite 13,000 ft. to the east. The total apparent depression eastward, due to tilting and to downthrow to the east by faulting, is about 14,250 ft. Thus this flow as projected is only 1870 ft. lower at the east end of the section than at the west, and the tilting and faulting are nearly compensatory.

(To be Continued.)

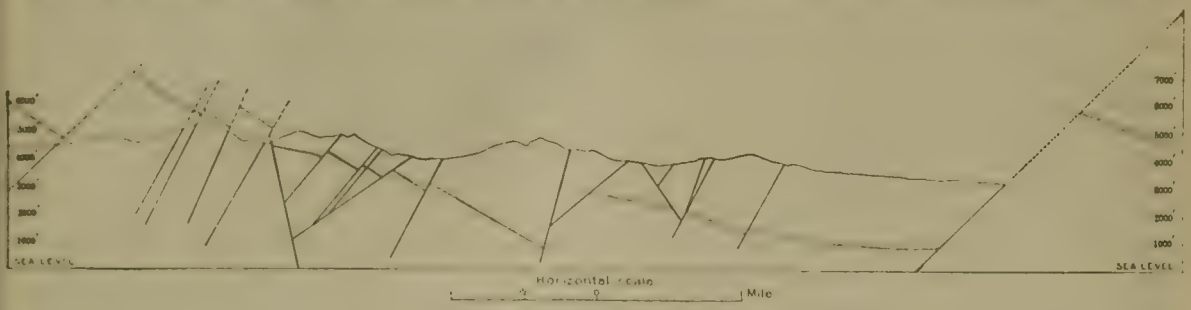


Fig. 3. Diagram Illustrating Displacement by Fault Lines at Bullfrog.

WESTERN AUSTRALIA GOLD INDUSTRY

According to figures published in 'The Gold Mines of Western Australia' the number of men engaged in gold mining in 1909 was 17,027; value of machinery, including 3900 head of stamps, £3,750,000; dividends paid in year, £1,359,115; dividends declared payable in January 1910, £112,719; total declared to January 31, 1910, £20,435,729. The following table shows the gold output, as reported to the Department of Mines for the year 1909, and also the totals for each goldfield since the records were begun in 1886:

Goldfield.	1909, fine oz.	1886-1909 inclusive, fine oz.
Kimberley	169	26,781
Pilbarra	5,529	229,008
West Pilbarra	1,396	22,007
Ashburton	228	5,569
Gascoyne	7	772
Peak Hill	7,322	204,561
East Murchison	148,238	1,058,202
Murchison	131,850	2,163,942
Yalgoo	627	54,577
Mt. Margaret	160,038	1,838,881
North Coolgardie	73,021	1,432,968
Broad Arrow	11,575	270,032
North-East Coolgardie	26,341	585,510
East Coolgardie	927,074	11,513,399
Coolgardie	36,663	1,275,869
Yilgarn	21,163	448,411
Dundas	35,895	411,831
Phillips River	7,631	41,625
Donnybrook	.....	840
State generally	502	22,183
Total	1,595,269	21,606,968
Value	£6,776,274	£91,780,565

The four best known and most promising copper-bearing regions of Alaska are the Kasaan peninsula of southeastern Alaska, the Prince William Sound district, the region included within the drainage area of Kotsina and Chitina rivers, and the region of upper Copper, Tanana, and White rivers.

The Long-Tom and Hydraulic Mining in California

By R. H. Campbell

On September 16, 1853, I arrived in Nevada City, California, with my parents, after a five-month trip across the plains with ox teams, a little alkalied but full of life and glad that I had come. Nevada City was at that time the greatest gold mining camp in the world, and while there were no real miners in the country, there were thousands of men engaged in gathering up the gold from the shallow creeks and river-bars, work that required little or no knowledge of mining. The pan, the rocker, and the long-tom constitute the only gold-saving devices used at that early date, the long-tom being used only in cases where the ground was from five to ten feet deep. Here the top soil, which contained too little gold to pay for washing in the long-tom, would be stripped by shoveling or by use of the wheelbarrow, and the rich bottom pay-gravel would be washed through the long-tom. Where the gravel bars were too deep to strip, the pay-gravel would be opened by drifts and wheeled out and washed in long-toms. That was nearly sixty years ago. I doubt if there are many living today that have ever seen a real long-tom such as was used in those days.

The long-tom such as was used by the early-day miner in California, was a shallow box about ten feet long and about twenty-six inches wide. The sides were about six inches high. At the lower or down-stream end, the sides were made to turn up like a sled runner, this portion being about three feet long. The bottom of this portion was of sheet-iron perforated with one-half inch holes. This sheet-iron portion of the long-tom was placed over what was called the riffle-box, a shallow box about five feet long with cross-riffles placed therein for saving the gold. The finer portion of the gravel, sand, and gold was discharged through holes in the sheet-iron into the riffle-box. The long-tom itself was set on a grade of perhaps twelve to fifteen inches, and the riffle-box set on a grade sufficient to carry the water and fine material that passed through the perforated sheet-iron. The water was generally conveyed to the upper end of the long-tom through a canvas hose.

Four men were required to operate the plant. Two men, one on each side, would shovel the gravel into the long-tom, the third would stand on a board laid across the riffle-box with a lond-handled, square-pointed shovel, and as the material shoveled in was washed down to him, his business was to stir the mass until the fine material had passed through the holes with the water into the riffle-box. He would then shovel the coarser gravel out, while the fourth man stood in the tail-race below the riffle-box and shoveled away the sand.

This was before the days of sluicing. The stripping of the non-productive top dirt was the most expensive part of the work. The all important question among the miners was 'How much stripping do you have to do?' The Georgian said he had two 'ax handles' of dirt and one 'ax handle' of 'pay grit'. This might be considered an average depth and proportion. Soon the shallow ground became exhausted, and other and cheaper methods of handling the top waste materials than hand shoveling became necessary. Ground-sluicing during floods became the popular method of getting rid of the top dirt, or at least a good portion of it. To save moving the long-tom so often, handling the bottom pay-gravel, sluice-boxes began to be added at the upper end, and by putting riffles in the sluice-boxes, it was found that the gold could all be saved in these without the use of the long-tom. It was then that the long-tom disappeared as if by magic. Sluicing became the accepted method, and it was discovered that by leading the water about over the ground through canvas hose, even the little force the water had when discharging from the hose, could be made to help in washing the gravel. Then the idea of a pipe or nozzle on the end of the hose quickly followed, and hydraulic mining was born. From this simple practice the great hydraulic system was inaugurated, came into general use, and grew to enormous proportions. The evolution from the rocker and the long-tom to hydraulicking in its simplest form required about two years. It was not until some time in 1856 that iron pipe and giants were brought into use and began to displace the cotton hose and plain nozzle.

The Long-Tom.

I well remember while attending school in Nevada City in the winter of 1855-6 that Amos T. Lard, who at that time owned one of the deepest open-cut mines in the country, was operating a real hydraulic mine on Coyote hill, just outside the city limits. Previous to his turning it into a hydraulic mine he employed over one hundred men digging by hand. The seventy-five or eighty-foot bank was worked in benches. It was an interesting sight to see one hundred men working with picks and shovels breaking this high bank down into the sluice below; but a more interesting sight was to be seen in the spring of fifty-six when he brought the water in at perhaps an elevation of eighty or one hundred feet and had two lines of cotton hose about ten inches diameter, with nozzles at the lower end. Five or six men operated the entire plant and displaced the one hundred or more shovelers, at the same time producing far better results. So interested was I that the moment school was dismissed I would make a bee-line for the Lard hydraulic mine.

By this time the shallow creeks and river bars were becoming well worked out and were abandoned

to the Comanche, while the attention of the mining men was turned to hydraulic mining in the deep ancient channels that exist so extensively in Nevada and adjacent counties. Quartz mining was little known, and aside from a few drift mines along the ancient channels, hydraulic mining absorbed almost the entire attention of the miners throughout the State. The power of water under pressure thrown against the bank through a hydraulic nozzle proved so effective that all the available water was soon appropriated and millions were expended in hydraulic mining enterprises. Immense dams, reservoirs, and hundreds of miles of ditches were constructed, requiring years to complete and at an enormous outlay of capital. Then it was that prosperity began to smile on California. The gold output, which, after the easy surface gold had been mainly gathered, had begun to diminish, began, with the introduction of the hydraulic system of mining, to rapidly increase.

The agricultural interests in the valleys below meanwhile had become extensive, and notwithstanding the enormous revenues that the farmers derived from the miners, they began war upon the hydraulic system of mining. At first the cry was little heeded, but it became stronger and stronger, and finally court proceedings were instituted against the hydraulic miners, who by this time had developed a most wonderful system of work. They were simply washing down the mountains and dumping the débris into the streams that flowed into the valleys, covering up the rich farm lands, forcing the abandonment of the latter. Not only were the farms destroyed, but the cities situated along the streams in the valleys were also threatened with destruction. The capital of the State, Sacramento, was in eminent danger of being destroyed. Hence the war against the hydraulic mining. Many of us well know of the bitter war which continued through every legislature of the State for over fifteen years. During all this time arrests and prosecutions of the miners for disobeying the court's injunctions were numerous. The miners in many cases would operate their mines, disregarding the court's injunctions. The farmers would send spies up into the mining districts to see that the miners were obeying the court's orders; the miners would often bribe the spies. In many cases lives were threatened, and one or two lives were lost in this bitter fight. It was not until the Federal Government stepped in and took a stand with the agriculturists in order to save the navigable streams of the State that the miners were forced to cease operations. The Government denied the State of California any further appropriations for her rivers and harbors until hydraulic mining ceased.

There is no law upon the statute books of California prohibiting hydraulic mining, but the Government has appointed a débris commission, and any one wishing to operate a hydraulic mine in the State of California must make application to that commission for a permit, and if upon examination, it is found possible to empound the débris and prevent it from entering the streams, a permit will be granted to operate under the hydraulic system. However, there are few places in the hydraulic district of California where large amount of débris can be empounded successfully, and thus practically places a ban upon the system. It is unfortunate, for there still are in the western slope of the Sierra Nevada mountains, extensive deposits of gold-bearing gravel which would yield millions annually if it were possible to mine them with the hydraulic system.

Cost of surfacing roads with gravel by means of a traction engine outfit depends largely on the accessibility of the gravel. The greater part of the roads in the town of Glenville, New York, are surfaced with pit-gravel, the town doing the work. In the following cost data, covering a period of years, no account is made of the value of gravel. The outfit consists of a traction engine, four 5-cu. yd. cars, bin, and conveyors. It cost $3250. The average yearly repair bill has been $50, and the average cost of working per day without the bin has been $10. The average cost of working per day with the bin has been $16. When using the elevator and bins nearly double the yardage per day has been moved. The average cost per cubic yard of gravel placed on road (three-mile haul) has been 42c.; for a one-mile haul the cost has been 20c. per cubic yard, and in some cases the cost has been as low as 15c. The cost of surfacing one mile of road with 4 in. of gravel (three-mile haul) has been $350 to $400 per mile. The cost of surfacing one mile of road with 4 in. of gravel (one-mile haul) has been $225 to $300 per mile. The labor required is as follows:

	Per day.
One engineer	$3.00
One helper	1.75
Two laborers at $1.50	3.00
When using bin, one team	4.00

Low prices have resulted in closing a number of the Chilean nitrate factories, according to Rea Hanna, United States Consul at Iquique, who reports that the prices of nitrate March 17 was $1.59 per quintal (101.61 lb.) for the 95% product and $1.65 for the 96% product, with 1% salt, for immediate delivery free alongside ship. Of the 154 oficinas or nitrate manufactories in Chile, 55 were then not being worked, 36 being closed before July 1, 1909, on account of having worked out their nitrate grounds, or the cost of production from various causes having been too high. The oficinas in which the cost of production is low are reported as being worked to their limit, taking advantage of the cessation of restrictions regarding production, at the discontinuance of the nitrate combination. The opinions regarding the renewal of the combination are contradictory, and although strong efforts in its favor are being continually made by those whose cost of production is high, there does not appear to be any immediate prospect for a new combination.

A new type of steam-turbine electric locomotive, where a turbine of the impulse type is directly coupled to a direct-current variable-voltage dynamo has been completed and tested at the works of the North British Locomotive Co., Glasgow, Scotland. It is stated that these tests were very satisfactory and confirmed the theoretical claims made by its designers.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Skip Fillers.

The Editor:

Sir—I have been unable to find anything published on skip fillers for large shaft-bins, and as others may have been in a similar predicament, a discussion by those who have had experience should be of interest. Suppose that it be desired to hoist in a vertical shaft with a one-ton skip, loading with a skip filler that can be operated from the station. (1) Can it be made to work satisfactorily? (2) If so, what is the best arrangement? (3) Would chairs be necessary? (4) If it can be done, is it desirable, and what are the advantages and disadvantages as compared with the ordinary way of having a skip-tender at the chute while loading, and dispensing with a filler?

C. O. Moss.

Klau, California, June 3.

Wet Gold-Assay for Prospectors

The Editor:

Sir—In regard to Robert DeLuce's wet method for the assay of gold, I am sending results of some experiments made by me in testing the efficiency of the scheme. The individual operations proposed by Mr. DeLuce are all known to chemists, the solvency of gold in an iodine and potassium iodide solution, and its precipitation from the solution by shaking the latter with mercury being mentioned in Fresenius 'Qualitative Analysis.' It was to test the value of the method quantitatively, as well as the details of manipulation, that the following experiments were made. Ores of varying composition were selected. Several of these were very rich, it being manifestly easier to detect relative errors while working with a large amount of gold. The assay corresponds somewhat to the chlorination process for gold ores, the chief difference being in the method of precipitating the gold. The figures enclosed in parenthesis are the weights in milligrams of the gold actually obtained in the assay.

Experiment 1. Free-milling ore from Nevada; laboratory number of sample 5994. I ground one assay ton 10 minutes with the iodide solution and allowed it to stand over night; then filtered and washed a few times after the washings became colorless. The filtration was very slow. I shook with 3 gm. of mercury until colorless, and then a little longer; washed with distilled water by decantation in a porcelain dish, added 10 c.c. nitric acid and warmed. The gold, which was all in one button, was washed with distilled water by decantation, dried, and heated. The result was gold 1.30 oz., value $26.87. By fire assay, gold 1.30 oz., value $26.87; percentage extracted therefore was 100. . The gold did not appear to be quite pure, and there was no doubt a counterbalancing of errors.

Experiment 2a. A slightly sulphide ore, laboratory sample No. 5890; a half assay ton was treated as in experiment 1. The filtration from the ore was quite rapid. In the reduction of the iodine solution with mercury the latter was broken up quite completely. Following the reduction of the iodine solution, a greenish mercury salt began to precipitate. Ordinarily in decanting from the mercury this precipitate, which settles slowly and goes over with the washings, carries with it gold in weighable quantities only with very rich ores. The mercury after treatment with nitric acid left the gold in a finely divided condition. Result, gold (18.64) 37.28 oz.; value $770.58; fire assay, gold 78.81 oz.; value $1629; percentage extracted 47.73. The gold at first was not pure, basic mercury nitrate, yellowish in color, separating out on diluting and washing with water. This dissolved on re-treating the gold with dilute nitric acid.

Experiment 2b. The residual ore from experiment 2a was re-treated with iodine and a small amount of gold, approximately $10 per ton, was recovered.

Experiment 2c. The reduced iodine of 2a was shaken occasionally for one day with mercury, and a minute amount of gold, less than $1 per ton was obtained. Subsequent experiments showed that ordinarily the loss due to incomplete precipitation of the gold from the iodine solution is practically nil.

Experiment 3a. Roasted 1/20 assay ton of No. 5890 at a low heat in a porcelain dish until no smell of sulphur could be observed; shook with iodine solution in a bottle occasionally for two days, and reduced with mercury as before, shaking from time to time throughout one day. The greenish precipitate noticed in 2a occurred as before, and indeed was quite general in all subsequent experiments, varying in color with the ore used. I washed the separated gold with dilute nitric acid to avoid precipitation of basic salts of mercury. Result, gold (2.81) 56.20 oz.; value $1161.65.

Experiment 3b. The residue from 3a was re-treated with iodine solution, shaking once in a while for two days, filtering and precipitating the gold as before. There was recovered gold (0.50) 10.00 oz.; value $206.70.

Experiment 3c. The reduced iodine solution from 3a was again shaken with mercury, but no gold was recovered. The total gold obtained from these experiments was 66.20 oz.; value $1368.35; percentage extracted 84.

Experiment 4. Sulphide (pyritic) ore; concentrate from Alaska; laboratory sample No. 6111. Treated as in the original method, grinding 1 assay ton for 10 minutes in a mortar with the iodine solution, etc., I obtained gold 1.84 oz.; value $38.03; fire-assay gave gold 3.23 oz.; value $66.76; percentage extracted, 56.9.

Experiment 5a. No. 6111. Roasted 1/5 assay-ton in a porcelain dish as in experiment 3a; shook with iodine solution occasionally for two days, and then with mercury for two days. The gold which weighed 0.46 mg. was evidently mixed with small particles of glass rubbed from the inside of the bottle during the shaking with mercury. On amalgamating the gold with a very small amount of mercury, the amalgam

was easily separated from the glass, and the gold extracted by treating with nitric acid as usual. Obtained gold (0.40) 2 oz., value $41.34. This mixture of glass with the gold was frequently observed, and unless the gold was in one or two pieces amalgamation with mercury had to be resorted to.

Experiment 5b. The green precipitate resulting from shaking the iodine solution with mercury was treated for gold, but none was found.

Experiment 5c. The residue from 5a was extracted with iodine for two days and the dissolved gold separated as usual. Obtained gold (0.22) 1.10 oz.; value $22.74; total extraction from 5a, 5b, and 5c, gold 3.10 oz., percentage extracted, 96.

Experiment 6. No. 6111. Treated ½ assay-ton with dilute nitric acid; filtered, burned the filter-paper, and shook the ash and residue for two days with iodine solution, and finished as usual, amalgamating the gold to free it from glass. Obtained gold (1.62) 3.24 oz.; value $66.97; percentage extracted, 100.3.

Experiment 7a. Rich telluride ore from Nevada, containing 2.08% copper, 2.42% tellurium, and 0.35% bismuth; laboratory sample No. 1520. Treated 1/20 assay-ton with nitric acid, boiled to within a few cubic centimetres of dryness, added hydrochloric acid and boiled to dryness. Shook the residue for two days with iodine solution and extracted the gold as usual. Obtained gold (25.50) 510 oz.; value $10,541.70; fire-assay, gold 584.62 oz.,; value $12,084.10.

Experiment 7b. Decanted again the washings from the mercury extraction of 7a in an endeavor to recover any gold carried over. Gold (0.04) 0.80 oz.; value $16.54. Evidently more gold escaped, but its relative value to the total amount of gold was small.

Experiment 7c. The residue from 7a was re-treated with iodine solution and an extraction obtained of gold (0.34) 6.80 oz.; value $140.56.

Experiment 7d. Reduced iodine solution from 7a, was re-shaken with mercury and gold obtained (0.27) 5.40 oz.; value $111.62. Total extraction in experiment 7; gold 523 oz.; value $10,810.41; percentage extracted 89.4.

From the few experiments made above, while not broad enough to be conclusive, it will be seen that the method has some merit. It probably is as good as, if not better than, any of the other wet methods devised for the assay of gold. Except with ores of extreme richness the precipitation of the iodine solution with mercury, the washing of the precipitate by decantation, the separation of the gold by washing the amalgam with nitric acid, followed by washing with dilute nitric acid, is practically quantitative. Where mixed with glass, a second amalgamation with mercury will allow the gold to be easily separated from the glass.

It is with the chemical and physical condition of the gold in the ore that the chief difficulty of the method lies. Where the gold was unalloyed, untarnished, and unconfined, as in experiment 1, its solution in iodine was quite rapid. With raw sulphide ores and concentrate the solution was incomplete. Where the latter were roasted an increased extraction resulted. No experiments were made with a dead roast. The treatment of the sulphide ore in experiment 6 with nitric acid, the only experiment made along this line, resulted in quantitative work. The single telluride ore experimented with gave incomplete extraction. In this experiment the residue boiled to dryness was probably heated to above 180° C., at which temperature the auric chloride ($AuCl_3$), soluble in water, would be changed to aurous chloride ($AuCl$), insoluble in water, and might have some effect on the result. It is hardly fair to test the method with such an unusual ore as this, where the gold in addition to being combined with tellurium, may also be alloyed in small amounts with other rare metals. Furthermore the relative errors seem to increase more rapidly with the wet assay than with the dry, as the richness of the ore increases. As regards the chemistry of the process the gold probably goes into solution with the iodine as auric iodide (AuI_3). From this the mercury precipitates it in the metallic state and then combines with the iodine to form greenish mercurous iodide, Hg_2I_2. This is blackened by light and should not be mistaken for the gold precipitate, which is much heavier. This mercurous iodide is partly soluble in the potassium iodide, and is easily removed by treatment with nitric acid, being soluble also in mercury nitrate. Dilution of the mercury nitrate solution, produced by the action of nitric acid on the mercury in freeing the gold, results in the formation of basic mercurous nitrate $xHg_2O.yN_2O_5.zH_2O$, a yellowish white precipitate insoluble in water but easily soluble in dilute nitric acid.

For practical purposes, I would suggest that all ores of unknown composition be first treated with nitric acid, or, where tellurides are suspected, with aqua regia. The residue should then be shaken in a glass bottle for as long a period as may be convenient, and filtered. Where filtration is slow, making up to a definite volume, and filtering through a dry filter, and taking an aliquot portion of the filtrate for shaking with mercury, will be in order. The bottles should have well fitted stoppers. With ordinary precautions to obtain the gold in a pure condition it can be worked up into a button where the limit of error should be within the error of estimating the amount of the gold with other buttons of known weight. By using aqua regia, as suggested, the chances of overlooking gold tellurides are slight.

JAMES W. HOWSON.

San Francisco, June 4.

The China Copper Co., according to its report for May, has a tonnage of developed and partly developed ore aggregating 18,798,078 tons, of an average grade of 2.59%. This is an increase for the month of May of 849,512 tons, the grade being the same. The amount of ore per acre now averages 323,000 tons. The total aggregate ore is now given as 8,725,000 tons fully developed ore and 10,073,000 partly developed ore. The company is now planning to carry on drilling to a greater depth. The above amounts of ore have been developed by 208 holes, covering an area of 58 acres. The average thickness of the capping is 82 ft., and the average thickness of the ore 96 feet.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Potassium cyanide is manufactured at Kolin, near Prague, Bohemia, from a mixture of lye and a thick molasses which is itself a by-product from the manufacture of beet sugar.

Wire screens are subject to irregular wear, due largely to uneven feed distribution and to rust. In a general way, however, their life is proportional to the square of the thickness of the wire.

Churn-drill exploration on a mining claim, performed for the discovery or estimation of quantity and character of ore deposits, or for the benefit of a deposit held under a valid location, is accepted as annual assessment work.

The rating of air-compressors, when expressed in the number of rock-drills to which they are capable of supplying air, is usually based upon a consumption of a volume of air at 60 lb. per square inch pressure, equivalent to about 100 to 110 cu. ft. of free air per second.

The Central Eastern line of the Japanese railways has been burning crude oil on its locomotives since April 1. This line was chosen by the railway board on account of the many tunnels, passing through which the passengers have heretofore been greatly annoyed by the accumulations of coal smoke.

Kimberlite, the rock in which the South African diamonds occur, is found in Arkansas and eastern Kentucky. Nearly identical rocks occur in western Kentucky, southern Illinois, at Syracuse, New York, and in the highlands of the Hudson. Diamonds have only been found in the Arkansas occurrence.

Siphons should always be built with a valve at the outlet so that the pipe may be completely filled with water. At the crown of the arch another valve is necessary to permit the escape of air, or the introduction of water. Any convenient size is used. This may need to be opened for a few moments several times a day. Automatic relief valves are not recommended for such a situation.

Bench deposits at different levels from a foot to several hundred feet above the present streams are common in many of the larger drainage areas in the Yukon-Tanana region. In the Fortymile district they occur on the high benches of Fortymile creek and some of its tributaries to a level of at least 300 ft. above that of the present streams. In the Rampart region there are bench gravels 500 ft. above the valleys.

In the square-set system of timbering, the framing must be suited to the direction of pressure of the superincumbent mass as demonstrated by experience in each mine. Where there is a heavy downward pressure, such as is often observed where the ore-body stands nearly vertical, the timbers are so framed that the posts meet when placed in the set. In veins inclined flatter than 65°, where the heavy pressure is evidently on the hanging wall side, the caps may be so framed that their adjacent ends butt one on the other. Angle braces are often used to resist a diagonal thrust, but filling is far more successful when possible, and allows the use of much lighter timbers.

The Mancayan copper mines are near the town of Mancayan in the northern portion of the island of Luzon in the Philippines. The veins are wide and the outcrops have been traced for over seven miles. The Igorots, who are natives of this district, have mined both gold and copper from this belt as far back as the history of the tribe can be traced, and have supplied the other inhabitants of the island with copper spears, pots, and pipes. According to record, they exported 20 tons of copper per year from 1840 to 1855.

Fine revolving screens operating on wet pulp act differently from dry shaking screens such as are used in a laboratory. The time allowed for screening is shorter and the particles of ore are not given the same number of chances to pass through. Fine wet machine screening is very rapid and therefore sand grains just large enough to pass through the meshes will often bridge over the openings and not go through. The result is that the undersize will always be of greater fineness than the corresponding product obtained by dry screening in the laboratory.

Mica occurs in dikes of coarse granite. These dikes are mined in the same manner as veins, the rock being sorted either underground or on the surface, or both. The mica is found in groups of crystals called 'books', owing to the cleavage of the mica plates, which resembles the leaves of a book. These books are split up, the good mica sorted out and cut by machines into as large sizes as the shape of the leaves will admit. The sheets are bound together in packages and shipped to stove manufacturers and others. The waste is used largely for electric insulation, as a base of lubricating compounds, and in the manufacture of wall-paper.

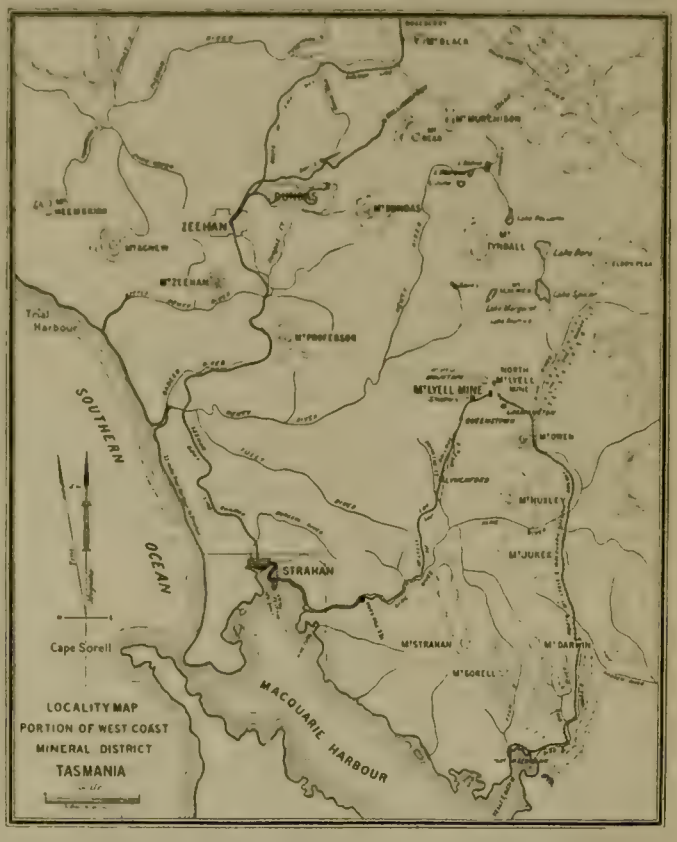
Artesian wells are now used to water about 2,194,674 acres of grazing land in Australia, and the watering of a further area of 380,960 acres has been undertaken. In addition a number of private wells have been sunk so that approximately 3,000,000 acres will be permanently watered. Many of the rivers of New South Wales, according to the last annual report of the Department of Public Works of that State, are simply drainage channels running through flat country, flowing after heavy rains and dwindling to a chain of water holes during periods of severe drought. Cattle men in some instances excavated tanks to catch a rain-water supply for their stock, but this method of storage was not always successful. Dams also were built across some of the creeks, but owing to the friability of the soil the surplus water soon cut out other channels, and additional dams had to be made. The ground-water supply, according to the report, lies in some places 3000 to 4000 ft. below the surface.

Special Correspondence

LONDON

Mount Lyell Reports —Chester Soon to Ship —Zeehan-Montana Buys at North Dundas.—Great Fingall Consolidated.

Results of the work at Mount Lyell for the half year ended March 31 have been received in London by cable. The feature of the period has been the commencement of the treatment of the large body of low grade ore. The total amount of ore treated during the half year was 190,396 tons, of which 122,816 tons came from the Mount Lyell mine and 67,580 from the North Mount Lyell. The average content was 2.61% copper, 1.89 oz. silver, and 0.78 dwt. gold per ton. The blister copper produced was 4164 tons, containing 4114 tons copper, 338,976 oz. silver, and 7627 oz. gold. The production of blister copper was 374 tons less than in the previous half year, owing to the lower content of the ore treated. In addition to the ore smelted, 6143 tons of sulphide ore was used for the manufacture of acid. At the beginning of the half-year 1295 tons of copper was unsold; this has since been sold at an average price of £59 1s. Of the copper produced during the half-year 2755 tons was sold at an average price of £61 11s. per ton and the remaining 1359 tons carried forward. The profit for the half-year was £115,335, after allowing £6094 for taxes, £10,076 for depreciation, and £13,954 for exploratory work. The dividend distributed absorbs £105,000, being at the rate of 1s. 9d. per £1 share. The cost of producing the blister copper was 16s. 4d. per ton of ore, 11d. higher than during the previous half-year, owing to low-grade ore being taken from Mount Lyell, and partly to more coke being used in the charge. The coal strike also accounts for some parts of the rise in costs. The reserve of ore is given as follows: At Mount Lyell, available by open-cut, 539,042 tons averaging 0.6% copper, 1.93 oz. silver, and 0.86 dwt. gold per ton; available by underground mining, 2,433,977 tons averaging 0.52 copper, 1.97 oz. silver, and 0.5 dwt. gold per ton; at the North Lyell, 842,163 tons averaging 6% copper, 1.33 oz. silver, and 0.1 dwt. gold per ton. This is an increase in the reserve at North Lyell during the year of 75,000 tons, and it is the highest figure yet recorded. An important new orebody has been discovered on the 850-ft. level of the North Lyell, and developments on the 1000-ft. level have been excellent. On the 1100-ft. level the orebodies are of as good quality as any found hitherto, a fact which gives great hope for the future. As already mentioned, underground reserves at Mount Lyell are now being drawn on. As regards outside interests, the Chester mines will soon be producing regularly and small shipments have already been made to the acid works. Prospecting has been continued with encouraging results at the Frankland River properties on Norfolk range, and has been started at the Hazelton group. The coal strike interfered with the coke-ovens at Port Kembla, and operations were suspended for several months, but the smelter was not inconvenienced because a large reserve of coke was in hand. The production of fertilizers has been well maintained at Yarraville and Port Adelaide, though at the latter operations were impeded to a small extent by the strike. The new fertilizer works at Fremantle will be ready to commence production shortly.



The Zeehan-Montana silver-lead mine was floated in London in 1892 as a subsidiary of the Mount Zeehan (Tasmania) Silver-Lead Mines, which still holds a large share interest. The property is situated on the west side of Tasmania not far from the coast. The mine did well until two years ago, when the developments became disappointing. At the end of 1908, the reserve of ore was practically exhausted and the outlook was dark. The manager, John Craze, persevered, and has had his opinions backed during the year by the Government geologists who made a special examination of the Zeehan district with a view of determining the chance of further discoveries. The report of the company for 1909 shows that Mr. Craze has been rewarded by the discovery of several small bodies of ore, and of one body which promises to develop into a valuable reserve. During the year 3435 tons of first-class and 16,618 of concentrating ore has been raised. The shipments consisted of 2090 tons of ore and concentrate sent to Antwerp, assaying 67% lead and 84 oz. silver, and 1247 tons sold to the Tasmanian Smelting Co. averaging 60% lead and 51 oz. silver. The concentrating plant treated 9950 tons coming from No. 1 shaft assaying 9.4% lead and 11.4 oz. silver, and yielding 1079 tons of concentrate averaging 67% lead and 75 oz. silver, and 6515 tons coming from No. 2 shaft assaying 12.4% lead and 11.4 oz. silver, yielding 786 tons of concentrate averaging 65.8% lead and 55 oz. silver. The plant also treated a few hundred tons from No. 4 shaft and a small amount of tributers' ore. The concentration was efficient, as only 1% lead and 2½ oz. silver were left in the tailing. The cost of crushing and concentration was just under 3s. per ton. Though the prospects at the mine have improved during the year, the directors have considered it the safest policy to try other properties, and Mr. Craze has therefore investigated the new tin district of North Dundas, a few miles away. A property has been bought for the small sum of £1250; it contains three different outcrops, each about 40 ft. wide, and giving results 1% and upward. The development of this property will be watched with unusual interest. The company has also taken a small interest in a new silver-lead property at Dundas acquired by the Mount Zeehan company. As regards the financial position of the Zeehan-Montana, the report shows that the sale of produce brought an income of £40,081 and the expenses at the mine were £40,721, the London expenses £667, and depreciation £840. There are other items in the account, and the net result of the year's work is a loss of £1725.

The Great Fingall Consolidated, a gold mine situated at Day Dawn, Western Australia, and managed by Bewick,

Moreing & Co., is now approaching exhaustion. Milling commenced in 1900 with 20 stamps, and since then the plant has gradually been extended until it now consists of 100 stamps, concentrators, roasting furnaces, and cyanide plant. Unfortunately during the last two years the developments have been unsatisfactory, and toward the end of 1908 the average content of the ore sent to the mill was considerably reduced. No further bodies of ore have been discovered, and only 40 of the 100 stamps were at work during 1909. The policy of the managers is to attack the rich pillars left in the mine. This cannot be done without first filling the stopes with sand, and the latter work is now in hand. The company owns approximately a quarter of a million tons of accumulated slime that has been hitherto considered unprofitable. This is now to be treated by the new vacuum slime plant recently erected. During 1909, the 40 stamps in operation crushed 140,982 tons yielding by amalgamation 21,074 oz., 1877 tons of concentrate produced 6039 oz., 105,225 tons of sand 8042 oz., 19,339 tons of current slime 1333 oz., and 77,280 tons of accumulated slime 4781 oz., a total production of 41,269 oz. The income from the sale of gold was £175,716, and £2900 was received as interest. The cost of treatment was £156,300, the London expenses £3150, depreciation £9181, and taxes £9240, leaving a margin for the year of only £320. In addition £25,888 was spent on capital account for development and additional plant. The company commenced the year with a balance in hand of £24,339, out of which £21,875 has been distributed as dividend, being at the rate of 8¾%. Irrespective of the rich pillars, the available ore reserve on December 31 was 49,460 tons averaging 23s. 9d. per ton. Owing to the insecurity of the workings it is impossible to enter for the purpose of measuring the other ore or the pillars until the sand-filling is in place. The company has a reserve of £95,000 in cash, and steps are being taken to employ it in developing other mines. A property has been acquired in West Africa and has been floated as the Taquah Central Mines, Ltd. Of the capital £40,000 has been subscribed by the Great Fingall.

JOPLIN, MISSOURI

Zincite Developing.—Disseminated Region Opening Good Ore.—Duenweg Mines Active.—McGee Silicate Mine.

Greater activity is noticed in the old Zincite camp near Joplin than at any time for a number of years. On a lease of the Llewellyn tract a party of Joplin men has just drained the mine to a depth of 133 ft., and a rich face of ore is now in shape for working. Some of the ore is free, while some requires milling, and it has not been yet decided whether to build a plant on the lease or haul the ore to a custom mill. Hand-jigs are being used temporarily. The Victoria M. Co., operating in Cottonwood Hollow, a portion of Zincite, has recently entered one of the largest bodies of ore found for some time. The present shaft is down 112 ft., although the ground is worked at 88 ft. The ground is soft and requires timbering. Both high-grade galena and zinc blende are taken out, much of the galena being ready for market without further treatment. The mill dirt is treated on the 150-ton plant of the Clara Bell, near by. The Clara Bell itself is carrying on additional development, driving two drifts at 126 ft. A better grade of ore is being found than any hitherto reached. An old shaft is down 140 ft. and it is said that good ore exists in the bottom of this shaft. It will be reached by a drift. The dirt will run 9 to 10%, being mainly blende. Operations are also being resumed on the Wyssbrod land at Zincite, upon which is situated the old Daylight and Colgen mines. Eight shafts are in ore on this 75-acre tract, and two custom mills operate. The work will now be begun upon an extensive scale, and the Daylight mine will be re-opened. It was formerly one of the best producers in this camp. The ore-face is 24 ft. high in the open pit and the ore is mainly zinc blende.

Just west of Joplin the Kittie Mack company is building a new mill to replace the one burned. The lease is well developed, and when completed the mill will be a steady producer. It is situated in the disseminated-ore region opened up only a few years ago, but now containing some important mines. The mill will handle about 250 tons of ore, and is constructed of galvanized iron and is new throughout. The Hercules, another mill in the same region, is just completed and has the largest capacity of any plant in that field. It is rated as a 500-ton mill, equipped throughout with Foust jigs and every modern improvement. It has made the initial 'turn-in' and will be ready for steady operation, as the ground is well developed. Matthes Bros., owning a large acreage near Jackson Station, have just purchased the Claram mill south of Webb City and will remove it to their land at once. A long campaign of prospecting has shown a rich run of shallow ore and shafts have been sunk and the ground well opened in a promising deposit. The ore is free in character and runs from 5 to 8% zinc. The strike is not far from the H. H. Gregg land, where a number of shallow-lying orebodies have been found.

The Jack Hayward company southwest of Joplin is preparing to take up a 15-ft. stope, extending from the 175-ft. level. The work is to be done by placing a steam-hoist in the drift to operate a car on an inclined winze. This will save the work of sinking a new shaft or opening a large stope outward from the shaft. The company has put down several drill-holes on the eight lots and has discovered ore at a lower level in sheet-ground. The ore where the winze is being worked appears to be in the form of a chimney extending down to this sheet-ground level. There is a 150-ton mill on the lease. The old Pilot mine southwest of Joplin is being re-opened and the company re-organized. Recent prospecting in this vicinity has opened many shallow and deep deposits and a number of new shafts are being sunk. The shaft at the Pilot will be deepened to the 195-ft. level. Former operations were conducted at much shallower levels. A large mill is already on the property. To the north of this property George Noble and others are beginning the sinking of a shaft on a lease of Matthes Bros.' land, where several encouraging prospects have been found. A 24-ft. face of ore was drilled through in three holes. Aside from drilling, this property has never been developed. There is no abatement in the interest in the vicinity of Toms Station, where during the entire spring months and late winter steady prospecting has been going on. Many discoveries have been reported, and J. M. Short has been actively drilling. A rich discovery has been reported, widening the mineralized territory. The ore in the last hole was found from 153 to 186 ft. This makes the fifth hole down, all hitting the orebody. A few more holes will be sunk and then shafts will be started. A well defined and rich orebody of considerable extent has been blocked out. Some of the cuttings assay as high as 27%. Others assayed from 15 to 20%, and others below this grade. The many discoveries made by Mr. Short, Wells Bros., and others have stimulated much interest in prospecting in the vicinity and there is a great demand for leases. A short distance away on the Mexico-Joplin land, S. L. Bradley has taken a lease on 40 acres, where five drill-holes have been sunk. More drilling will be done by the new owners before further development is undertaken. The ore has been found from 120 to 150 ft. in depth, while in other holes the run did not appear above 160 ft. On an adjoining tract good ore was struck at 40 ft.

The Holy Moses mine at Four Corners made its initial turn-in recently, consisting of 70,000 lb. of blende cleaned on hand-jigs. A second shaft is being sunk to increase the output of the mine. A mill will be built if the dirt proves suitable. The ore is found at 70 ft., at which depth three drifts have been well opened, showing a 12-ft. face. The McGee silicate mine in the Duenweg camp, already famous as a long-lived producer and a rich property, has recently been extended by the opening of another rich run. A record run of the mine was made recently when in six shifts 126,000 lb. of ore was turned out, making over ten tons per single shift. Considerable difficulty has been met recently in keeping the boilers running steadily owing to the scarcity of coal. A silicate mine in this field is usually short lived, but this property has produced steadily for over two years, and while still the best silicate producer in the district has a large amount of ore in sight. The initial turn-in has been made from the new mill on the old White Rat lease at Duenweg. The mill is the former Myrick-

The newly developed ore in the White Rat is in sheet ground, lying partly beneath the drifts on the former lease. Another producer has just been started up in the Porto Rico camp by the New York & Western Co. on a lease of the Knol land. The lease was formerly worked and was a steady producer of high grade ores. A mill has been started by Henson and McDonald on the Troupe ground where operations many years ago showed ore which was considered too thin to be operated at a profit. A later run was taken out averaging 10c. and a large tonnage of high grade ore was produced. The plant has been recently erected and the land will become a steady producer. An important discovery has been made in the Neck City camp by Gardner and associates, where at a depth of 74 ft. the shaft passed through 9 ft. of almost pure galena with a small percentage of blende. This is the richest ore in this portion of the camp, though it is in the centre of the Neck City mining field. The company will erect a plant as soon as the shaft is completed.

MEXICO

Altar Placers.—Auto Stage.—Quenner Machines.—San Antonio Placers in Banauca District.—Boleo Copper.

It is believed there will be great activity in the dry placer regions of the Altar district of Sonora in the fall. A great area of placer has been denounced during the last several months, and titles to properties are now being awaited, the new mining law of Mexico providing against the working of claims until titles are secured. The towns of Nogales, Sonora, and Nogales, Arizona, recently arranged funds for an automobile road from Nogales to Altar, the centre of the district, a distance of 90 miles, and it is planned to have this road completed by July 15. H. J. and W. E. Karns, of the Sonora Auto Co., will establish a regular service on the new road, a car going to Altar one day and returning the next. The trip each way will be made in six hours. It is also proposed to operate a car between Altar and Boludo, where some placer work is now in progress, a distance of 36 miles, and later this service will be extended 20 miles to La Cienega, around which point there are many placer denouncements. After the close of the rainy season in the fall the automobile service may be extended from Altar through Caborca to Port Lobos, on the Gulf of California. Ten of the Quenner crushing machines, which are principally responsible for the present interest in the dry placers of the Altar district, are being built at the shops of Roy & Titcomb, in Nogales, for the American Ore Milling Co., the concern that was recently organized to take over a 70% interest in the Quenner patent and build and install the machines. D. A. Richardson, of Douglas, Arizona, is at the head of the enterprise in the southwest. This company is successfully operating a Quenner machine at a placer near Boludo. Jose Monteverde, who bought the placer lease and machine of Mitts Quenner, the inventor, and Charles H. Peck and J. E. Suits & Co., are also operating Quenner plants in the Boludo section. Lawton B. Garside is installing a Quenner machine at placers nine miles east of Llano, a station on the Sonora railway, and George D. Stonestreet, representing New York interests, is operating five miles west of that point.

Exploration work with Keystone drills is in progress at the old San Antonio placers in the Banauca district of Sonora. These placers are now held by New York men represented by Herman Wendler, a well-known mining engineer. The exploration work will be continued for three months, and if at the end of that time the results are as satisfactory as they have been up to this time, expensive dredging equipment will be installed. During colonial days several millions were taken out of the San Antonio placers. The gold is found along a former channel of the Yaqui river and in gulches leading into it from the mountains. The Spaniards worked down the gulches from the mountains until the underground flow of the river stopped them, getting gold in the lower sections of the gulches only above the water level. The town of San Antonio, founded early in the eighteenth century, is on gold-bearing ground, and the plans of the New Yorkers call for the building of a new town outside the placer zone and the destruction of the old one. Mr. Wendler has made arrangements with the inhabitants—about 60 families—for the change. A close corporation is being organized to carry on the placer operations. In the mountains above the San Antonio placers the Yaqui Mines Co., an English concern, is working a gold property with good results. A 12-ft. ledge of $13 free milling gold ore has been cut. This company is closely identified with the Hudson's Consolidated, which has extensive interests in that section of Sonora. Mr. Wendler is also in charge of the operations of the English concern.

It is authoritatively stated that the profits of the Boleo Copper Co., the French concern operating in Lower California, have averaged more than a million francs a year since 1900. The company has a capital of 12,000,000 francs, divided into 120,000 shares of 100 francs each per value. Just at present the Boleo has several important plans, among them the installation of converters and the shipment of their product as blister copper instead of matte. Matte of about 63% is now being shipped. French steamers taking it to Dunkirk and Liverpool, via the Straits of Magellan. A shipment of pyrite is to be brought from Spain for experiments in ore combinations as at present the percentage of copper lost in the slag is high, and a better extraction is demanded. It is stated that if good results are obtained by the experiments the operation of the Inguaran mines in Michoacan, controlled by the same interests and where suplies of pyrite are available, may result. Extensive development has been done at the Inguaran properties, but the construction of a railroad to the Pacific Coast would be necessary to permit of the shipment of Inguaran ores to Santa Rosalia, the port of the Boleo Copper Co., where the Boleo smelter is located. The Boleo production is now averaging a little more than 1000 tons of copper monthly. The concern is controlled by the Paris branch of the Rothschilds.

GOLDFIELD, NEVADA

Mine Inspection.—Consolidated Improves Conditions.

The Goldfield Consolidated Mines Co. has recently organized a division of inspection and is making especial effort to increase the safety of its men and property. Within a few weeks the surface drainage and sewage systems have been improved, and with the work planned will provide for the disposal of all waste water and refuse in a sanitary manner. Antiseptics are used in all drains, pits, and places where gases are liable to arise. As fast as possible, the general appearance of the surface is being improved. Old buildings are being removed, scrap material is being hauled to an out of the way place, and provisions made to prevent such material from accumulating around the property. A high-pressure water system for fire-fighting purposes, has been planned and is now under construction. A reservoir, located on top of Columbia mountain has been started and pipe-line trenches through solid rock are now about completed down to the foot of the mountain. Material has been ordered to install this system, including pipe, high-pressure pumps, hydrants, hose, and a full equipment to insure complete protection against fire. The properties are divided into fire divisions, each of which will have a fire house, with its own equipment. Each division will have its own captain and fire organization which will be thoroughly drilled and ready at all times to respond to an alarm. Each of these divisions has been supplied with a 40-gallon Badger chemical engine. These, together with the hand extinguishers, will afford ample protection against small fires. Fire helmets for use underground in case of fire, have been ordered and upon arrival of these helmets men will be trained to use them so as to be able to protect both life and property underground. A regular inspection of hoists, cages, shafts, and ropes is now practiced. This, together with the co-operation of efficient engineers and cage tenders, will insure good protection to men from accident, while being lowered or hoisted from mines. A close watch is being kept on all ladderways and main passage ways, in all parts of the mine to insure perfect safety. All surface plants and machinery are being inspected and where

ever improvements can be made to guard against accidents they are being made. One line of work in particular that the inspection department intends to take up will be to investigate the causes of disease peculiar to underground workers, and, if possible, to take steps to eliminate the cause, if such is found in the mines of the Consolidated.

NEW YORK

Copper and the Merger.—British Columbia.—Mines Company of America Reorganized.—La Dura Purchased.

A strong tone of optimism is developing in the market and the expectation is general for increased activity at higher prices. The liquidation engendered by the action of the Federal Department of Justice in bringing the injunction suit against the Western railroads seems to have run its course. The natural optimism of the country is beginning to assert itself. The one weak spot in the market is the copper situation. The companies controlling the low-grade milling properties have command of the market, but in the case of Utah Copper practically all of the net proceeds from operation is being paid out in dividends. This company is producing on a basis of about 100,000,000 lb. per annum, and is paying $3 per annum in dividends, while earning about $3.13 per share on the present copper market. This leaves the dividends derived from Utah's half interest in Nevada, amounting to $1,425,000 in round numbers, to be carried to surplus account, but this is as broad as it is long, since Utah's interest in Nevada Con. was acquired by the exchange of stock. In a recent interview L. Vogelstein, of L. Vogelstein & Co., said in part: "It is production rather than the consumption which unsettles the market, especially as, taking a long distance view of the situation, the outlook is for more copper in 1910 than in 1909, and more in 1911 than in 1910. The total production for five months of 1910 was 590,047,362 lb., compared with 564,825,116 in 1909. Great hopes having been entertained that good business during the second half of the year would enable demand to keep pace with supply, discouragement is proportionately keen at the prospect that these expectations may be disappointed. If the market has been leaning on a broken reed in this respect there would seem to be nothing now, in the absence of a copper combination, except for the inexorable law of supply and demand to take its course until an equilibrium between supply and demand is established." There is a serious revival of talk of a copper merger. The combination is evidently to come. The real question involved is what coterie of financial interest is to dominate it. The Lake coppers with their Boston connections have always held aloof from the Western mining interests. Among the latter the three groups of leaders are evidently sparring for an opening. The Phelps-Dodge interests are believed to be preparing to land copper in New York by trans-shipment across the isthmus of Tehuantepec. The Cole-Ryan party is working with the Anaconda and making a strong bid for leadership, while the Guggenheims are at the moment in command of the low-grade porphyries. Any three-cornered battle between these groups would be so expensive that it may be safely said that the banking interests involved would interfere. Amalgamated's position is becoming more and more questionable. Its market level is so far out of proportion to its income that the shares must come down in price. The heaviest financial powers of the world are identified with copper, and they have learned the advantage of unification over competition. The copper merger is probably more nearly at hand now than it has ever been at any time heretofore. A daily copper production of 4,000,000 lb. makes some effective market protection necessary.

Operations at the British Columbia are about normal once more. Ores from the Wellington mines are being received. Shipments from the New Dominion begin this week. Two furnaces are in blast, while the third is being enlarged. When alterations are completed, which will be in the course of 60 days, the plant will have a daily capacity of 2700 tons. The action of the Granby directors in withholding the report of Vice-president Jay P. Graves is taken to mean unequivocally that the conditions exist as outlined in the Sussman report. The rejuvenation of the Granby is indefinitely postponed. The Butte and Ballaklava, at Butte, Montana, is proving to be a twin discovery for Tuolumne. Both properties are of comparatively small acreage and both are phenomenally rich. The Butte and Ballaklava has made some copper, which it is claimed was all profit, the precious metals paying all expenses. Tuolumne's million pounds of copper per month has been made from ore running from 10½ to 15% copper, and copper costs have been probably below 6c. The concentrate from the Miami mill, now in course of construction, are to go to Douglas, to the Copper Queen smelter. The management negotiated with the Old Dominion smelter at Globe, but in order to handle the concentrate additional reverberatory furnaces would have had to be provided at a cost of a quarter of a million or more, so that the Old Dominion company preferred not to undertake the contract.

It is some ten years or so since the Colorado Creston properties at Minas Prietas, Sonora, Mexico, were taken over as the Mines Company of America by a group of Western capitalists familiarly known as the 'Gates crowd'. Among the prominent figures were John J. Mitchell, president of the Illinois Trust & Savings Bank, of Chicago, who is supposed to be J. P. Morgan's right hand man in all of the latter's affairs centering in Chicago; Isaac L. Ellwood, who was one of the original patentees of the barbed wire fence, out of which the redoubtable John W. Gates made his first stake; John Lambert, president of the Illinois Steel Co., and others. These gentlemen acquired a large interest in the Mines Company of America on a basis of $1,300,000 for the property, this consideration including a one-sixth interest in the Dolores Mines Co., of Chihuahua, Mexico. Mines Company of America has paid $3,785,000 in dividends, besides distributing the Dolores shares as a dividend. Recently the company has been paying 3% quarterly. The larger insiders are supposed to have sold their shares at the higher prices prevailing when dividends were larger. Now a consolidation is to be effected. The capital stock of the Mines Company of America is to be increased to $9,000,000, par $10, as against its present $2,000,000, par $1. The additional capital so provided is to be used in acquiring a controlling interest in Dolores by an exchange of ten shares of Mines Company stock for one share of Dolores and seven shares of El Rayo. The Dolores is situated in Chihuahua and is controlled by the same interests that control the Mines Company of America. It has a capital of $2,000,000, par $5, and has paid in dividends about $1,000,000. The El Rayo is likewise situated in Chihuahua, it is a recently developed property and has paid but three or four dividends aggregating about $50,000. The quarterly report just issued shows a net profit of $66,698 derived from 13,700 tons of ore averaging in value $13.96 per ton. El Rayo is controlled by W. B. Thompson, who was prominent in Cumberland Ely, Nipissing, LaRose, Inspiration, and Mason Valley, and W. Hinckle Smith, of Philadelphia, who is one of the important factors in Nevada. Prior to the re-making of Mines Company of America into a holding company three members of the new merger each acquired a one-third interest in the LaDura properties on the Yaqui river in Sonora. George A. Schroter has occupied the position of consulting engineer for the companies mentioned and will continue to act as such for the consolidation. The real importance of the move here discussed is not particularly in the consolidation of the properties mentioned but in the creation of so large a holding company backed by such intrests. It is intended to make the Mines Company of America one of the most important proprietary and development companies operating in Mexico. The new company will have more than ample capital for its operations and may be expected to become an important factor in Mexican mining.

The dearth of news from Porcupine and the lack of endorsement by such competent engineers as have visited the camp indicates a failure for the new Goldfield. There does not appear to be any life in such reports as are made and the verdict now seems to be that Porcupine will prove a disappointment. California oil promotions are coming East in increasing numbers and the showings are such that Eastern capital and financial institutions here with London connections are beginning to take an added interest in the possibilities presented.

General Mining News

ARIZONA

COCHISE COUNTY

Two new orebodies have been opened in the Shattuck Arizona mine at Bisbee within the past few weeks, the raises from the 600 to the 500 ft. level both having cut ore that assays 35% copper with considerable manganese. The company is shipping about 150 tons of high grade ore per day but it is reported that the shipments are to be increased and the grade lowered by mixing the low grade material that is now left in the mine.—The two electric pumps at the 500 ft. level of the Holbrook shaft of the Copper Queen have been lowered to the 600 and another large pump installed to handle the water during the wet season. The company is operating a diamond drill on the Silverton claim at Courtland.—Sinking has been started in the Irish Mag shaft of the Calumet & Arizona at the 1250 ft. level, and will be continued 200 ft., stations being cut on the 1350 and 1450 ft. levels.—The C. O. D. company at Courtland shipped a carload of ore to the Douglas smelter that averaged about 20% copper.—The Bisbee Sonora company has just completed 1000 ft. of development at Paradise, in which it has cut the orebody in several places. This company has been at work since opening its mine three years ago, and is now ready to install machinery.—The Whitetail mine which has been recently taken over by a new company has opened a good body of lead silver ore on the 120-ft. level and are now grading for the installation of a new power-plant.

GILA COUNTY

(Special Correspondence).—The drift following the stringer of ore on the 660-ft. level of the National Mining Exploration property has advanced westward 180 ft., the present breast showing the vein to be 30 in. wide. Beginning June 26, sinking of the shaft will be resumed at its present depth of 708 ft.——The McGaw shaft of the Superior & Boston Copper Co. has been sunk 163 ft. below the sixth level. The west winze put down from the fourth level of the Gardner workings is still sinking in ore on the Black Oxide vein averaging 8% copper.——Churn-drill hole No. 5, situated 1100 ft. west of the shaft on the property of the Live Oak Development Co., cut ore 320 ft. from the surface, and is still in schist with an average copper content of over 2%, at the depth of 425 ft. Hole No. 7 is being drilled 700 ft. south of the shaft, and is still in granite 65 ft. from the surface.——The output of the Old Dominion smelter for May was 2,150,000 lb. of copper, and it is estimated by the management that nearly the same amount of copper will be produced during June. Three blast-furnaces are being kept in operation.——The vein recently opened on the 650-ft. level of the Superior & Globe property, at a distance of 475 ft. north of the shaft, is 5 ft. wide. This vein contains much hematite, but few traces of copper. Along the foot-wall, some native silver was found. The company will soon have a diamond-drill at work prospecting. H. V. Snell is superintendent.

Globe, June 18.

MOHAVE COUNTY

Sinking is now under way at the Summit mine of the Needles Mining & Smelting Co. on the summit of the Cerbat range north of Stockton hill. The vein is one of the largest in that district, the cross-cuts having opened 16 ft. of ore that contains lead, gold, and silver, with about 40% iron which makes it ideal for the work at the smelter.——The station has been cut on the 200-ft. level of the C. O. D. mine and a cross-cut is being driven to the vein.——The Arizona Turquoise Co. has nearly completed the road into I X L basin and will commence the work of hauling in the machinery and cleaning out the old I X L mine early next month.——The Golconda mine in the Union Basin district paid another dividend several days ago of 1% per share, making the seventh of its kind in about as many months. In five months ended May 31, the mine shipped 4395 tons of ore netting about $87,000 above freight and smelter charges.——In the new shaft of the Tennessee at Chloride three shifts are making 25 ft. per week. It is down 120 ft. and will be continued to 500 ft. before any stations are cut.—The ore opened in the Keystone last week is holding up both in size and value as driving progresses. Shipping of the high grade ore has been started, and, pending the completion of a railroad spur, six tons per day are being hauled to Chloride and from there shipped to the Needles smelter.

PIMA COUNTY

The Gould Mining Co. is completing plans for the erection of a smelter at the Gould mine, 18 miles west of Tucson, and will commence work repairing the wagon road so the machinery can be hauled in. The plant will be so situated that it can draw on a large area for custom ore and it is thought that the mines of the district will supply an ample tonnage without shipping in any ore from the outside.

YAVAPAI COUNTY

A triplex electric station pump has been ordered by the Arizona Central Copper Co. from the Arizona Mine Supply Co. for its mine in the Black hills near Dewey. Up to the present time the flow of water has been small, being handled entirely by the skip. A much stronger flow has now been opened and the new pump will be placed at the 900 ft. level while the shaft is being sunk to the 1000. J. B. Cleveland is manager for the company.——The Mount Elliot Consolidated Mines Co., which recently remodeled its mill, has completed the connection to the wires of the Arizona Power Co., and the camp is now supplied with electricity for light as well as power. The pole-line is now being constructed to several of the other camps in the district.

YUMA COUNTY

It is reported that the Lewisohn interests which took over the old Planet mine at Planet about a year ago are to replace the 30-ton furnace at the mine with a large and modern plant, and that work on a spur from the Arizona & California railroad to the town will be started this fall. A 600-ft. shaft has been sunk on the property and over 1000 ft. of drifts driven under the present management. The churn-drills now operating have been in ore for some time.

CALIFORNIA

CALAVERAS COUNTY

(Special Correspondence).—The Calaveras Copper Co. is pushing development on its properties in the Copperopolis district. The Union shaft is down 800 ft., and has opened a body of ore assaying 9 to 12% copper in the north drift which is being extended to open a 40-ft. body of ore that was intersected by a winze from the ninth level. The Keystone Discovery shaft is down 600 ft., is triple-compartment and will be the main working avenue. The North Keystone mine is being opened by a new shaft, down about 265 ft.—A new reverberatory furnace was recently installed at the Campo Seco smelter, and activities throughout the copper fields of the county are more pronounced at this time than for many years.

San Andreas, June 20.

New York interests have secured a three-year bond on the Ophir Consolidated mine in the San Andreas district and work has been started on an adit that will open the vein at a vertical depth of 300 ft. The property is near the Foot & Thompson mine where a $15,000 pocket was opened a short time ago.——The Sierra Nevada Water Co. is to resume work on its power-plant site on the Mokelumne river between West Point and Rail Road Flat.——There are 500 tons of milling ore stored at the Newman mine near West Point that will be run through the 10-stamp mill in a short time, and 80 tons of sulphide ore that will be shipped to the smelter for treatment.——George Porteous has hauled about 20 tons of ore to the Thompson mill and is to ship four or five tons to the Selby plant.——It is reported that the Blue Mountain mine, formerly known as the Heckendorn, is to be re-opened.——Brady & Cethel have completed retimbering their property at Murphys and expect to open milling ore at an early date.

INYO COUNTY

The old Union mine in the Russ district has been bonded to the Mortimer Mining Co., of Philadelphia, and preparations are being made to re-open the property. Six men are

now at work and the force will soon be doubled.——The Four Metals Mining & Smelting Co., operating near Keeler, have suspended work temporarily.——At the Loretta mine the shaft which is being sunk to the 750-ft. level is now down 475 ft. The vein is almost perpendicular and the shaft is being sunk parallel to it, cross-cuts being driven every 100 ft. The ore opened on the 400-ft. level averaged 5% copper.——The adit at the Maverick is in 450 ft. with some 300 ft. additional before the main vein is opened.——The new mill at the Buckeye has been started and is reported to be running smoothly.

LOS ANGELES COUNTY

The Sierra Madre Club, of Los Angeles, will be the host of the American Mining Congress from September 26 to October 1 of this year, when the annual convention will be in session.

NEVADA COUNTY

The shaft at the Cassidy is going down steadily in $35 ore. The company has installed a 50-hp. boiler to facilitate in pumping, as considerable water has been met lately.——The Gaston Mining Co., which recently completed a long drainage adit to the old workings, is preparing to unwater the lower portion of the mine and will commence blocking out ore to keep the 40-stamp mill busy.——The North Star Mines Co., at Grass Valley, paid a 5% dividend of $125,000 on June 18, making a total this year of $200,000 as a 3% dividend was paid March 30.

PLACER COUNTY

A 245-ft. cross-cut to the old adit at the Kimball mine has been completed and the old workings are being cleaned out.——Three shifts are at work in the adit at the Mayflower which will open a large amount of ground that has never been tested.——The blue lead has been cut in the Glenn mine on Duncan ridge.——Frank Bonham has finished the 250-ft. adit to the channel on his claim in Indian canyon and is now opening pay gravel.——The London & Placer County Development Co. has been organized to prospect the veins opened by the grading on the Southern Pacific railroad. The first ground to be taken over is that of Mrs. Gertrude D. Nicol, near Weimar.

SAN BERNARDINO COUNTY

There are about 25 men working at the Gold Mountain mine at Victorville and the 40-stamp mill is running night and day.

SHASTA COUNTY

A compromise has been effected by the Delta Consolidated Gold Mining Co., and the Inca Treasure Mining Co., operating near Delta, in the suits that have hampered the work on both properties for the past year and the cases have been dismissed by Judge J. E. Barber.——Nearly a quarter of a million shares of stock in the Sibyl Mining Co. was sold at auction at Redding to reimburse the holders of several notes of G. A. Von Kruse who had given the stock as security for the notes.

SIERRA COUNTY

The bond on the Red Star mine at Alleghany which is held by Colorado interests has been extended and work will be resumed on the property. An adit is now in over 3000 ft. cutting several veins that prospect well and work will be centered on this till it cuts the vein that is supposed to be the extension of the Tightner.——The company sinking the shaft at Poker Flat has installed a new ¾-in. cable and is continuing the work at a depth of 275 ft.——Machinery for the addition of 10 stamps to the Chipps mill is on the ground and construction will be started as soon as the lumber can be hauled to the mine.——Preparations have been completed for the resumption of active work at the Gibraltar early in July.——It is reported that a new vein has been opened in the hanging wall of the old Sierra Buttes east of Downieville, and that the No. 9 mill will be started.——Work for the season is soon to be started on the Phoenix mine above Sierra City.——Truax, Camp & Ish are figuring on erecting a 2-stamp mill on the Sargent property in Slate Castle ravine which they are opening under bond as a shoot of high-grade ore has been opened.——The air shaft at the Bunker Hill has been completed and work started in the long bedrock adit that is being driven to tap the gravel.——The Bullion mine west of Sierra City is being sampled and upon the results depend the action that will be taken on the property.——The drift at the Ramshorn group is opening a shoot that assays high in copper.——The drift at the Gladstone mine near Gibsonville has opened the vein showing 2 ft. of high-grade ore samples from which have assayed as high as $350 per ton. The company has been developing the property for some time and will erect a 10-stamp mill, and possibly a cyanide annex, in a short time. Charles Root is superintendent.

SISKIYOU COUNTY

Albert C. Aiken, W. A. Graham, and associates have purchased the Boggett placer claim two miles above Oak Bar and are planning to work the ground with a steam-shovel.——Francis McCarthy opened a rich pocket in the Scott's Bar district a short time ago.——F. H. Osgood, of Seattle, purchased the claim in which the Fiddler Brothers were interested near Yreka for $5000.

TRINITY COUNTY

(Special Correspondence).—The 40-stamp cyanide mill under construction by the Trinity Gold Mining & Reduction Co., at its Headlight mine near Carrville, is now half finished and will be hastened to completion as rapidly as possible. It will include in its equipment two Oliver slime filters and four Dorr thickeners, but there will be no plates or concentrators as all ore is to be cyanided. The Merrill system of zinc precipitation will be employed. Seventy tons

Central Portion of Northern California.

of machinery have already been brought in. Power will be supplied by a 500-hp. hydro-electric plant that the company is to build on the west side of Trinity river just north of Carrville. The flume to bring the water from Coffee creek is now under construction. This will be ample for all purposes with some to spare for outside demands. A compressor will also be installed at the mine to operate 5 drills. It is the intention to have the entire plant in running order by November 1. David Goodale, assistant manager, is in charge of the work.——Reed & Chapman have installed an 8-ton cyanide plant on their Windy Camp claim in the Coffee Creek district. The vein carries 15 oz. gold per ton.

Carrville, June 13.

YUBA COUNTY

The California Mother Lode Mining Co., operating near Indian ranch, has ordered cyanide equipment to construct an annex to the mill that will treat 100 tons of ore per day, and expects to have the plant in operation by August 1. A Chilean mill has also been ordered that will re-grind the plup from the stamps before it is sent to the cyanide tanks. Warren C. Wilkins is manager.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—A shipment of 800 lb. of ore from the Elephantine mine on Covode mountain was settled for at $180 per ton in gold.——Drifting is in progress on a streak of mineral that is from 3 to 5 in. wide.——Stephens & Co., leasing in the upper workings of the Mendota mine from the Victoria adit level, have uncovered an 8-in. streak of galena that mills 175 oz. in silver with 45% in lead.——The ground is being placed in condition preparatory to stoping.——Work has again been put under way in the carrying of the raise that is to connect the Scepter adit with the Sunburst workings.——The Marshall Russell adit on Miller mountain, has been driven for 1500 ft.——Driving has been started on the Neef vein cut 4200 ft. from the portal.——The Silver Horn Mines Co. has been incorporated with a capitalization of $1,000,000, shares having a par value of $1 each. The Silver Horn group of seven patented claims is owned.——The holdings are situated up Bard creek and in former years a heavy production was made.——F. E. Wire is manager.——Cannady & Ford, operating under lease on the Katie Emmett, had down a 3-ton shipment of smelting ore last week that brought a settlement of $200 per ton.——The German mine up Virginia canyon has entered among the list of shippers.——W. H. Bartow, operating under lease, had down four tons of ore last week that milled $190 per ton in gold and silver.

Idaho Springs, June 18.

GILPIN COUNTY

(Special Correspondence).—The Gilpin mill at Black Hawk is to be taken over by the owners of the Klein-German mine. The plant is to be remodeled throughout.——A 12-hp. gasoline engine has just been received at the Egyptian mine on Quartz hill. Heavy shipments of smelting ore are being made, the product being taken from the 150-ft. level.——It is reported that the Hughes mine on Bellevue mountain has been purchased by L. Hakeman, of London. The property is equipped with a modern plant of machinery while the shaft has been sunk to a depth of 300 ft.——The machinery at the Brooklyn mine is being overhauled, while the shaft-building is being remodeled. W. E. Scott, of Perigo, has been appointed manager.——The Daisy mill at Perigo has been started and the machinery is being fed upon ore from the Tip Top mine.——The Perigo mill is treating a heavy tonnage of ore from the War Eagle and Comstock mines in Independent district. The machinery at the New York mill at Black Hawk was brought into commission this week and will run on ore from the Pewabic mine in Russell district.

Central City, June 18.

LAKE COUNTY

Work is to be started in the old Monarch mine at Leadville as soon as the pump in the Cleveland shaft has unwatered the ground.——An electric power-plant and air-compressor is to be installed at the Clear Grit shaft, and it is reported that a similar plant is to be placed on the Ella Beeler ground adjoining and power-drills used underground.——Harry Mamlock has made considerable improvement in the surface plant at the Dorris mine, and has completed arrangements to resume work on the lower levels which have good production records.——Work has been put under way at the G. M. Favorite, one of the old-time producers of Iowa gulch, and operations will be in full blast in the course of the next few weeks.——The Dinero shaft has been tapped by a bore-hole from the Dinero adit on Sugar Loaf mountain and is now completely drained. No effort has been made by the management to cross-cut to the shaft as yet as all attention is directed to getting out shipping ore from the north drift.——The lessees of the La Plata shaft are shipping 25 tons of oxidized ore per day that averages $10 per ton.

TELLER COUNTY

The shoot which Ed. Cookerly opened a few weeks ago on Prince Albert ground in the Cripple Creek district continues to improve as the cut is advanced on the vein. A drift will be driven to determine the length of the shoot and a winze put down on the ore which is 4 ft. wide in the cut and assays about $35 per ton.——The Furst Brothers, of Victor, who have a lease on the Dead Pine claim of the Ophir Mining & Milling Co., have opened a shoot of smelting ore at the eighth level that assays from $25 to $40 per ton, with screenings that run as high as $100 per ton.——The Pinnacle Leasing Co., operating the Mitchell mine on Bull hill, is erecting new ore-bins and will increase the shipments from the mine.——Leonard Worcester and associates, who have a sub-lease on the Conundrum mine on the western slope of Gold hill, opened a shoot on the seventh level that is from 10 to 12 ft. wide and are now stoping for shipment.——Sub-lessees, operating on the eighth level of the main shaft of the Hidden Treasure property, have cut a shoot that will assay from 3 to 5 oz. gold per ton and are saving the ore for shipment.

IDAHO

SHOSHONE COUNTY

The Federal Mining & Smelting Co. is negotiating for the purchase of the Star, a partly developed lead-silver property adjoining the Morning mine at Mullan, also the Flynn group of 30 claims, situated between the Frisco and Morning mines in the Coeur d'Alene district. The Star has developed a large orebody to a depth of 800 ft. which ranges from 15 to 18 ft. in width. The Flynn groups are west of the Star.——J. J. Stanford, of Wallace, engineer for the Silica Gold & Copper Co., reports that the first vein cut by the cross-cut is 16 ft. wide, with a pay-streak of 4 ft. that assays 4.3% copper. Ore in the upper portion of the vein assays up to $12 in gold.——The Snowstorm Mining Co. paid a dividend of $22,500, at the rate of 1½c. per share, on 1,500,000 shares on June 20.——C. L. Cowell, of Missoula, Montana, president of the Marsh Mining Co., announces that work with the new electric hoisting machinery has started on the property near Burke, three shifts being employed. The vein averages 4 ft. in width, 2 ft. of which is good shipping ore. It adjoins the old Tiger-Poorman and is soon to be equipped with a mill and additional machinery.

MISSOURI

JASPER COUNTY

Following a shut-down of several months, the Hallowe'en mine, on the McCown land at Spring City, is to resume operations. The mine has several drifts opened below the 150-ft. level, the ore being of high quality and occurring in rich blanket veins, this property showing one of the best marked blanket formations of that district. The mill is in good shape, and the only thing standing in the way of immediate operations is the need of pumping, the drifts having become flooded during the long shut-down.——The directors of the Tiwah Mining Co., operating on a tract at Galena, have decided to purchase from the Nowata company the Kenwood mill at Miami, which recently was taken over by the Nowata company, the intention at that time being to move the plant to the West Joplin tract, which is showing such good ore. The Tiwah company is to begin the moving of the mill to Galena soon. The plant is one of the complete ones in the Miami district, but has been idle for some time.

MONTANA

LEWIS AND CLARK COUNTY

Work is being rushed on the Hauser Lake dam and hydro-electric plant of the United Missouri River Power Co. near Helena, and it is thought that the machinery will be ready for operation by fall. A total of 91,000 hp. will be developed at the lake. Besides supplying mines, highways, and factories, the United company proposes to use electric power for the raising of water to the bench lands for irrigation along the Missouri river and in Prickly Pear valley. The plan is to hoist this water by pumps and then store it in reservoirs on the foothills, reclaiming about 100,000 acres of rich lands. When the company began to furnish power to the Butte mines, the transmission proved so successful that the original Canyon Ferry plant was enlarged from 4000 to 10,000 hp. and the lines extended to the Washoe smelter. The Canyon Ferry dam now produces a head of 38 ft., and its reservoir, known as Lake

Sewell, covers 6½ square miles. The first Hauser Lake dam was commenced in July 1905, and completed in January 1907. A year later this plant was developing 16,000 hp., which was increased by a fifth turbine to 20,000 hp. On April 14, 1908, a big rise in the Missouri destroyed the dam and caused immense damage. In July of the same year the company started to reconstruct, and the broken dam has now been replaced with a solid concrete foundation from bedrock. A large portion of it is 50 ft. below the natural level of the river. When finished, the dam will be 100 ft. high from the lowest foundation and will impound water 65 ft., while the reservoir produced will cover 9 square miles, extending 18 miles southward to Canyon Ferry dam and up Prickly Pear valley to within 8 miles of Helena. The power-house at Hauser Lake, which was not damaged much, has been repaired. Water from the reservoir is led into a canal and thence through girds, designed to keep out driftwood, into five turbines driving 4000-hp. generators. Transformers change the current from 2400 to 70,000 volts.

NEVADA

CLARK COUNTY

The Spokane-Searchlight in the Searchlight district is now driving east on the third level, having cut through the fault and picked up the vein beyond.——The Searchlight Mining & Milling Co. will complete the re-timbering and aligning of its shaft the early part of July and will erect a new steel head-frame. A station pump with a capacity of 500 gal. per minute and a 125-hp. gasoline engine will be installed.——Smith & Fessler ran a small lot of ore from their lease on the I. X. L. ground through the mill with good results.

ESMERALDA COUNTY

(Special Correspondence).—The Hydro-Electric Power Co. of Bodie, California, is arranging to run a transmission line to Rawhide to furnish light and power to the town and mines. It is expected to commence construction work shortly.——The Rawhide Queen Mining Co. has placed a force of men at work on the old Dromiac lease and is working from the 125-ft. level.——The St. Ives lease on Queen ground is developing a 4-ft. vein of rich ore on the 450-ft. level, obtaining assays from $40 to $250 per ton. A 25-hp. compressor has been installed and a 100-ton capacity ore-bin constructed.——The Truett-Rawhide lease recently shipped 500 tons of ore to the National mill, and is now delivering 500 tons to the Klinker plant. E. C. Klinker, manager of the Klinker mill, states that a cyanide plant will be shortly installed.——The Grutt-Balloon Hill lease on the Queen has opened 4 ft. of ore at a depth of 350 ft. Silver predominates and the ore will have to be held until some of the local plants install cyanide departments.——The Victor mill is running steadily on ore from the Proskey lease.——The Schmidt-Loufek lease is sending small consignments of $25 ore to the National mill.

Rawhide, June 17.

The three-compartment shaft of the Goldfield Annex lease on the Polverde claim of the Jumbo Extension, which is going down between 3 and 4 ft. per day, is now well past the 900-ft. mark. A station will be cut at the 1000-ft. level and the vein explored from that point to pick up the shoot that was opened on the 800.——At the Goldfield Consolidated mill 80 stamps are now dropping and it is stated that 700 tons per day is being crushed, while shipments of high-grade ore to the smelters from the Clermont keep up the regular output.——The Combination Fraction is again on the producing list, having started the 20 stamps in the leased mill. Considerable repair work was found necessary in the plant, but now it is in good running order and is expected to run smoothly. Underground the ore is being drawn from the stopes between the 280 and 380-ft. levels, and from the 500 and 750-ft. workings.——The shaft on the Victor claim of the C. O. D. Consolidated has been re-timbered to the 485-ft. level and the drifts on the 400 and 485 cleaned out. There is considerable milling ore opened and it is thought that the company will erect a plant to handle its ores.——Three sets of lessees are working on the Diamondfield Black Butte and the ore is being stored for shipment.

LANDER COUNTY

The three-compartment shaft of the Kimberly Consolidated Mines Co. has opened a number of stringers of copper sulphide and carbonate, with some gold and silver in the quartzite. The company is also preparing to sink a two-compartment shaft on the Golden Rule group, which is under its control.——The district has been granted a post office, and mail should now be addressed to Kimball.

LINCOLN COUNTY

R. W. Miller has succeeded in interesting Eastern capitalists in his property near Crescent, and the ore is now being tested to determine the best method for treatment to be installed in the contemplated plant. A large open-cut has been run on the vein, opening ore that assays between $12 and $15 per ton.——Fred Falkner, receiver for the defunct Bamber-Delamar Gold Mining Co. will sell the remaining machinery in the mill and the claims about the middle of July. The power-plant at Stine is being dismantled under the supervision of George M. Baker and will be shipped to Ogden by the Salt Lake & Ogden Railroad Co. which purchased it some time ago.——Jim Lee and Ed. Hing, who have a lease on the Zip Coon and Golden Eagle claims have over 100 tons of $40 ore on the dump and have opened several shoots of high-grade in the underground work.——Repairs on the main line of the Salt Lake route have been completed and regular trains are now running. On the Pioche branch the work is well under way and trains are expected to be in regular operation in a short time. This means much for this district, as a number of mines have been idle or confined operations to small amounts of development on account of high cost of supplies while the railroad was not in operation. In most of these considerable ore is blocked out and shipping will be resumed at once.

WHITE PINE COUNTY

The machinery for the new mill of the Nevada Amalgamated Mines Co. is now on the Willowpath mill-site near Black Horse, and the lumber is being hauled from Ely. It is anticipated that the mill will be completed this fall, when it will be prepared to operate on custom ore as well as that from the company's mines.

NEW MEXICO

SOCORRO COUNTY

(Special Correspondence).—A new filter-press is being installed at the Socorro mines which will increase the capacity of the plant to 150 tons of ore per day. The drift on the 600-ft. level and the raise from the 500 have both opened ore that assays from $39 to $50 per ton.——Last week the Ernestine Mining Co. treated 680 tons of ore, producing 60 sacks of concentrate. The mill is reported to be making an excellent saving, the tailing assaying from 65 to 95c. per ton.——The station on the 400-ft. level of the Deadwood mine is being enlarged to accommodate a pump which the company is to install to handle the water during the wet season.

Mogollon, June 17.

SOUTH DAKOTA

CUSTER COUNTY

(Special Correspondence).—The Ideal mine is situated about 12 miles northeast from the town of Custer, on a high mountain, at the foot of which flows what is called Iron creek. On this mountain are two groups of mines, the Bessie and the Rushville, consisting of 60 claims owned by the Ideal Mining & Milling Co., whose officers mostly reside in Indianapolis. They are to be opened by an adit now in 700 ft., and with 500 ft. still to be run before striking the main vein. This, from all indications, is about 600 ft. in width and consists of a large belt of quartzite which conforms in strike with the old micacious slates which form the country rock. A granite dike of a coarsely crystallized character forms one wall of the main vein, and it, in common with the quartzite, is vertical. Assays have been obtained from the whole width of the quartzite running from a trace to $480 per ton in gold, and it is estimated

that this body of ore will mill about $5 per ton. Numerous drifts have been run from the adit both north and south, all of which are in ore, showing an average assay reported as $10 per ton in gold. The mine is equipped at present with a mill of 50 tons per day capacity, made by the Downie-Wright Co., of Rapid City. A 12-ft. slow-speed Chilean mill is used for crushing. It is expected that the mill will be ready to run about July 10. The ore is a sulphide, not free milling, and cyanide will be used in its reduction. Water will be obtained from Iron creek and there is plenty of timber on the ground. George Van Camp is the president, R. F. Conover, general manager, and his son, A. B. Conover, assistant.

Custer, June 17.

UTAH

BEAVER COUNTY

The raise on the orebody recently opened on the 500-ft. level of the Cedar Talisman is now up over 40 ft. in high-grade ore. This has been especially satisfactory to the management as the raise was started for an air-connection rather than to open the ore. ——The drift on the 200-ft. level of the Michigan mine has opened a 12-in. stringer of ore that assays 50% lead with 70 oz. of silver per ton and a shipment will soon be forwarded to one of the smelters.

JUAB COUNTY

The output of Centennial Eureka at Eureka, which is normally 40 or 50 carloads per week, has been curtailed recently while preparing for the installation of a new pumping plant. ——The Gemini Mining Co.'s large electric pump which was broken some time ago and sent to the factory for repairs has been returned and is now being installed in the mine.——Work is to be resumed in the Crown Point early in July.——The head-frame at the Bradley in North Tintic has been completed and the new gasoline hoist installed. The property is now under the supervision of S. E. Ware.——Work at the Beck Tunnel property has been suspended as the return from the ore shipped has fallen considerably below the operating expenses of the mine. It is probable that an assessment will be levied on the stock and work resumed as soon as sufficient money is raised.

SUMMIT COUNTY

The Daly-Judge company at Park City has installed an air lift at the 1500-ft. level of the mine and will attempt to unwater the ground to the 1600 where rich orebodies were reported before the miners were driven out by an excessive flow of water.——In a circular letter to the stockholders of the King Consolidated it is stated that the mine is in excellent condition and that prospects for opening commercial ore are good. To raise $50,000 to carry on the development work the company is to issue several notes which are to be redeemable in stock of the company at par any time prior to their maturity.——Rapid progress is being made in the tunnel of the Snake Creek Mining & Tunneling Co., the face being now in about 375 ft.——An assessment has been levied on the Scottish Chief stock and work is to be resumed in the face of the adit which lacks about 100 ft. of cutting the contact on which the ore is thought to be developed.

SALT LAKE COUNTY

The directors of the Utah Copper Co. have voted an issue of $2,500,000 first-mortgage 6% bonds by the Bingham & Garfield Railway Company.

TOOELE COUNTY

The adit at the Boston Consolidated Mining Co.'s property on the east slope of Lion hill in the Ophir district is now in about 575 ft., and is expected to cut the ore in about 200 ft. The company is working under considerable difficulty as the ore is now hoisted to the adit-level 185 ft. with a windlass. The ore in the bottom of the winze is a decomposed lime-quartz with large bunches of high-grade chloride of silver.

UTAH COUNTY

The Bonnevill Mining Co. has been incorporated at Provo and has commenced work on an adit on the Crandall property between Provo and Springville. The Knight interests are the controlling factors in the company and the work will be under the supervision of George A. Storrs.

WASHINGTON

FERRY COUNTY

James L. Harper, general manager of the Republic Mines Corporation, operating the Lone Pine Pearl Surprise group in Republic, announced at the annual meeting in Spokane on June 15 that the second dividend will be disbursed in July. He reported that the mines produced more than 4000 tons of ore since January, the net value of which is placed at approximately $101,482, exclusive of ore at the smelter and in transit, upon which the return has not been received. He estimates this will add $45,000 to the gross value of $139,573.

JEFFERSON COUNTY

Work is progressing satisfactorily on the Tubal Cain property at Iron Mountain. The adit is now in over 1300 ft., and the management expects to open a good body of ore in a short time.

MEXICO

JALISCO

The experimental mill erected at the Peginto mine in the western portion of the State is crushing from six to eight tons of ore per day. The pulp is run over the plates and treated with cyanide, a total extraction of 85% being obtained. There is a large tonnage of ore blocked out in the mine and it is probable that a larger mill will be erected by the owners, H. H. Cross and H. W. Young.

Amparo Mill, Jalisco.

PUEBLO

The Teziutlan Copper Co.'s new plant at Teziutlan which has been in operation for about two months is now running at good capacity and 2500 men are working. The plant has been under reconstruction for nearly two years and is said to be one of the best of its kind in the republic. There are two furnaces of 500 tons capacity each and a completely equipped converting plant to produce blister copper. All machinery is driven by electricity in both the mines and smelter, the current being generated at a hydro-electric station under a 1000-ft. head. The property has been shipping copper to New York for several weeks, and shipments will increase as the efficiency of the plant is raised. R. L. Lloyd, formerly superintendent at the Greene-Cananea plant, is superintendent and T. C. Saunders, formerly in charge of Los Ocotes mines belonging to the same company at Ejutla, Oaxaca will be in charge of the mines. These have a capacity of 12,000 to 15,000 tons per month. The company has its own railway from the mines to Teziutlan, a distance of ten miles.

SONORA

The Sonora Exploration Co. has been organized to take over the Antigua, Texas, Last Chance, and the claims operated by the Florida Copper Co., in the Tigre district south of Douglas. The company is composed largely of New York interests and will commence work on the claims at an early date.——The La Cobriza Mining Co. has commenced work on the smelting plant which is to be erected at the mine two miles west of Noria, and is having the machinery for the furnace built at El Paso. Fred C. Emery is manager. ——At the Santa Fe mine, nine miles south of Cananea, considerable work is being done, though operations are somewhat retarded on account of the experiments to determine the best method of treatment for the ore which is high-grade lead-silver-zinc.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

J. F. KEMP is at Lake George, New York.

F. W. BRADLEY was at Goldfield this week.

J. H. MCKENZIE has returned from Nicaragua.

J. MORGAN CLEMENTS has returned to New York.

NORMAN C. STINES has returned from Death Valley.

GEORGE B. STARR visited Goldfield, Nevada, this week.

C. W. MERRILL has returned from New York and the East.

CLARENCE B. OSBORNE has returned to Los Angeles from Cuba.

G. B. STREET has left San Francisco for Wilmington, Delaware.

J. P. KEENE is investigating oil lands at Matsqui, British Columbia.

T. LANE CARTER, of OSGOOD, CARTER & Co., is examining mines in Nevada.

C. C. O'LOUGHLIN is at the Bogardus Testing Laboratories, Seattle, Washington.

O. H. PACKER has gone to Minaret, Inyo county, for a month's stay examining properties.

R. B. BRINSMADE is in the Rainy Lake district of Ontario, making examinations for West Virginia investors.

W. M. CAHOONE, formerly with the Bunker Hill & Sullivan M. & C. Co., is now with the Tri-Metal Co., Benton, California.

S. H. BROCKUNIER, of Wheeling, West Virginia, has finished his examination of the Erie and Aucho mines near Graniteville, Nevada county, California, and has returned to his home.

J. B. STEWART, formerly of El Oro and Guanajuato, Mexico, has joined the CONSTANT HERZIG Co., and will be in charge of the metallurgical department, making a specialty of cyanide work.

FRANK O. JAMES, formerly with the Butters Copala mines, at Copala, Mexico, and lately with the Guanajuato Amalgamated Gold Mines Co., is now in charge of the cyanide department of the Yoquiro Development Co., in Chihuahua.

W. J. ADAMS, who died at San Francisco, June 10, was born at New York City in 1855. He was for many years identified with the mining industry of the West being especially well known through his useful little book, 'Hints on Amalgamation'.

The Prospector

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination. To ensure promptness in publication of the determinations, payment must be forwarded with specimens.

C. H. S., Chafey, Nevada: Vein quartz with actinolite.

L. L., Chihuahua, Mexico: The rock is sedimentary limestone.

C. F., Gaston, California: No. 1 and 2, two phases of granodiorite.

W. A., Reveille, Nevada: Fine grained decomposed silicious rock, probably the result of the decomposition of a rhyolite or chert.

H. O. J., Bowman, California: No. 13, fine grained silicious rock, too much altered for further classification. The yellow mineral is not an ore of uranium.

Dividends.

On Friday, June 3, 1910, the Bunker Hill & Sullivan M. & C. Co. paid dividend No. 153 of $98,100. This makes the amount of dividends paid since January 1, 1910, $451,200, and the total to date $11,737,200.

Market Reports

LOCAL METAL PRICES.

San Francisco, June 23.

Antimony	12—12¾c	Quicksilver (flask)	47½—48
Electrolytic Copper	14½—15¼c	Spelter	7—7¾c
Pig Lead	4.70—5.65c	Tin	35¼—36¾c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
June 16	12.25	4.34	4.95	53½
" 17	12.31	4.34	4.95	53½
" 18	12.31	4.34	4.96	53½
" 19	Sunday.	No market.		
" 20	12.37	4.34	4.96	53¾
" 21	12.37	4.34	4.96	53¾
" 22	12.37	4.34	4.96	53¾

ANGLO-AMERICAN SHARES.

Cabled from London.

	June 16. £ s. d.	June 23. £ s. d.
Camp Bird	1 8 6	1 8 0
El Oro	1 6 6	1 7 9
Esperanza	2 15 6	2 13 9
Dolores	1 8 9	1 8 9
Oroville Dredging	0 7 6	0 6 6
Mexico Mines	8 10 0	8 10 0
Tomboy	1 0 0	1 0 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., N. Y.)

COPPER SHARES—BOSTON.

	Closing prices, June 23.		Closing prices, June 23.
Adventure	5¾	Mohawk	49½
Allouez	41	North Butte	27
Atlantic	6	Old Dominion	37
Calumet & Arizona	54	Osceola	133
Calumet & Hecla	540	Parrot	13¾
Centennial	16½	Santa Fe	1½
Copper Range	63¾	Shannon	10
Daly West	8	Superior & Pittsburg	10⅞
Franklin	11½	Tamarack	51
Granby	35	Trinity	5½
Greene-Cananea, ctf	7⅝	Utah Con	21¼
Isle Royale	17½	Victoria	3
La Salle	11½	Winona	8
Mass Copper	8¼	Wolverine	111

(By courtesy of J. C. Wilson, Mills Building.)

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from Catlin & Powell Co., New York.)

	Closing prices, June 23.		Closing prices, June 23.
Amalgamated Copper	65⅝	Miami Copper	20
A. S. & R. Co.	77⅝	Mines Co. of America	⅝
Boston Copper	18½	Montgomery-Shoshone	⅝
B. C. Copper Co.	6¼	Nevada Con.	19⅜
Butte Coalition	19⅜	Nevada Utah	⅝
Chino	11⅝	Nipissing	11⅜
Davis-Daly	1⅛	Ohio Copper	1⅞
Dolores	6⅝	Ray Central	2½
El Rayo	4	Ray Con.	16⅞
Ely Central	1⅛	South Utah	1¼
First National	8¼	Superior & Pittsburg	10⅝
Giroux	7	Tenn. Copper	24¼
Guanajuato Con	1¼	Trinity	5⅜
Inspiration	8⅛	Tuolumne Copper	3¼
Kerr Lake	8⅛	United Copper	6⅝
La Rose	4¼	Utah Copper	44¼
Mason Valley	7¼	Yukon Gold	4¼

SOUTHERN NEVADA STOCKS.

San Francisco, June 23.

Atlanta	$ 11	Mayflower	$ 3
Belmont	3.50	Midway	26
Booth	15	Montana Tonopah	99
Columbia Mtn	6	Nevada Hills	1.50
Combination Fraction	52	Pittsburg Silver Peak	68
Daisy	6	Rawhide Coalition	21
Fairview Eagle	24	Rawhide Queen	26
Florence	2.15	Round Mountain	41
Goldfield Con	9.40	Sandstorm	4
Gold Kewenas	6	Silver Pick	7
Great Bend	3	St. Ives	13
Jim Butler	28	Tonopah Extension	80
Jumbo Extension	24	Tonopah of Nevada	8 87
MacNamara	28	West End	56

(By courtesy of San Francisco Stock Exchange.)